# ACHIEVEMENT EMOTIONS IN UNIVERSITY TEACHING AND LEARNING, STUDENTS' STRESS AND WELL-BEING

EDITED BY: Jesus de la Fuente, Douglas F. Kauffman and Meryem Yilmaz Soylu

PUBLISHED IN: Frontiers in Psychology and Frontiers in Education

frontiers Research Topics

# frontiers



ISSN 1664-8714
ISBN 978-2-88976-192-0
DOI 10.3389/978-2-88976-192-0

## About Frontiers

Frontiers is more than just an open-access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

## Frontiers Journal Series

The Frontiers Journal Series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the Frontiers Journal Series operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

## Dedication to Quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews.
Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

## What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact

# ACHIEVEMENT EMOTIONS IN UNIVERSITY TEACHING AND LEARNING, STUDENTS' STRESS AND WELL-BEING

Topic Editors:
**Jesus de la Fuente,** University of Navarra, Spain
**Douglas F. Kauffman,** Medical University of the Americas – Nevis, United States
**Meryem Yilmaz Soylu,** Georgia Institute of Technology, United States

**Citation:** de la Fuente, J., Kauffman, D. F., Yilmaz Soylu, M., eds. (2022). Achievement Emotions in University Teaching and Learning, Students' Stress and Well-being. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88976-192-0

# Table of Contents

frontiers | Frontiers in Psychology

EDITORIAL
published: 27 April 2022
doi: 10.3389/fpsyg.2022.910980

# Editorial: Achievement Emotions in University Teaching and Learning, Students' Stress and Well-being

*Jesús de la Fuente*[1,2]*, *Douglas F. Kauffman*[3] *and Meryem Yilmaz Soylu*[4]

[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] Department of Psychology, School of Psychology, University of Almería, Almería, Spain, [3] Medical University of the Americas, Devens, MA, United States, [4] Georgia Institute of Technology, Atlanta, GA, United States

**Keywords: achievement emotions, learning and teaching, university, stress, wellbeing**

## Editorial on the Research Topic

## Achievement Emotions in University Teaching and Learning, Students' Stress and Well-being

Current research in achievement emotions, as a topic in Educational Psychology, has meant a paradigm shift, broadening the research panorama to include different motivational-affective variables, going beyond the prevailing research paradigm with an exclusively cognitivism-based focus. It has therefore stimulated analysis and inquiry into different issues which had not formerly been analyzed with rigor. Six manuscripts have analyzed this problem, providing diverse evidence of the different relationships: Cognitive Test Anxiety, Motivation, and Self-Regulation Through Curvilinear Analyses (Cassady and Finch), Mental Health and Academic Performance (Dekker et al.), Coping Strategies and Self-Efficacy (Freire et al.), Philosophical Inquiry and Students Engage in Learning (Leng), the Perception of Support in the Classroom and students' Motivation and Emotions (Trigueros et al.), and the resilience and creativity (Fan et al.).

On the one hand, current research now addresses meta-motivational and meta-affective processes, through analyzing the effects of achievement emotions on classic cognitive processes of learning. On the other hand, this domain has helped point research into the role of individual differences in the achievement emotions experienced, based on how they relate to powerful, classic variables of personality and cognition. Three research reports have analyzed these relationships between some of them: the relationship with emotional problems and adaptation to the university, in cyberbullying (Martínez-Monteagudo et al.), the preventing stress among undergraduate learners, and the importance of emotional intelligence, resilience, and emotion regulation (Thomas and Zolkoski), and the role of active coping in the relationship between learning burnout and sleep quality among college students (Wang et al.).

Moreover, the analysis of achievement emotions is being contextualized within academic teaching-learning contexts, where these emotions are commonly produced, so that they can be assessed and improved. In addition, this research paradigm does not overlook the importance of explanatory, predictive models of students' wellbeing and their psychological health, given that the university context is highly predictive of academic stress. Six manuscripts have provided evidence regarding the relevance of the teaching-learning process in various variables, based on the *Self-vs External- Regulated Learning Theory*: regarding achievement emotions (de la Fuente, Martínez-Vicente et al.), strategies for coping with academic stress (de la Fuente, Amate et al.), the factors and symptoms of academic Stress (de la Fuente, Peralta-Sánchez et al.), the learning approaches, academic achievement, and satisfaction (de la Fuente, Sander, Kauffmann and Yilmaz Soylu, 2020), and academic behavioral confidence and procrastination (de la Fuente, Sander, Garzón-Umerenkova et al.).



***Edited and reviewed by:***
*Pablo Fernández-Berrocal, University of Malaga, Spain*

***Correspondence:**
*Jesús de la Fuente*
*jdlfuente@unav.es*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *01 April 2022*
***Accepted:*** *11 April 2022*
***Published:*** *27 April 2022*

***Citation:***
*de la Fuente J, Kauffman DF and Yilmaz Soylu M (2022) Editorial: Achievement Emotions in University Teaching and Learning, Students' Stress and Well-being. Front. Psychol. 13:910980. doi: 10.3389/fpsyg.2022.910980*

In conclusion, in this Research Topic was presented theoretical and empirical-based studies, and evidence-based proposals. The submitted manuscripts aim to minimize university students' experience of stress and to promote their wellbeing and psychological/emotional health through psychological assessment and intervention.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## FUNDING

This work was supported by R&D Project PGC2018-094672-B-I00, University of Navarra (Ministry of Science and Education, Spain) and R&D Project UAL18 SEJ-DO31-A-FEDER, University of Almería, Spain (European Social Fund).

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

**Publisher's Note:** All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers in Psychology

ORIGINAL RESEARCH
published: 18 September 2019
doi: 10.3389/fpsyg.2019.02070

# Applying the *SRL vs. ERL Theory* to the Knowledge of Achievement Emotions in Undergraduate University Students

*Jesús de la Fuente*[1,2]*, *José Manuel Martínez-Vicente*[2,3], *Francisco Javier Peralta-Sánchez*[2,3], *Angélica Garzón-Umerenkova*[4], *Manuel Mariano Vera*[5] and *Paola Paoloni*[6]

[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] School of Psychology, University of Almería, Almería, Spain, [3] Center of Research of Psychology, University of Almería, Almería, Spain, [4] Fundacion Universitario Konrad Lorez, Bogotá, Colombia, [5] Department of Personality, Assessment and Psychological Treatment, University of Granada, Granada, Spain, [6] Río Cuato-CONICET National University, Córdoba, Argentina

The *SRL vs.*ERL Theory predicts that a student's own self-regulation and the regulatory nature of the context are factors that jointly determine the student's level of motivational-affective variables. However, this principle has not yet been verified in the case of achievement emotions. The aim of this research was to test this prediction, with the hypothesis that students' level of self-regulation (low-medium-high), in interaction with the regulatory nature of the teaching (low-medium-high), would determine positive or negative emotions as well as the degree of burnout/engagement. A total of 440 university students completed validated questionnaires on self-regulation; regulatory teaching; achievement emotions in class, in study and in testing situations; and on burnout/engagement. Using a quasi-experimental design by selection, ANOVAs and MANOVAs (3 × 3; 5 × 1) were carried out. The results confirmed that the level of self-regulation and the level of external regulation jointly determined university students' level of achievement emotions, as well as their level of burnout/engagement. Based on these results, a five-level progressive scale was configured. We conclude that this scale may be useful and adequate as a heuristic technique or model for understanding and analyzing the type of student-teacher interaction that is taking place in the university classroom, and thereby learn the probability of stressful effects and the students' level of emotional health.

**Keywords: SRL vs. ERL theory, achievement emotions, burnout-engagement, university, stress**

OPEN ACCESS

***Edited by:***
*Michael S. Dempsey,*
*Boston University, United States*

***Reviewed by:***
*Simona De Stasio,*
*Libera Università Maria S.S. Assunta, Italy*
*Reza Pishghadam,*
*Ferdowsi University of Mashhad, Iran*

***Correspondence:**
*Jesús de la Fuente*
*jdlfuente@unav.es*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *04 June 2019*
***Accepted:*** *26 August 2019*
***Published:*** *18 September 2019*

***Citation:***
*de la Fuente J, Martínez-Vicente JM, Peralta-Sánchez FJ, Garzón-Umerenkova A, Vera MM and Paoloni P (2019) Applying the SRL vs. ERL Theory to the Knowledge of Achievement Emotions in Undergraduate University Students. Front. Psychol. 10:2070. doi: 10.3389/fpsyg.2019.02070*

## INTRODUCTION

Classic Educational Psychology research on *individuals' learning variables* has focused on two large groups of constructs that would establish individual differences in learning and so predict achievement. On one hand is *intelligence,* with its related lines of research, such as the study of cognitive and metacognitive factors in learning processes. On the other hand is *personality*, as well as students' motivational-affective and meta-motivational processes. Detailed analysis over the past years has produced a considerable amount of research evidence, and a paradigm has emerged for the study of emotions and non-cognitive or "soft" skills in the educational sphere (Pekrun et al., 2009, 2019; Frenzel et al., 2016, 2018; Lüftenegger, 2016; Dicke et al., 2018; Muis et al., 2018). In

a complementary fashion, research on *contextual variables of teaching* has analyzed the role of the teaching process and its elements, with special attention to the role of effective teaching (Pekrun et al., 2014a; Murayama et al., 2017; Gentsch et al., 2018; Mainhard et al., 2018). However, a precise analysis of the joint, interactive and interdependent relationships between the two sets of factors—pertaining to the learning process and the teaching process—remains to be achieved. Notwithstanding, certain interactive models have laid the foundation for this area of study (Vermunt, 1989, 2007; Bigg, 2001). Consequently, the present study aims to offer conceptual foundations and empirical evidence in this direction.

## Academic Emotions as a Learning Variable

### Positive vs. Negative Academic Emotions

Emotions having to do with learning/achievement situations and outcomes are referred to as academic emotions (Pekrun et al., 2005, 2011, 2017a,b; Schutz and Pekrun, 2010; Pekrun and Stephens, 2012; Pekrun, 2014). Academic emotions therefore include achievement emotions experienced at school, but they also address emotions related to the instruction or the process of studying. Pekrun (1992) expanded on earlier conceptualizations of emotions by classifying academic emotions using a three-way taxonomy, namely, their *focus, valence, and activation*. Two types of academic or achievement emotions can be distinguished if we consider their origin: activity emotions originate in ongoing activities that relate to achievement, while outcome emotions stem from focusing on the outcomes of such activities (Pekrun, 2006). Both activity and outcome emotions are further classified by their valence (positive vs. negative or pleasant vs. unpleasant) and their role in activation (activating vs. deactivating). Students' activity emotions in academic settings have been addressed in recent research: for example, enjoyment as a positive, activating emotion (for an overview, see Ainley and Hidi, 2014) and boredom as a negative, deactivating emotion. Positive, activating emotions (enjoyment, hope, pride) are generally assumed to have positive effects on achievement, while negative (anger, anxiety, shame, hopelessness), and deactivating emotions (boredom, relief) would affect achievement and learning behavior in a negative fashion. This assumption is supported by empirical evidence (Frenzel et al., 2007; Pekrun et al., 2014b).

Empirical findings increasingly support that academic enjoyment and boredom are aligned with specific domains (Goetz et al., 2004, 2007a, 2014). Findings showed that enjoyment was the most domain-specific emotion, after comparing emotions assessed in six different subject domains. Adolescents' emotions in different subjects were shown to have relatively little relationship to each other; different levels of enjoyment and boredom were experienced in different subjects. While evidence increasingly confirms the domain specificity of academic emotions, little attempt has been made to search out the underlying mechanisms.

### The Effect of Positive vs. Negative Emotions on Students

Several studies have reported positive effects of enjoyment on students' achievement (Pekrun, 2014; Pekrun et al., 2019), while boredom shows detrimental effects (Goetz et al., 2014), across scholastic domains. Motivation, meta-cognitive activities, and cognitive resources have been theorized as mediating factors. Students' mastery goals, interest, intrinsic motivation, attention, invested effort, self-regulation, elaboration and use of metacognitive strategies have been found in positive association with enjoyment, and in negative association with boredom; these elements have the same positive and negative associations with achievement (Goetz et al., 2007b).

In the academic context, we find enjoyment and boredom among the emotions most often reported (Goetz et al., 2007b; Linnenbrink-Garcia and Pekrun, 2011; Pekrun and Linnenbrink-Garcia, 2014). Because these two emotions are so prevalent in academic settings and so visible across academic domains (e.g., Goetz et al., 2007b; D'Mello, 2013), and because they affect learning and achievement in opposing directions, positive and negative emotions were selected as the object of the present study. From a complementary approach, the Transactional Analysis (TA) theory has also found a relationship between positive emotions and specific learning domains, in the teacher-student relations (Pishghadam and Khajavy, 2014).

Relationships of academic emotions with burnout vs. engagement have also been found. *Burnout* represents fatigue, depersonalization, lack of expectations and disaffection for a task (Maslach and Jackson, 1981); *engagement* represents taste, commitment and enjoyment with a given task (Maslach and Leiter, 1997). Previous research has reported factors that predict and probabilize both (Uludag and Yaratan, 2010). Thus, it has been found that academic emotions (positive vs. negative) are differentially associated with burnout (Burr and Dallaghan, 2019). It has also been found that engagement probabilizes metacognitive self-regulation and knowledge construction (Khosa and Volet, 2014). More recently, both have been conceptualized as positive (engagement) vs. negative (burnout) learning (Dormann et al., 2017). On the other hand, burnout has consistently appeared as a negative predictor of motivation and performance (Salanovaa et al., 2010; Stoeber et al., 2011), although the authors of the inventories, they have recognized that the direction between both constructs is not simple but complex, and requires more specific analysis through profiles (Leiter and Marlach, 2017a,b).

## Academic Emotions as Teaching Variable

### Regulatory Teaching

Regulatory teaching is refers to encouragement of self-regulation in students and it's characteristic of effective teaching. In empirical research, high quality teachers are those who have a positive impact on their students' engagement with learning activities (Reeve et al., 2004). Some authors have explained self-regulation promoting teaching strategies (Paris and Winograd, 2003, pp. 12–14):

1. *Self-regulation can be taught with explicit instruction, directed reflection, and metacognitive discussions.* Cognitive research has shown that expertise can develop in many ways and explicit instruction is not always necessary. However, many children do not gain metacognitive insights or use SRL effectively

without direct instruction and it seems plausible that many teachers can increase their own metacognitive understanding through explicit instruction. The most direct method of making new teachers aware of SRL is to incorporate it in the curriculum as a topic of study.

2. *Self-regulation can be promoted indirectly by modeling and by activities that entail reflective analyses of learning.* SRL can be taught indirectly with classroom activities, tools to evoke reflection and metacognitive understanding. One excellent method is the use of journals because they can be used with students of any age. Prospective teachers who use journals in classes learn to distinguish superficial entries and responses from analytic entries and responsive comments, so they are less likely to "do journals" as an activity and more likely to use journal writing as an avenue for self-exploration, self-discovery, and self-disclosure. A second tool that translates easily from teachers to students is conferences. Conferences can be focused on cooperative projects, report cards and grades, planning and brainstorming, and other classroom events but in all the endeavors, the focus of the conference can include analyses of thinking, learning, and teaching.

3. *Self-regulation can be promoted by assessing, charting, and discussing evidence of personal growth.* SRL can be promoted through record keeping of goals met, grades received, and progress made in behavior management and learning. Teachers who use these records will understand how periodic self-appraisal can lead to feelings of pride or to renewed efforts. This simple technique is often used by people who monitor their diets, exercise, expenditures, and so forth and it can easily be extended to academic performance."

Recent research has shown that the perceived classroom learning environment variables were good predictors of students' self-regulation. Additionally, teacher variables (effectiveness teaching) were found to have direct relations with students' self-regulation and moderate the relationships between the learning environment and self-regulation variables (Yerdelen and Sungur, 2019).

### The Influence of the Teaching Context on Students' Academic Emotions

Formerly, when researchers have attempted to predict students' academic emotions in social environments, they have relied mainly on parents' and teachers' observations, set by their own expectations, and their child raising or teaching practices, respectively. For example, Pekrun (2006) asserted that parents' and teachers' achievement expectations, and the structure of their interaction with the student (e.g., feedback practices, established goal structures, autonomy support vs. control) influences the source of the student's emotions (i.e., control- and value-related appraisals). The importance of social influences on students' enjoyment and boredom is specifically identified in other theoretical models (Goetz et al., 2007b). The social environment is considered a third type of predictor in model of academic boredom; how the subject domain is valued by teachers, parents and peers impacts the student's experiences of academic boredom. This perspective is adopted in the present study, where we apply it to the context of *regulatory teaching*.

## SRL vs. ERL Theory as Heuristic of Research

The theory of *Self-Regulated Learning vs. Externally-Regulated Learning* (de la Fuente, 2017) is founded on the following theoretical assumptions. Behavioral regulation of the individual can be defined as different types along a behavioral continuum:

### Principle 1. Self-Regulated Behavior, Non-regulated Behavior or Dysregulated Behavior as a Personal Characteristic

(1) *Self-Regulation* (SR) has to do with positive proactivity, that is, the individual actively and adequately regulates and manages his or her own conduct. This level is referred to as *high level*, in terms of the degree to and quantity of behaviors used to regulate one's own behavior (level 3).

(2) *Non-Regulation* (NR) may be conceptually defined as a person's lack of proactivity, or the absence of self-regulating behaviors. This is the conceptual equivalent of *reactivity*. This level is referred to as *medium level*, in terms of the degree to and quantity of behaviors used to regulate one's own behavior (level 2).

(3) *Dysregulation* (DR) has to do with negative proactivity, that is, the individual actively but inadequately regulates and manages his or her own conduct. Examples include the use of self-handicapping strategies or procrastination. This level is referred to *low level*, in terms of the degree to and quantity of behaviors used to regulate one's own behavior (level 1). The three behavior types are shown in **Table 1**.

**TABLE 1 |** Conceptual continuum and typologies of each self-regulatory behavior.

| Characteristics of the person | Self-regulation (SR)high level (3) | Non-regulation (NR) medium level (2) | Dys-regulation (DR) low level (1) |
|---|---|---|---|
| | *Before*<br>Self-analysis of tasks<br>Self-defines goals<br>Self-motivation | *Before*<br>No analysis of tasks<br>No goals<br>No motivation | *Before*<br>Erroneous self-analysis<br>Erroneous goals<br>Self-demotivation |
| | *During*<br>Self-observation<br>Self-analysis<br>Self-correction | *During*<br>No self-observation<br>No supervision<br>No self-correction | *During*<br>Self-distraction<br>Cognitive self-avoidance<br>Self-handicapping<br>Procrastination |
| | *After*<br>Self-reflection<br>Self-attributions<br>Positive self-affect | *After*<br>No reflection<br>No attributions<br>No affect | *After*<br>Erroneous self-assessment<br>Erroneous self-attributions<br>Negative self-affect |
| *Type of Activity* | *Self-regulatory (SR)* | *Non-regulatory (NR)* | *Dys-regulatory (DR)* |
| Academic | Self-regulated learning (SRL) | No norms/limits | Self-handicapping |

### Principle 2. External Regulation, Non-regulation, or Dysregulation Provided by the Context

(1) *External Regulatory* (ER) context. Positive or adequate proactivity is promoted through the context, which clearly fosters self-regulation. This context features *high levels* (level 3) of external signs or encouragements to promote self-regulated behavior and increases its likelihood at each moment of learning acts: beginning, middle and end. Such encouragement can be in the form of *antecedents* (patterns, norms, limits, expectations of success in self-regulation, value given to self-regulation) or contextual *consequences* (positive and negative contingencies favoring self-regulation, adaptation, etc.).

(2) *External Non-Regulatory* (ENR) context. The context neither encourages self-regulation nor does it tend to dysregulate students' learning. *Medium level* or no external *signs* (level 2) or other aspects promote self-regulated behavior or dysregulated behavior, so as to make either of these more likely at the beginning, middle and end of learning acts. A *non-regulatory* context supposes that the individual would engage in a moderate level of self-regulated behavior, in the absence of contextual elements that enhance or discourage such action. The context is characterized by a lack of predictability of action.

(3) *External Dys-Regulatory* (EDR) context, actively promotes dysregulation or *low levels* of self-regulation (level 1). The context promotes proactivity that is not positive, but inadequate or negative. Many external signs make dysregulated behavior more likely, and encourage active dysregulation at the beginning, middle and end of learning acts. These signs can also be in the form of *antecedents* (modeling, rules, limits, expectations of success in self-regulation, value given to self-regulation) or contextual *consequences* (positive and negative contingencies, molding, etc.) that favor dysregulation. This kind of context would require the individual to make a great effort if self-regulation is pursued. The context is a strong predictor of negative action (see **Table 2**).

**TABLE 2 |** Conceptual continuum of the context dimension, Externally-Regulated Learning (ERL).

| Characteristics of the Context | External regulation high level (3) | External non-regulation medium level (2) | External dys-regulation low level (1) |
|---|---|---|---|
| | *Before*<br>Presents analysis of tasks<br>Suggests adjusted goals<br>Suggests self-motivation | *Before*<br>Does not present tasks<br>Does not propose goals<br>Does not induce motivation | *Before*<br>Erroneous tasks<br>Erroneous goals (Self-handicapping)<br>Induces demotivation |
| | *During*<br>Promotes self-observation<br>Promotes self-analysis<br>Self-correction | *During*<br>No self-observation<br>No supervision<br>No self-correction | *During*<br>Promotes self-distraction<br>Cognitive self-avoidance,<br>Self-handicapping,<br>Procrastination |
| | *After*<br>Promotes self-reflection<br>Promotes adjusted self-attributions<br>Promotes positive adjusted self-affect | *After*<br>No reflection<br>No attributions<br>No affect | *After*<br>Promotes erroneous self-assessment,<br>Erroneous self-attributions.<br>Promotes maladjusted self-affect |
| *Type of Context* | Externally-regulating | Non-regulating | Dys-regulating |
| Academic | Regulatory teaching (RT) | Laissez-faire | Stressful teaching |

### Principle 3. Academic Emotions as an Internally (SR) and Externally (ER) Mediated Process

According to this principle, academic emotions are produced in a probabilistic fashion, with both internal mediation (self-regulation as a personal characteristic) and external mediation (favoring or discouraging regulation). Human learning is thus envisioned as the *combination* of a person's self-regulating ability and the external regulatory features of the context, with four types of interactions. Self-regulated learning, therefore, may be explained and predicted by an individual's self-regulation in conjunction with the external characteristics of the context. Consequently, the prediction of the model is that the *1st combination* (low self-regulation and low externally-regulation) should produce few positive and many negative emotions, high burnout and low engagement. The *2nd combination* (low self-regulation and medium/high externally-regulation) should produce medium-low positive emotions and negative medium-high, medium-high burnout and medium-low engagement. The *3rd combination* (medium/high self-regulation and medium-low externally-regulation) should produce medium/high positive emotions and low negative emotions, medium-high engagement and medium-low burnout. The *4th combination* (high self-regulation and high externally-regulation) should produce high positive emotions and low negative emotions, high engagement and low burnout (see **Table 3**).

## Aims and Hypothesis

Based on the foregoing models and empirical data, this investigation had several *objectives*: (1) to improve the heuristic technique for assessing the type of combination—as established by SRL vs. ERL Theory—using five types or levels; (2) to establish whether these interaction levels determined positive and negative achievement emotions, as defined in Pekrun's model; (3) to analyze whether there was a similar impact in the correlates of engagement and burnout. *Hypotheses* consistent with these objectives were defined as follows: (1) The possible combinations of student's level of self-regulation and level of external regulation offered by the teaching can be ordered in five progressive levels (averaging the level of personal self-regulation and the regulation promoted by the context, on a range between 1 and 3, and on a scale from 1 to 5); (2) the gradual increase of interaction level, ranging from 1 to 5, will lead to a proportionate increase in positive emotionality and a decrease in negative emotionality, as conceptualized by the Pekrun model; (3) using the same logic, these levels will correspond to a progressive increase in student engagement and a decrease in burnout.

**TABLE 3 |** Positive vs. negative emotions in the *SRL vs. ERL Theory*.

| Type of combination | Presage | Process (teaching) | Process (learning) | Product | |
|---|---|---|---|---|---|
| Pintrich's journey metaphor | Driver | Highway | Driving | Positive vs. Negative Emotions | Success Arrival vs. Accident |
| Level | Self-Regulation (SR)* *(student)* | Regulatory Teaching (ER)* *(context)* | Self-Regulated Learning (SRL) *(student)* | Achievement Emotions* *(student)* | Motivation* *(student)* |
| 4° | High=> low stress | High=> low stress | High=> Deep approach<br>Low=> Surface approach | High=> + emotions<br>Low=> – emotions | High=> engagement<br>Low=> burnout |
| 3° | High=> low/medium stress | Low=> Medium/low stress | Medium/High=> Deep approach<br>Medium/Low=> Surface approach | Medium/High=> + emotions<br>Medium/Low=> – emotions | Medium/High=> engagement<br>Medium/low=> burnout |
| 2° | Low=> medium/high stress | High=> medium/high stress | Medium/Low=> Deep approach<br>High/Medium> Surface approach | Moderate/Low=> + emotions<br>Moderate/High=> – emotions | Moderate/Low=> engagement<br>Medium/High=> burnout |
| 1° | Low=> high stress | Low=> high stress | Low=> Deep approach<br>High=> Surface approach | Low=> + emotions<br>High=> – emotions | Low=> Engagement<br>High=> Burnout |

*Variables of this research.*

# METHOD

## Participants

For the interdependence relations among low-medium-high levels of *Personal Self-Regulation* (SR), and *Regulatory Teaching* (RT), we used a total sample of 440 undergraduate students from two universities in Spain. A selected sample of 336 students was used to analyze the type of combination. The sample was composed of students enrolled in Psychology, Primary Education, and Educational Psychology degree programs; 86.5% were women and 13.5% were men. Their ages ranged from 19 to 49, with a mean age of 23.08 ($\sigma_X = 4.4$) years.

## Instruments (see Annex I. Complementary Material)

### Learning Process

***Personal self-regulation (meta-behavioral variable)***

This variable was measured using the *Short Self-Regulation Questionnaire (SSRQ)* (Miller and Brown, 1991). It has already been validated in Spanish samples (Pichardo et al., 2014, 2018), and possesses acceptable validity and reliability values, similar to the English version. The Short SRQ is composed of four factors (goal setting-planning, perseverance, decision making and learning from mistakes) and 17 items (all of them with saturations >0.40), with a consistent confirmatory factor structure (Chi-Square = 250.83, $df = 112$, CFI = 0.95, GFI = 0.94, AGFI = 0.96, RMSEA = 0.05. *Internal consistency* was acceptable for the total of questionnaire items ($\alpha = 0.86$) and for the factors of goal setting-planning ($\alpha = 0.79$), decision making ($\alpha = 0.72$) and learning from mistakes ($\alpha = 0.72$). *Correlations* have been studied, between each item and its factor total, among the factors, and between each factor and the complete questionnaire, with good results in all cases, except for the decision-making factor, which had a lower correlation with other factors (range: 0.41–0.58). The correlations between the original version and the complete version, and between the original and the short versions with a Spanish sample (complete SRQ with 32 items and short SRQ with 17 items) are better for the short version (short-original: $r = 0.85$ and short-complete: $r = 0.94$; $p < 0.01$) than for the complete version (complete-original: $r = 0.79$; $p < 0.01$).

### Teaching Process

***Regulatory teaching (meta-instructional variable)***

The Scales for Assessment of the Teaching-Learning Process, ATLP, student version (de la Fuente et al., 2012) were used to evaluate students' perception of the teaching process. The scale entitled *Regulatory Teaching* is Dimension 1 of the confirmatory model. IATLP-D1 comprises 29 items structured along five factors: Specific regulatory teaching, regulatory assessment, preparation for learning, satisfaction with the teaching, and general regulatory teaching. The scale was validated in university students (de la Fuente et al., 2012) and showed a factor structure with adequate fit indices (Chi-Square = 590.626; $df = 48$, $p < 0.001$, CF1 = 0.958, TLI = 0.959, NFI = 0.950, NNFI = 0.967; RMSEA = 0.068) and adequate internal consistency (IATLP D1: $\alpha = 0.83$; Specific regulatory teaching, $\alpha = 0.897$; regulatory assessment, $\alpha = 0.883$; preparation for learning, $\alpha = 0.849$; satisfaction with the teaching, $\alpha = 0.883$ and general regulatory teaching, $\alpha = 0.883$). The ATLP is a self-report instrument completed by the teacher and the students, available in Spanish and English versions. It also includes a qualitative part where students can make recommendations for improving

each of the processes evaluated. As for the instrument's external validity, results are also consistent, since there are different interdependent relationships among perceptions of variables that exist in an academic environment.

## Learning Product

### *Achievement emotions*

The Achievement Emotions Questionnaire, AEQ (Pekrun et al., 2005) is a multidimensional self-report instrument designed to assess university students' achievement emotions. This questionnaire was generated on the basis of a quantitative and qualitative research program analyzing the emotions that students experienced in academic achievement situations. Several discrete emotions are measured within each of the three main academic achievement situations: attending class, studying, and completing tests and exams. The current version of the AEQ can measure eight class-related emotions, eight learning-related emotions, and eight test emotions. Three corresponding scales—class-related, learning-related, and test-related emotions—make up the three sections of the AEQ. Eighty items in the *class-related emotions scale* (CRE) measure the following eight emotions: class-related enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom. The *learning-related emotions scale* (LRE) contains 75 items and measures the same eight emotions in study situations. The *test emotions scale* (TES) contains 77 items that assess test-related enjoyment, hope, pride, relief, anger, anxiety, shame, and hopelessness. Each section is formed by three blocks of items, for assessment of emotions experienced either before, during, or after the achievement situations addressed in that section. Trait achievement emotions are assessed, that is, the student's typical, individual emotional reactions in achievement situations. The AEQ instructions can be altered for the purpose of measuring emotions experienced in a particular class subject (course-specific emotions), or in specific situations at a specific time (state achievement emotions).

The AEQ assesses four positive emotions (enjoyment, hope, pride, and relief) and five negative emotions (anger, anxiety, hopelessness, shame, and boredom). Two main criteria were used to decide which emotions to include. First, the emotions identified are frequently experienced by college students (Pekrun, 1992). Second, the emotions can be classified along two dimensions, each with two possible values: valence (positive vs. negative) and activation (activating vs. deactivating). Their combination results in four categories of emotions that can summarize how emotions affect learning, achievement, personality development, and health. Emotions are classified into the four categories as follows, *positive activating:* enjoyment, hope, pride; *positive deactivating*: relief; *negative activating:* anger, anxiety, shame; *negative deactivating:* hopelessness, boredom.

The three main types of achievement situations at university—attending class, studying, and taking tests and exams—differ according to function and social structure. This implies that emotions toward these situations would also differ. Enjoyment of classroom instruction, for example, would differ from enjoying the challenge of an exam. Some students may feel excited about going to class, others when taking exams. The AEQ takes this into account by providing separate scales for emotions that are class-related, learning-related, and test-related.

## Confirmatory Factor Analysis and Reliability

(1) *Class-Related Emotions* (translation: Paoloni, 2014). The psychometric properties of the CRE were satisfactory in students from Spain. In this sample, the model obtained good fit indices. Unidimensionality of the scale and metric invariance were confirmed in the samples evaluated (Chi Square=10,885,597, Degrees of freedom = 3052, $p < 0.001$; CFI = 0.951, TLI = 0.952, IFI = 0.963, TLI = 0.958, and CFI = 0.952; RMSEA = 0.041; HOELTER=458, $p < 0.05$; 466 $p < 0.01$). The Cronbach alpha for this sample was 0.904, 0.803 (40 items), and 0.852 (40 items), for each part, respectively (80 items).

(2) *Learning-Related Emotions* (translation: de la Fuente, 2015a). The psychometric properties of the LRE were satisfactory in students from Spain. In this sample, the model obtained good fit indices. Unidimensionality of the scale and metric invariance were confirmed in the samples evaluated (Chi Square= 10885,597, Degrees of freedom = 3052, $p < 0.001$; CFI = 0.959, TLI = 0.942, IFI = 0.969, TLI = 0.955, and CFI = 0.958; RMSEA = 0.038; HOELTER=501, $p < 0.05$; 511 $p < 0.01$). The Cronbach alpha for this sample was 0.930, 0.880 (38 items), and 0.846 (37 items), for each part, respectively (75 items).

(3) *Test-Related Emotions* (translation: de la Fuente, 2015b). The psychometric properties of the TRE were satisfactory in students from Spain. In this sample, the model obtained good fit indices. Unidimensionality of the scale and metric invariance were confirmed in the samples evaluated (Chi Square= 10885,597, Degrees of freedom = 3052, $p < 0.001$; CFI = 0.954, TLI = 0.946, IFI = 0.964, TLI = 0.959, and CFI = 0.953; RMSEA = 0.039; HOELTER=492, $p < 0.05$; 502 $p < 0.01$). The Cronbach alpha for this sample was 0.913, 0.824, and 0.869, for each part, respectively (77 items).

### *Engagement-burnout*

This version has shown adequate reliability and construct validity indices in a cross-cultural study.

*Engagement* was assessed with a validated Spanish version of the *Utrecht Work Engagement Scale for Students* (Shaufeli et al., 2002). The psychometric properties of the TRE were satisfactory in students from Spain. In this sample, the model obtained good fit indices. Unidimensionality of the scale and metric invariance were confirmed in the samples evaluated (Chi-square = 792,526, $df$=74, $p < 0.001$; CFI = 0.954, TLI = 0.976, IFI = 0.954, TLI = 0.979, and CFI = 0.973; RMSEA = 0.083; HOELTER=153, $p < 0.05$; 170 $p < 0.01$). The Cronbach alpha for this sample was 0.900 (14 items), 0.856 (7 items), and 0.786 (7 items), for each part, respectively.

*Burnout* was assessed with a validated Spanish version of the *Burnout Scale for Students* (Shaufeli et al., 2002). The psychometric properties of this version scale were satisfactory in students from Spain. In this sample, the model obtained good fit indices. Unidimensionality of the scale and metric invariance were confirmed in the samples evaluated (Chi Square= 767,885, $df$=87, $p < 0.001$; CFI = 0.956, TLI = 0.964, IFI = 0.951, TLI = 0.951, and CFI = 0.953; RMSEA = 0.071; HOELTER=224,

$p < 0.05$; 246 $p < 0.01$). The Cronbach alpha for this sample was 0.874 (15 items), 0.853 (8 items), and 0.793 (7 items), for each part, respectively.

## Procedure

Participants voluntarily completed the scales using an online *platform* (de la Fuente et al., 2015a). A total of five specific teaching-learning processes in different university subjects, imparted over two academic years, were evaluated. *Presage* variables were evaluated in September to October of 2017 and 2018, *Process* variables in February to March of 2017 and 2018, and *Product* variables in May to June of 2017 and 2018. The procedure was approved by the respective Ethics Committees of the two universities, in the context of an R & D Project (2018–2020).

## Data Analysis

A previous confirmatory factor analysis was conducted in this sample as evidence of factorial validity and to ensure the previous structural fit of each inventory (Chi Square, NFI, TLI, RFI, RMSEA and HOELTER), using the statistical program AMOS (v. 22) Reliability was also calculated (Cronbach Alpha) through SPSS (v.25).

Using an ex-post-facto design, first, a 3 K-means cluster analysis was conducted to establish low-medium-high groups in each of the two variables: Personal Self-Regulation (SR) and Regulatory Teaching (RT). In the case of the SR variable, the values (Low = 2.70; Medium = 3.48; High = 4.20) formed the centers of the clusters, response ranges being low (1.00–3.09), medium (3.10–3.84), and high (3.85–5.00). In the case of the RT variable (Low = 2.72; Medium = 3.58; High = 4.34), formed the centers of the clusters, response ranges being low (1.00–2.34), medium (2.35–2.83) and high (2.84–5.00). In addition, several ANOVAs and MANOVAs were carried out, to ascertain the effect of low-medium-high levels of the dependent variable, achievement emotions. Also, using a 3-factor design (low-medium-high self-regulation levels) × 3 (low-medium-high levels of regulatory teaching), several MANOVAs were conducted, taking the aforementioned levels as the independent variable. Finally, based on the low-medium-high groups in both variables (SR and RT), five combinations were configured, according to the theoretical model proposed (see **Table 4**). MANOVAs were conducted to establish statistical suitability of these groupings, as well as the effects of the dependent variables defined, with Pillai's trace and Sheffé test index.

# RESULTS

## Interdependent Relations Among Levels of Personal Self-Regulation (SR) and Levels of Regulatory Teaching (RT) in the Achievement Emotions

### Class Achievement Emotions (CAE)

A statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(4,714)} = 14.831$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.077$], and *RT IV (low-medium-levels)* [$F_{(4,714)} = 8.975$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.048$], was noted on the CAE. The statistically significant partial effect was maintained of the *SR IV (low-medium-high levels)* for both *Positives Emotions* [$F_{(2,365)} = 25.945$, $p < 0.001$, $n^2 = 0.127$, 1>2>3], and *Negatives Emotions* [$F_{(2,365)} = 18.314$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.127$; 3 >2 >1]. The statistically significant partial effect was maintained of the *PR IV (low-medium-high levels)* for both *Positive Emotions* [$F_{(2,365)} = 15.847$, $p < 0.001$, $n^2 = 0.082$, 3>2,1], and *Negative Emotions* [$F_{(2,365)} = 9.884$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.052$; 3 < 2,1]. No statistical effect of significant interaction appeared.

Complementarily, a statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(16,702)} = 4.865$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.100$], and *RT IV* (low-medium-levels) [$F_{(16,702)} = 3.804$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.080$], was noted on the factors of CAE. The statistically significant partial effect was retained for *enjoyment* [$F_{(2,366)} = 5.385$, $p < 0.001$, $n^2 = 0.037$; *post-hoc*: 3>2>1], for *hope* [$F_{(2,366)} = 13.463$, $p < 0.001$, $n^2 = 0.164$; *post-hoc*: 3>2>1], for *pride* [$F_{(2,366)} = 15.540$, $p < 0.001$, $n^2 = 0.080$; *post-hoc*: 3>2>1], for *boredom* [$F_{(2,366)} = 9.749$, $p < 0.001$, $n^2 = 0.952$; *post-hoc*: 1>2>3], for *anger* [$F_{(2,366)} = 9.448$, $p < 0.001$, $n^2 = 0.050$; *post-hoc*: 1>2>3], for *anxiety* [$F_{(2,366)} = 13.033$, $p < 0.001$, $n^2 = 0.068$; *post-hoc*: 1>2>3], for *shame* [$F_{(2,366)} = 11.080$, $p < 0.001$, $n^2 = 0.062$; *post-hoc*: 1>2>3], and for *hopelessness* [$F_{(2,366)} = 17.667$, $p < 0.001$, $n^2 = 0.090$, *post-hoc*: 1 >2>3].

### Learning Achievement Emotions (LAE)

A statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(4,696)} = 16.145$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.085$], and RT IV (low-medium-levels) [$F_{(4,696)} = 8.833$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.048$], was noted on the LAE. The statistically significant partial effect was maintained of the *SR IV (low-medium-high levels)* for both *Positive Emotions* [$F_{(2,348)} = 27.716$, $p < 0.001$, $n^2 = 0.135$, 1<2<3], and *Negative Emotions* [$F_{(2,348)} = 21.804$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.111$; 1>2>3]. The statistically significant partial effect was maintained of the *PR IV (low-medium-high levels)* for both *Positive Emotions* [$F_{(2,348)} = 15.028$, $p < 0.001$, $n^2 = 0.079$, 3>2,1], and *Negative Emotions* [$F_{(2,348)} = 8.205$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.045$; 3 < 2,1]. No statistical effect of significant interaction appeared.

Complementarily, a statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(16,684)} = 4.943$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.104$], and *RT IV* (low-medium-levels) [$F_{(16,684)} = 2.964$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.065$], was noted on the factors of LAE. The statistically significant partial effect of *SR IV* was retained for *enjoyment* [$F_{(2,348)} = 18.713$, $p < 0.001$, $n^2 = 0.097$; *post-hoc*: 3>2>1], for *hope* [$F_{(2,348)} = 29.686$, $p < 0.001$, $n^2 = 0.146$; *post-hoc*: 3>2>1], for *pride* [$F_{(2,348)} = 17.887$, $p < 0.001$, $n^2 = 0.093$; *post-hoc*: 3>2>1], for *boredom* [$F_{(2,348)} = 15.194$, $p < 0.001$, $n^2 = 0.080$; *post-hoc*: 1>2>3], for *anger* [$F_{(2,348)} = 9.746$, $p < 0.001$, $n^2 = 0.053$; *post-hoc*: 1>2>3], for *anxiety* [$F_{(2,348)} = 16.603$, $p < 0.001$, $n^2 = 0.097$; *post-hoc*: 1>2>3], for *shame* [$F_{(2,348)} = 19.089$, $p < 0.001$, $n^2 = 0.099$; *post-hoc*: 1>2>3], and for *hopelessness* [$F_{(2,348)} = 19.308$, $p < 0.001$, $n^2 = 0.100$, *post-hoc*: 1 >2>3]. A statistically significant partial effect of *RT IV* was retained for *enjoyment* [$F_{(2,348)} = 9.841$, $p < 0.001$, $n^2 = 0.054$; *post-hoc*: 3>2,1], for *hope* [$F_{(2,348)} = 13,123$, $p < 0.001$,

**TABLE 4 |** Interdependence relations between the low-medium-high levels of *Self-Regulation* and *External Regulation (Regulatory Teaching)* as independent variables, in *achievement emotions*, burnout and engagement.

| ***DVs*** | ***Self-regulation*** | | | ***External regulation*** | | |
|---|---|---|---|---|---|---|
| | **1. *Low*** **DR ($n$ = 104)** | **2. *Medium*** **NR ($n$ = 215)** | **3. *High*** **SR ($n$ = 99)** | **1. *Low*** **EDR ($n$ = 85)** | **2. *Medium*** **ENR ($n$ = 173)** | **3. *High*** **ER ($n$ = 172)** |
| ***Class Achievement Emotions (CAE)*** | | | | | | |
| *Positives (+)* | 2.97 (0.59) | 3.38 (0.54) | 3.84 (0.61)* | 3.11 (0.67) | 3.29 (0.58) | 3.72 (0.60) |
| *Negatives (–)* | 2.43 (0.63) | 2.05 (0.56) | 1.69 (0.54)* | 2.29 (0.64) | 2.14 (0.62) | 1.81 (0.55)$^{3<2,1*}$ |
| Enjoyment (+) | 2.88 (0.63) | 3.23 (0.62) | 3.65 (0.72)* | 2.99 (0.72) | 3.13 (0.62) | 3.58 (0.66)* |
| Hope (+) | 2.98 (0.66) | 3.51 (0.56) | 4.03 (0.63)* | 3.22 (0.73) | 3.42 (0.64) | 3.84 (0.64)* |
| Pride (+) | 3.05 (0.70) | 3.41 (0.62) | 3.84 (0.68)* | 3.11 (0.70) | 3.29 (0.64) | 3.80 (0.64)* |
| Boredom (–) | 2.75 (0.87) | 2.27 (0.79) | 1.90 (0.80)* | 2.60 (0.97) | 2.39 (0.80) | 1.91 (0.77)* |
| Anger (–) | 2.19 (0.73) | 1.86 (0.66) | 1.57 (0.62)* | 2.12 (0.74) | 1.96 (0.67) | 1.56 (0.54)* |
| Anxiety (–) | 2.51 (0.72) | 2.18 (0.65) | 1.78 (0.62)* | 2.24 (0.71) | 2.21 (0.74) | 1.97 (0.65) $^{3<2,1*}$ |
| Shame (–) | 2.57 (0.91) | 2.19 (0.80) | 1.79 (0.75)* | 2.21 (0.83) | 2.21 (0.88) | 1.99 (0.74) |
| Hopelessness (–) | 2.14 (0.74) | 1.75 (0.60) | 1.40 (0.55)* | 1.85 (0.70) | 1.86 (0.70) | 1.50 (0.50) $^{3<2,1*}$ |
| ***Learning Achievement Emotions (LAE)*** | | | | | | |
| *Positives* | 3.27 (0.61) | 3.63 (0.53) | 4.01 (0.57)* | 3.36 (0.62) | 3.55 (0.59) | 3.98 (0.51)* |
| *Negatives* | 2.61 (0.69) | 2.14 (0.62) | 1.80 (0.62)* | 2.37 (0.80) | 2.30 (0.69) | 1.89 (0.56) $^{3<2,1*}$ |
| Enjoyment (+) | 3.13 (0.63) | 3.46 (0.57) | 3.90 (0.59)* | 3.18 (0.82) | 3.46 (0.68) | 3.73 (0.57)* |
| Hope (+) | 3.16 (0.74) | 3.64 (0.66) | 4.14 (0.68)* | 3.34 (0.83) | 3.56 (0.73) | 4.01 (0.64) $^{3>2,1*}$ |
| Pride (+) | 3.34 (0.76) | 3.76 (0.63) | 4.20 (0.63)* | 3.11 (0.70) | 3.29 (0.64) | 3.80 (0.64)* |
| Boredom (–) | 2.72 (0.88) | 2.23 (0.83) | 1.79 (0.75)* | 2.60 (0.97) | 2.39 (0.80) | 1.91 (0.77) $^{3<2,1*}$ |
| Anger (–) | 2.29 (0.82) | 1.96 (0.73) | 1.59 (0.64)* | 2.11 (0.81) | 1.96 (0.67) | 1.56 (0.54) $^{1>2,3*}$ |
| Anxiety (–) | 2.97 (0.70) | 2.57 (0.64) | 2.27 (0.68)* | 2.11 (0.71) | 2.24 (0.74) | 1.97 (0.65) $^{3<2,1*}$ |
| Shame (–) | 2.60 (0.82) | 2.07 (0.76) | 1.82 (0.76)* | 2.21 (0.83) | 2.21 (0.88) | 1.99 (0.74) $^{ns}$ |
| Hopelessness (–) | 2.39 (0.90) | 1.90 (0.72) | 1.52 (0.71)* | 1.85 (0.70) | 1.86 (0.70) | 1.50 (0.66) $^{3<2,1*}$ |
| ***Test Achievement Emotions (TAE)*** | | | | | | |
| *Positives (+)* | 2.88 (0.68) | 3.24 (0.60) | 3.60 (0.62)* | 3.00 (0.68) | 3.15 (0.65) | 3.51 (0.62)* |
| *Negatives (–)* | 2.78 (0.56) | 2.51 (0.55) | 2.27 (0.56)* | 2.61 (0.65) | 2.58 (0.55) | 2.44 (0.55) $^{3<2,1*}$ |
| Enjoyment (+) | 2.81 (0.70) | 3.10 (0.68) | 3.38 (0.81)* | 2.87 (0.70) | 3.08 (0.70) | 3.32 (0.67)* |
| Hope (+) | 2.87 (0.77) | 3.32 (0.66) | 3.74 (0.75)* | 3.08 (0.73) | 3.21 (0.78) | 3.63 (0.68) $^{3,2>1*}$ |
| Pride (+) | 2.96 (0.76) | 3.33 (0.76) | 1.70 (0.57)* | 3.07 (0.70) | 3.25 (0.72) | 3.58 (0.75)* |
| Relief (–) | 3.50 (0.85) | 3.68 (0.75) | 3.63 (0.88) | 3.38 (0.84) | 3.67 (0.76) | 3.75 (0.82)* |
| Anger (–) | 2.51 (0.70) | 2.19 (0.68) | 1.91 (0.67)* | 2.24 (0.68) | 2.25 (0.66) | 1.99 (0.69) $^{3<2,1*}$ |
| Anxiety (–) | 3.28 (0.83) | 2.90 (0.83) | 2.60 (0.86)* | 2.88 (0.94) | 2.94 (0.90) | 2.83 (0.85) $^{n.s.}$ |
| Shame (–) | 2.20 (0.87) | 1.84 (0.74) | 1.61 (0.75)* | 2.01 (0.89) | 1.96 (0.77) | 1.72 (0.74) $^{3<2,1*}$ |
| Hopelessness (–) | 2.41 (0.88) | 1.96 (0.79) | 1.59 (0.78)* | 2.07 (0.91) | 2.04 (0.81) | 1.72 (0.79) $^{3<2,1*}$ |
| ***Burnout* (–)** | 2.61 (0.62) | 2.20 (0.53) | 1.88 (0.53)* | 2.42 (0.68) | 2.32 (0.58) | 1.87 (0.56)* |
| Depletion | 2.96 (0.82) | 2.52 (0.54) | 2.16 (0.59)* | 2.69 (0.87) | 2.62 (0.79) | 2.34 (0.83)* |
| Cynicism | 2.45 (0.93) | 2.01 (0.81) | 1.78 (0.75)* | 2.25 (0.92) | 2.17 (0.85) | 1.78 (0.77)* |
| Lack of Effectiveness | 2.43 (0.47) | 2.08 (0.52) | 1.71 (0.48)* | 2.33 (0.65) | 2.17 (0.52) | 1.80 (0.51)* |
| ***Engagement* (+)** | 3.15 (0.63) | 3.44 (0.60) | 3.84 (0.60)* | 3.20 (0.70) | 3.37 (0.61) | 3.38 (0.78)* |
| Vigor | 2.86 (0.82) | 3.23 (0.71) | 3.69 (0.68)* | 2.95 (0.73) | 3.14 (0.73) | 3.57 (0.73)* |
| Dedication | 3.59 (0.77) | 3.86 (0.69) | 4.17 (0.18)* | 3.62 (0.85) | 3.77 (0.69) | 4.18 (0.64)* |
| Absorption | 3.00 (0.80) | 3.22 (0.79) | 3.67 (0.79)* | 3.02 (0.88) | 3.20 (0.80) | 3.58 (0.77)* |

*SR, Self-Regulation; NR, Non-Regulation; DR, Dys-Regulation; ER, External Regulation; ENR, External Non-Regulation; EDR, External Dys-Regulation.*
**Statistical significance effect in each variable: $p < 0.001$.*

$n^2 = 0.170$; *post-hoc*: 3>2,1], for *pride* [$F_{(2, 348)} = 13.693$, $p < 0.001$, $n^2 = 0.073$; *post-hoc*: 3>2>1], for *boredom* [$F_{(2, 348)} = 13.165$, $p < 0.001$, $n^2 = 0.070$; *post-hoc*: 1,2>3], for *anger* [$F_{(2, 348)} = 6.645$, $p < 0.001$, $n^2 = 0.037$; *post-hoc*: 1,2>3], for *anxiety* [$F_{(2, 348)} = 3.090$, $p < 0.001$, $n^2 = 0.037$; *post-hoc*: 1>2>3], for *shame* [$F_{(2, 348)} = 2.676$, $p < 0.001$, $n^2 = 0.015$; *post-hoc*: 1,2>3], and for *hopelessness* [$F_{(2, 348)} = 7.935$, $p < 0.001$, $n^2 = 0.044$, *post-hoc*: 1,2>3].

### Test Achievement Emotions (TAE)

A statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(4,716)} = 14.276$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.074$], and RT IV (low-medium-levels) [$F_{(4,716)} = 5.8705$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.032$], was noted on the TAE. The statistically significant partial effect was maintained of the *SR IV (low-medium-high levels)* for both *Positive Emotions* [$F_{(2,358)} = 21.361$, $p < 0.001$, $n^2 = 0.107$, 3>2>1], and *Negative Emotions* [$F_{(2,358)} = 17.415$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.087$; 1 >2 >3]. The statistically significant partial effect was maintained of the *PR IV (low-medium-high levels)* for both *Positive Emotions* [$F_{(2,358)} = 11.268$, $p < 0.001$, $n^2 = 0.059$, 3>2,1], and *Negative Emotions* [$F_{(2,3585)} = 0{,}595$ (Pillai's Trace), ns, $n^2 = 0.052$]. No statistical effect of significant interaction appeared.

Complementarily, a statistically significant main effect of the *SR IV (low-medium-high levels)* [$F_{(16,704)} = 4.613$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.095$], and *RT IV* (low-medium-levels) [$F_{(16,704)} = 2.981$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.063$], was noted on the factors of TAE. The statistically significant partial effect was retained for *enjoyment* [$F_{(2,358)} = 7.161$, $p < 0.001$, $n^2 = 0.038$; *post-hoc*: 3>2,1], for *hope* [$F_{(2,358)} = 11.813$, $p < 0.001$, $n^2 = 0.062$; *post-hoc*: 3>2,1], for *pride* [$F_{(2,358)} = 9.958$, $p < 0.001$, $n^2 = 0.053$; *post-hoc*: 3>2,1], for *relief* [$F_{(2,358)} = 4.789$, $p < 0.01$, $n^2 = 0.952$; *post-hoc*: 1>2,3], for *anger* [$F_{(2,358)} = 2.518$, $p < 0.05$, $n^2 = 0.014$; *post-hoc*: 1,2>3], for *anxiety* [$F_{(2,358)} = 0.341$, ns, $n^2 = 0.002$], for *shame* [$F_{(2,358)} = 0.225$, ns, $n^2 = 0.001$], and for *hopelessness* [$F_{(2,358)} = 2.405$, $p < 0.09$ ns, $n^2 = 0.013$].

### Engagement-Burnout

A statistically significant general main effect of the *Self-Regulation IV* (*low-medium-high levels*) [$F_{(4,1808)} = 38.541$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.079$; *post-hoc*: 3 >2 > 1], and *Regulatory Teaching IV* (*low-medium-high levels*) [$F_{(4,1808)} = 21.850$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.046$; *post-hoc*: 3 >2 > 1] was observed on *Engagement-Burnout levels*. The statistically significant partial effect was maintained of *Self-Regulation* IV both *Engagement* [$F_{(2,914)} = 44.886$, $p < 0.001$, $n^2 = 0.090$, 1>2>3], and *Burnout* [$F_{(2,914)} = 76.096$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.144$; 3 >2 >1]. A statistically significant general main effect of the *Regulatory Teaching IV (low-medium-high levels)* both *Engagement-Burnout* [$F_{(4,1808)} = 21.850$, $p < 0.001$, $n^2 = 0.946$, 1>2>3].

The combined analysis of the *Self-Regulation* IV*'s effect (low-medium-high levels)* on the components of *engagement-burnout* yielded a statistically significant main effect [$F_{(12,1800)} = 17535$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.105$]. The statistically significant partial effect was retained for *vigor* [$F_{(2,904)} = 48.663$, $p < 0.001$, $n^2 = 0.097$; *post-hoc*: 3>2>1], for *dedication* [$F_{(2,904)} = 24.995$, $p < 0.001$, $n^2 = 0.092$; *post-hoc*: 3>2>1], for *absorption* [$F_{(2,904)} = 23.660$, $p < 0.001$, $n^2 = 0.093$; *post-hoc*: 3>2>1], for *exhaustion* [$F_{(2,904)} = 48.474$, $p < 0.001$, $n^2 = 0.097$; *post-hoc*: 1>2>3], for *cynicism* [$F_{(2,904)} = 30.573$, $p < 0.001$, $n^2 = 0.063$; *post-hoc*: 1>2>3], for *lack of effectiveness* [$F_{(2,904)} = 84.497$, $p < 0.001$, $n^2 = 0.156$; *post-hoc*: 1>2>3].

In a complementary way, a statistically significant general main effect of the *Regulatory Teaching* IV (*low-medium-high levels*) was observed on the components of *engagement-burnout levels* [$F_{(12,1800)} = 9{,}218$ (Pillai's Trace), $p < 0.001$, $n^2 = 0.058$]. The statistically significant partial effect was retained for *vigor* [$F_{(2,904)} = 35.222$, $p < 0.001$, $n^2 = 0.072$; *post-hoc*: 3>2>1], for *dedication* [$F_{(2,904)} = 33.156$, $p < 0.001$, $n^2 = 0.068$; *post-hoc*: 3,2>1], for *absorption* [$F_{(2,904)} = 21.111$, $p < 0.001$, $n^2 = 0.041$; *post-hoc*: 3,2>1], for *exhaustion* [$F_{(2,904)} = 21.111$, $p < 0.001$, $n^2 = 0.145$; *post-hoc*: 1, 2>3], for *cynicism* [$F_{(2,904)} = 17.524$, $p < 0.001$, $n^2 = 0.037$; *post-hoc*: 1,2>3], for *lack of effectiveness* [$F_{(2,904)} = 37.543$, $p < 0.001$, $n^2 = 0.077$ *post-hoc*: 1>2>3] (see **Tables 4**, **5**, and **Figure 1**).

## Combined Effects of Regulation Variables: A Utility Model™ for Types of Interactions Between Levels of Self-Regulation and External Regulation (Regulatory Teaching)

### Building a Combination Typology for Understanding Academic Emotions and Effects

The multivariate analyses (MANOVAs) showed a statistically significant main effect of the five interaction types on the low-medium-high levels of SR and of RT (see **Table 6**):

*Combination 1* presented a statistically significant low level in *SR* and low level in *RT (1 and 1)*. The **average regulation level of 1.0**, and the **rank level** is **1**. The range of regulation tends toward low SR and low RT, associated with a *high level of dysregulation*. The most probable emotions are low levels of positive emotions and high levels of negatives emotions. Consequently, the effects are a *high level of stress: high burnout and low engagement*.

*Combination 2* had a statistically significant low-medium level in *SR* and medium-low level in *RT* and vice versa *(2 and 1, or 1 and 2)*. The **average regulation level is 1.5,** and the **rank level** is **2.** The range of regulation tends toward low-medium SR and low-medium RT, and vice versa, associated with *medium-low level of dysregulation*. The most probable emotions are medium-low level of positive emotions and medium-low level of negative emotions. Consequently, the effects are a *medium-high level of stress: medium-high burnout and medium-low engagement*.

*Combination 3* presented a statistically significant medium SR level *(2)* and medium RT level *(2 and 2)*. The **average regulation level of 2.0,** and the **rank level** is **3.** The range of regulation tends toward medium SR and medium RT, associated with *medium level of dysregulation*. The most probable emotions are medium level of positive emotions and medium level of negative emotions. Consequently, the effects are a *medium level of stress: medium burnout and medium engagement*.

*Combination 4* had a statistically significant medium SR- high RT and high RT- medium SR (*2 and 3, or 3 and 2*). The **average regulation level is 2.5**, and the **rank level** is **4.** The range of regulation tends toward high SR–medium RT and medium SR and high RT, associated with a good level of *regulation*. The most probable emotions are medium-high level of positive emotions and medium-low level of negative emotions. Consequently, the effects are a *medium-low level of stress: medium-low burnout and medium-high engagement*.

*Combination 5* presented statistically significant high SR- high RT and high RT- high *SR (3 and 3)*. The **average regulation level is 3.0**, and the **rank level** is **5.** The range of regulation tends

**TABLE 5 |** Combined and Interdependent effects (3 × 3) between the independent variables of low-medium-high levels of *Self-Regulation (SR)* and low-medium-high levels of *Regulatory Teaching (RT)*, i.e., external regulation, on dependent variables ($n = 201$).

| ***SR*** | ***Low (n = 87)*** | | | ***Medium (n = 193)*** | | | ***High (n = 86)*** | | |
|---|---|---|---|---|---|---|---|---|---|
| ***RT*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** |
| ***n=*** | **24** | **45** | **18** | **43** | **51** | **99** | ***29*** | **47** | **86** |
| ***Class Achievement Emotions (CAE)*** | | | | | | | | | |
| Positive (+) | 2.83 (0.60) | 2.97 (0.58) | 3.22 (0.64) | 3.19 (0.59) | 3.33 (0.46) | 3.63 (0.53) | 3.47 (0.51) | 3.58 (0.67) | 4.04 (0.51)* |
| Negative (–) | 2.55 (0.62) | 2.48 (0.58) | 2.15 (0.74) | 2.11 (0.54) | 2.12 (0.59) | 1.87 (0.18) | 2.12 (0.84) | 1.76 (0.44) | 1.58 (0.50)* |
| Enjoyment (+) | 2.75 (0.65) | 2.87 (0.60) | 3.19 (0.62) | 3.06 (0.72) | 3.19 (0.54) | 3.48 (0.61) | 3.34 (0.74) | 3.32 (0.75) | 3.87 (0.63)* |
| Hope (+) | 2.83 (0.74) | 3.01 (0.72) | 3.22 (0.70) | 3.33 (0.72) | 3.46 (0.49) | 3.73 (0.78) | 3.71 (0.76) | 3.82 (0.69) | 4.21 (0.52)* |
| Pride (+) | 2.91 (0.66) | 3.02 (0.69) | 3.26 (0.74) | 3.17 (0.71) | 3.33 (0.53) | 3.69 (0.59) | 3.36 (0.57) | 3.61 (0.76) | 4.04 (0.58)* |
| Boredom (–) | 3.15 (0.19) | 2.63 (0.69) | 2.18 (0.73) | 2.46 (0.89) | 2.35 (0.69) | 2.00 (0.80) | 2.36 (0.88) | 2.17 (0.93) | 1.71 (0.69)* |
| Anger (–) | 2.15 (0.91) | 2.33 (0.72) | 2.03 (0.83) | 2.01 (0.78) | 2.00 (0.74) | 1.70 (0.53) | 2.00 (0.98) | 1.70 (0.69) | 1.45 (0.45)* |
| Anxiety (–) | 2.40 (0.62) | 2.67 (0.68) | 2.40 (0.97) | 2.07 (0.65) | 2.28 (0.69) | 2.10 (0.56) | 2.27 (0.99) | 1.76 (0.47) | 2.27 (0.99)* |
| Shame (–) | 2.37 (0.75) | 2.90 (0.90) | 2.40 (0.99) | 2.23 (0.85) | 2.20 (0.79) | 2.12 (0.69) | 2.25 (0.99) | 1.68 (0.64) | 1.76 (0.69)* |
| Hopelessness (–) | 2.27 (0.74) | 2.16 (0.71) | 1.88 (0.67) | 1.78 (0.53) | 1.84 (0.65) | 1.55 (0.45) | 1.69 (0.95) | 1.45 (0.43) | 1.33 (0.53)* |
| ***Learning Achievement Emotions (LAE)*** | | | | | | | | | |
| Positive (+) | 2.92 (0.64) | 3.31 (0.61) | 3.42 (0.69) | 3.45 (0.62) | 3.55 (0.50) | 3.88 (0.49) | 3.59 (0.58) | 3.92 (0.61) | 4.23 (0.68)* |
| Negative (–) | 2.81 (0.83) | 2.70 (0.58) | 2.35 (0.70) | 2.39 (0.67) | 2.22 (0.59) | 1.93 (0.42) | 2.16 (0.97) | 1.89 (0.58) | 1.64 (0.56)* |
| Enjoyment (+) | 2.90 (0.56) | 3.27 (0.56) | 3.26 (0.66) | 3.25 (0.65) | 3.46 (0.54) | 3.65 (0.49) | 3.47 (0.72) | 3.73 (0.74) | 4.03 (0.44)* |
| Hope (+) | 2.81 (0.75) | 3.22 (0.70) | 3.44 (0.75) | 3.55 (0.78) | 3.61 (0.60) | 3.94 (0.54) | 3.66 (0.59) | 4.02 (0.68) | 4.31 (0.62)* |
| Pride (+) | 3.05 (0.79) | 3.45 (0.72) | 3.58 (0.83) | 3.55 (0.64) | 3.69 (0.60) | 4.04 (0.59) | 3.65 (0.63) | 4.00 (0.62) | 4.35 (0.57)* |
| Boredom (–) | 2.91 (0.97) | 2.72 (0.73) | 2.28 (0.81) | 2.48 (0.91) | 2.30 (0.79) | 1.88 (0.63) | 2.28 (0.99) | 1.90 (0.81) | 1.57 (0.62)* |
| Anger (–) | 2.35 (0.91) | 2.33 (0.72) | 2.03 (0.83) | 2.01 (0.78) | 2.00 (0.74) | 1.70 (0.53) | 2.00 (0.98) | 1.70 (0.69) | 1.45 (0.45)* |
| Anxiety (–) | 2.85 (0.75) | 3.80 (0.57) | 2.83 (0.80) | 2.52 (0.66) | 2.62 (0.55) | 2.49 (0.60) | 2.47 (0.74) | 2.36 (0.61) | 2.13 (0.70)* |
| Shame (–) | 2.49 (0.89) | 2.80 (0.74) | 2.47 (0.99) | 2.03 (0.81) | 2.16 (0.83) | 1.96 (0.58) | 2.07 (0.99) | 1.82 (0.68) | 1.67 (0.68) |
| Hopelessness (–) | 2.44 (0.99) | 2.56 (0.81) | 2.16 (0.84) | 1.92 (0.79) | 2.03 (0.69) | 1.62 (0.56) | 1.98 (0.99) | 1.64 (0.65) | 1.39 (0.62) |
| ***Test Achievement Emotions (TAE)*** | | | | | | | | | |
| Positive (+) | 2.56 (0.64) | 2.85 (0.66) | 3.23 (0.55) | 3.14 (0.70) | 3.27 (0.52) | 3.46 (0.59) | 3.30 (0.40) | 3.62 (0.60) | 3.70 (0.64)* |
| Negative (–) | 2.74 (0.61) | 2.81 (0.52) | 2.80 (0.62) | 2.52 (0.66) | 2.55 (0.53) | 2.38 (0.41) | 2.21 (0.66) | 2.28 (0.48) | 2.24 (0.41)* |
| Enjoyment (+) | 2.55 (0.69) | 2.82 (0.71) | 3.11 (0.56) | 2.95 (0.80) | 3.05 (0.59) | 3.27 (0.67) | 3.17 (0.40) | 3.44 (0.66) | 3.55 (0.62)* |
| Hope (+) | 2.57 (0.65) | 2.76 (0.76) | 3.34 (0.68) | 2.95 (0.80) | 3.05 (0.89) | 3.53 (0.64) | 3.45 (0.47) | 3.75 (0.70) | 3.85 (0.80)* |
| Pride (+) | 2.57 (0.65) | 2.96 (0.72) | 3.23 (0.63) | 3.23 (0.72) | 3.31 (0.59) | 3.54 (0.73) | 3.27 (0.56) | 3.67 (0.60) | 3.74 (0.71)* |
| Relief (–) | 3.21 (0.80) | 3.57 (0.77) | 3.46 (0.91) | 3.56 (0.71) | 3.66 (0.66) | 3.81 (0.85) | 3.15 (0.65) | 3.71 (0.77) | 3.68 (0.76)* |
| Anger (–) | 2.54 (0.64) | 2.45 (0.60) | 2.48 (0.81) | 2.24 (0.68) | 2.23 (0.67) | 1.91 (0.53) | 1.96 (0.77) | 2.00 (0.56) | 1.79 (0.58) |
| Anxiety (–) | 3.15 (0.80) | 3.35 (0.84) | 3.43 (0.79) | 2.90 (0.93) | 2.91 (0.82) | 2.85 (0.73) | 2.51 (0.96) | 2.61 (0.85) | 2.57 (0.82) |
| Shame (–) | 2.30 (0.86) | 2.28 (0.85) | 2.25 (0.99) | 1.29 (0.89) | 1.90 (0.67) | 1.67 (0.62) | 1.58 (0.87) | 1.52 (0.53) | 1.62 (0.68) |
| Hopelessness (–) | 2.55 (0.76) | 2.38 (0.84) | 2.37 (0.93) | 2.02 (0.91) | 2.07 (0.72) | 1.68 (0.65) | 1.84(1.00) | 1.54 (0.54) | 1.52 (0.81) |
| ***Engagement* (+)** | 2.87 (0.70) | 3.10 (0.60) | 3.50 (0.57) | 3.31 (0.67) | 3.39 (0.57) | 3.68 (0.57) | 3.58 (0.64) | 3.62 (0.60) | 4.00 (0.50)* |
| Vigor | 2.59 (0.70) | 2.79 (0.68) | 3.26 (0.73) | 3.06 (0.69) | 3.18 (0.68) | 3.46 (0.73) | 3.40 (0.66) | 3.49 (0.68) | 3.86 (0.80)* |
| Dedication | 3.19 (0.69) | 3.59 (0.75) | 3.93 (0.73) | 3.81 (0.81) | 3.79 (0.64) | 4.13 (0.59) | 3.85 (0.90) | 3.95 (0.65) | 4.13 (0.70)* |
| Absorption | 2.83 (0.86) | 2.93 (0.77) | 3.31 (0.76) | 3.06 (0.84) | 3.20 (0.77) | 3.44 (0.79) | 3.39 (0.89) | 3.47 (0.76) | 3.86 (0.70)* |
| ***Burnout* (–)** | 2.84 (0.53) | 2.64 (0.61) | 2.40 (0.65) | 2.29 (0.68) | 2.27 (0.48) | 1.98 (0.47) | 2.05 (0.57) | 2.03 (0.55) | 1.74 (0.44)* |
| Depletion | 3.17 (0.74) | 2.95 (0.79) | 2.85 (0.87) | 2.59 (0.90) | 2.55 (0.72) | 2.36 (0.77) | 2.22 (0.66) | 2.26 (0.79) | 2.07 (0.74)* |
| Cynism | 2.61 (0.82) | 2.52 (0.95) | 2.20 (0.99) | 2.13 (0.95) | 2.07 (0.73) | 1.73 (0.65) | 2.75 (0.60) | 2.45 (0.50) | 2.16 (0.53)* |
| Lack of effect | 2.75 (0.60) | 2.45 (0.50) | 2.16 (0.53) | 2.19 (0.58) | 2.14 (0.49) | 1.86 (0.45) | 1.96 (0.65) | 1.87 (0.44) | 1.55 (0.40)* |

** Statistical effect in the variables.*
*SR, Self-Regulation Levels; RT, Regulatory Teaching Levels.*

toward high SR–high RT, associated with a *high level* of *regulation*. The most probable emotions are high level of positive emotions and low level of negative emotions. Consequently, the effects are a *low level of stress: low engagement and high burnout.*

## Empirical Evidence for Combination Typology in Understanding Achievement Emotions

### *Preliminary analysis*

The MANOVA produced statistically significant differences among the five groups in levels of self-regulation (SR) and regulatory teaching (RT); both variables were adequately configured as established in **Table 6**. See **Table 7** for statistical effects.

### *Effects*

A statistically significant main effect of the *five combinations of SR and RT as IV* was noted in *Class Achievement Emotions (CAE), Learning Achievement Emotions (LAE)* and *Test Achievement Emotions (TAE)*. The statistically significant partial effect was maintained of the *five combinations of SR and RT IV* for both

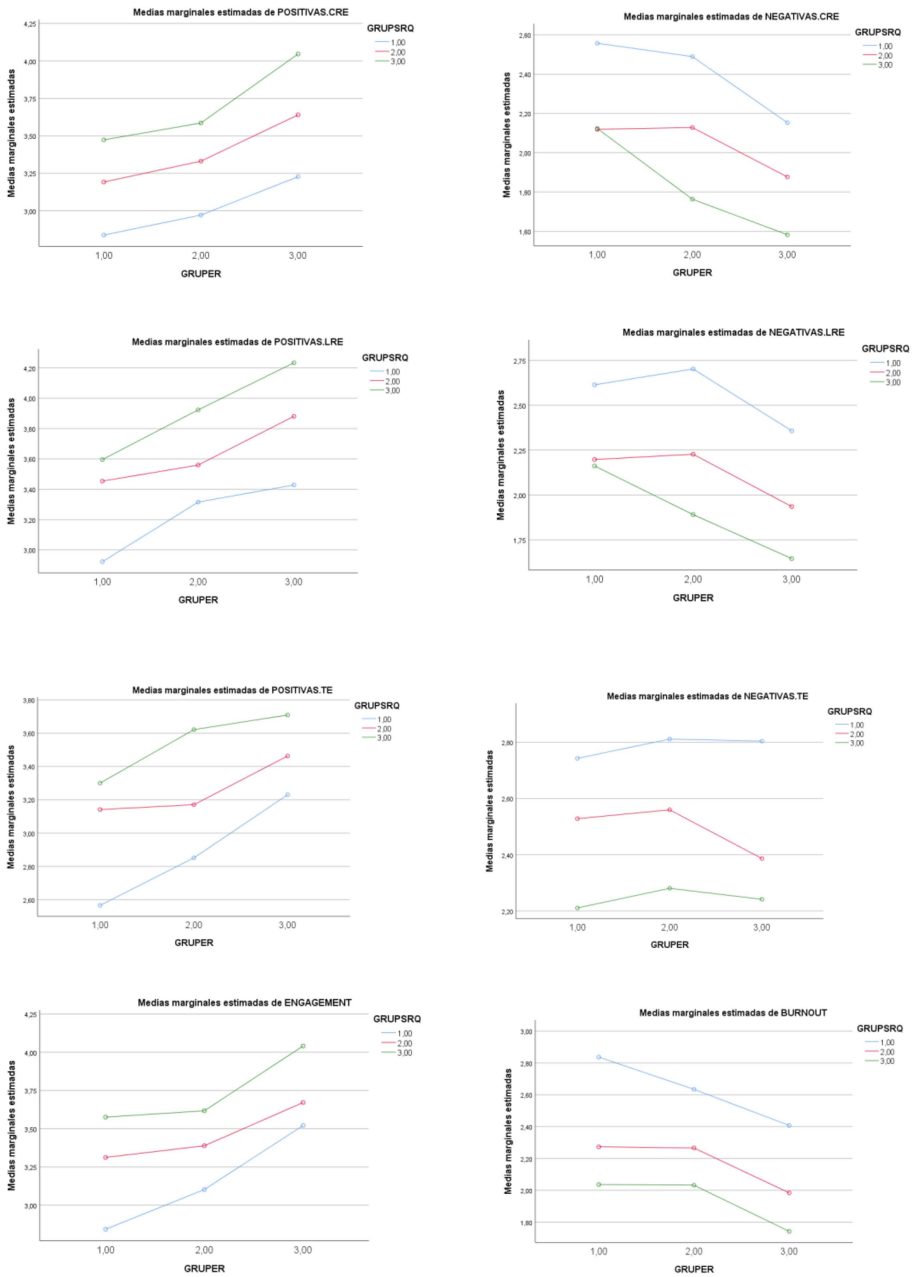


**FIGURE 1 |** Graphic representation of the effect of the low (1)-medium (2)-high (3) levels in *Self- Regulation IV* (GRUPSRQ) and low (1)-medium (2)-high (3) in *Regulatory Teaching IV* (GRUPER) on the positive and negative academic emotions of each situation: class (CRE), study (LRE) and exam (TE). Complementarily, effects on ENGAGEMENT and BURNOUT.

*Positive Emotions* and *Negative Emotions*. In the case of *positive emotions*, a significant statistical effect appeared in favor of higher levels [4, 5 > 3 > 2, 1], while for *negative emotions* the effect was reversed, in favor of lower levels [1, 2 > 3 > 4, 5]. The statistically significant partial effect was maintained for each positive emotion (*enjoyment*, *hope*, *pride)*, and for negative emotions (*boredom -or relief-*, *anger, anxiety, shame*, and *hopelessness)*. Complementarily, in the case of *engagement*, a significant statistical effect appeared in favor of higher levels [4, 5 > 3 > 2, 1], while for *burnout* the effect was reversed, in favor of lower levels [1, 2 > 3 > 4, 5]. The statistically significant partial effect was maintained for *engagement* factors (*vigor*, *dedication, absorption)*, and for *burnout* factors (*depletion, cynicism, and lack of effectiveness)* (see **Table 7**). The graphic representation of the differential progressive effect of the combination between SR and RT levels is shown in **Figure 2**. Thus, while positive academic emotions and engagement progressively increase through the 5 levels of interaction, negative academic emotions and burnout

**TABLE 6 |** Combination between the parameters of the model hypothesized by the SRL vs. ERL Theory: the *Utility Model*$^{TM}$ (de la Fuente, 2019).

| Combination level | | Regulation average/rank | | Regulation tendency rank | Academic Emotions | | | ENG vs. BURN |
|---|---|---|---|---|---|---|---|---|
| SR level (range) | RT level (range) | | | > | | < | | |
| **3** (3.85–5.00) **H** | **3** (2.84–5.00) **H** | 3.0 | **5** | High-High: *High-Regulation* | ++ | | − | *High ENG* |
| **2** (3.10–3.84) **M** | **3** (2.84–5.00) **H** | 2.5 | **4** | Medium-High: *Regulation* | + | | − | *M-H ENG* |
| **3** (3.85–5.00) **H** | **2** (2.35–2.83) **M** | 2.5 | **4** | High-Medium: *Regulation* | + | | − | *M-H ENG* |
| **2** (3.10–3.84) **M** | **2** (2.35–2.83) **M** | 2.0 | **3** | Medium: *Non-Regulation* | + | = | − | *M EN/BU* |
| **2** (3.10–3.84) **M** | **1** (1.00–2.34) **L** | 1.5 | **2** | Medium-Low: *Dys-regulation* | − | | + | *M-H BUR* |
| **1** (1.00–3.09) **L** | **2** (2.35–2.83) **M** | 1.5 | **2** | Low-Medium: *Dys-regulation* | − | | + | *M-H BUR* |
| **1** (1.00–3.09) **L** | **1** (1.00–2.34) **L** | 1.0 | **1** | Low-Low: *High Dys-regulation* | − | − | + | *High BUR* |

*H, high; M, medium; L, low.*

decrease in the same proportion. Specifically, the clearest effects are increased *vigor* as the degree of interaction rises, and greater *loss of effectiveness* with lower interaction levels.

# DISCUSSION

SRL vs. ERL Theory (de la Fuente, 2017) predicts that achievement emotions may be determined jointly by the students' degree of *self-regulation* and the level of *external regulation* offered by the teaching process. Furthermore, this type of interaction can be understood as the combination of *low-medium-high levels* of both factors, as seen in prior evidence (de la Fuente et al., 2015b, 2017). This hypothesis, however, has not been tested in reference to achievement emotions, even though there is recent research that considers this focus (Frenzel et al., 2018).

In the case of the *first hypothesis*, the evidence presented here shows the plausibility of ordering the combinations of students' levels of self-regulation (low-medium-high) and the regulatory level of the teaching process (low-medium-high), along a continuum. This allows for an improved combination model that organizes this interactive reality, as compared to the prior version of this theoretical model (de la Fuente, 2017). The previous model had only four levels of interaction and was more inaccurate (see **Table 3**). This means that the university teaching-learning process can be measured and classified along such a continuum.

In the case of the *second and third hypotheses*, the predictions were fulfilled quite accurately. The increase in the level of *self-regulation level* of students, significantly determined an increase in positive emotions (enjoyment, hope, pride…) and engagement, and a decrease in negative emotions (anger, anxiety, haplessness…), deactivation (boredom and relief) and burnout. On one hand, this lends empirical support to the construct of *self-regulation,* by showing that it has the potential to discriminate degrees of positive and negative emotions in students. This result is consistent with plentiful prior evidence that has shown a positive, significant correlation between self-regulation and the personality factor of *conscientiousness*, leading us to consider that self-regulation is a meta-behavioral variable that materializes this personality variable, associated with less stress, in contrast to the variable of *neuroticism* (Cheng et al., 2017). Also, consistent would be the expectancy-value theory (Pekrun, 2006; Stark et al., 2017), if we take degree of *self-regulation* as a correlate of a higher level of expectancy, of the task value, the effort and the success of university students (Garzón-Umerenkova et al., 2018).

On the other hand, there is evidence to support the construct of a *regulatory teaching level*, by establishing that this variable also determines the degree of students' positive and negative emotions, engagement and burnout. Thus, the positive emotion that is prompted by greater levels of external regulation is *confidence*—resulting from a more predictable context—while a negative emotion of *anger* or *hopelessness* results from the lack of contextual regulation or from dysregulation. These results are consistent with evidence-based recommendations and are required in order to implement the *regulatory teaching* or *effective teaching* (Roehrig et al., 2012): (1) Cognitive quality of the instruction task; (2) Quality of motivation during the instruction; (3) Support for autonomy through teaching self-regulation; (4) Goal structures, practices and performance expectations; (5) Design of tests and quizzes; (6) Performance consequences.

In general, this classification would reveal the interdependence between the self-regulation level, and regulatory teaching level, and type of academic emotionality. Greater levels of positive or negative emotionality, ultimately entail, greater experiences of engagement or burnout.

## Limitations and Future Directions

Beyond the evidence of the positive and negative emotionality that characterizes the interactions described above, there is still a need to establish whether the different interactions produce different specific stress factors coming from the context, therefore resulting in stress responses from the students. This aspect has not been addressed in the present research study. This would mean looking further into scientific evidence that would confirm the precise origin of positive or negative emotionality that stems from the teaching context. Future research studies should also establish the relationship between regulatory teaching and the teacher's own achievement emotions (Frenzel et al., 2016) or the emotional intelligence of the teacher (Pishghadam et al., 2017). It is plausible that a teacher who deploys a regulatory teaching

**TABLE 7 |** Combined Effects of Levels in Regulatory Type variables (5 × 2; 5 × 8): Mean score, standard deviation and specific effects ($n = 336$).

| DVs | Type of Combination in Groups (IVs) | | | | | |
|---|---|---|---|---|---|---|
| | **1 ($n = 24$)** | **2 ($n = 88$)** | **3 ($n = 119$)** | **4 ($n = 88$)** | **5 ($n = 47$)** | **Effects *Post hoc*** |
| *Configuration Group* | | | | | | $F_{(8, 2500)} = 187.65$ (Pillay), $p < 0.001$, $n^2 = 0.423$ |
| *Self-Regulation* | 2.65 (0.37) | 3.02 (0.42) | 3.41 (0.44) | 3.80 (0.39) | 4.23 (0.29) | $F_{(4, 1025)} = 302.61$, $p < 0.001$, $n^2 = 0.541$, all $p < 0.001$ |
| *Regulatory Teaching* | 2.73 (0.32) | 3.24 (0.50) | 3.63 (0.68) | 4.03 (0.44) | 4.39 (0.29) | $F_{(4, 1025)} = 252.64$, $p < 0.001$, $n^2 = 0.496$, all $p < 0.001$ |
| ***Class Achievement Emotions (CAE)*** | | | | | | $F_{(12, 1083)} = 11.127$, $p < 0.001$, $n^2 = 0.110$ |
| *Positive* (+) | 2.83 (0.60) | 3.07 (0.59) | 3.32 (0.50) | 3.62 (0.58) | 4.04 (0.51)* | $F_{(4, 361)} = 33.378$, $p < 0.001$, $n^2 = 0.270$; 5,4>3>2,1, $p < 0.001$ |
| *Negative (–)* | 2.40 (0.59) | 2.24 (0.61) | 2.08 (0.66) | 1.78 (0.44) | 1.55 (0.51)* | $F_{(4, 361)} = 17.461$, $p < 0.001$, $n^2 = 0.162$; 5,4<3<2,1, $p < 0.001$ |
| | | | | | | $F_{(32,1428)} = 5,483$, $p < 0.001$, $n^2 = 0.109$ |
| Enjoyment (+) | 2.75 (0.65) | 2.96 (0.67) | 3.20 (0.57) | 3.44 (0.66) | 3.87 (0.63)* | $F_{(4, 361)} = 21,165$, $p < 0.001$, $n^2 = 0.190$, 5,4>3>2,1, $p < 0.001$ |
| Hope (+) | 2.83 (0.74) | 3.16 (0.63) | 3.45 (0.68) | 3.76 (0.62) | 4.21 (0.52)* | $F_{(4, 361)} = 34,882$, $p < 0.001$, $n^2 = 0.278$ 5,4,3, 2>1, $p < 0.001$ |
| Pride (+) | 2.91 (0.66) | 3.10 (0.70) | 3.32 (0.56) | 3.67 (0.65) | 4.04 (0.58)* | $F_{(4, 361)} = 25,344$, $p < 0.001$, $n^2 = 0.219$, 5>4,3,2>1, $p < 0.001$ |
| Boredom (–) | 3.15 (0.96) | 2.54 (0.79) | 2.32 (0.16) | 2.05 (0.84) | 1.71 (0.69)* | $F_{(4, 361)} = 18,064$, $p < 0.001$, $n^2 = 0.167$, 1,2>3>4,5 $p < 0.001$ |
| Anger (–) | 2.57 (0.79) | 2.05 (0.65) | 1.94 (0.69) | 1.64 (0.53) | 1.40 (0.51)* | $F_{(4, 361)} = 18.757$, $p < 0.001$, $n^2 = 0.162$, 1,2>3>4,5, $p < 0.001$ |
| Anxiety (–) | 2.40 (0.62) | 2.38 (0.71) | 2.30 (0.76) | 1.99 (0.56) | 1.70 (0.62)* | $F_{(4, 361)} = 10.904$, $p < 0.001$, $n^2 = 0.108$, 1,2>3>4,5, $p < 0.001$ |
| Shame (–) | 2.37 (0.75) | 2.57 (0.93) | 2.24 (0.85) | 1.97 (0.70) | 1.76 (0.69)* | $F_{(4, 361)} = 10.063$, $p < 0.001$, $n^2 = 0.100$, 1,2>3>4,5, $p < 0.001$ |
| Hopelessness (–) | 2.27 (0.74) | 1.98 (0.65) | 1.83 (0.69) | 1.52 (0.44) | 1.33 (0.57)* | $F_{(4, 361)} = 16.097$, $p < 0.001$, $n^2 = 0.151$, 1,2>3>4,5, $p < 0.001$ |
| ***Learning Achievement Emotions (LAE)*** | | | | | | $F_{(8, 704)} = 16.283$, $p < 0.001$, $n^2 = 0.156$ |
| *Positive* (+) | 2.92 (0.77) | 3.37 (0.62) | 3.53 (0.54) | 3.89 (0.54) | 4.23 (0.48)* | $F_{(4, 352)} = 10.327$, $p < 0.001$, $n^2 = 0.266$; 5>4>3,2>1, $p < 0.001$ |
| *Negative (–)* | 2.61 (0.83) | 2.49 (0.66) | 2.24 (0.65) | 1.91 (0.51) | 1.64 (0.54)* | $F_{(4, 361)} = 8.209$, $p < 0.001$, $n^2 = 0.190$; 5,4>3>2,1, $p < 0.001$ |
| | | | | | | $F_{(32,1392)} = 4,292$, $p < 0.001$, $n^2 = 0.090$ |
| Enjoyment (+) | 2.93 (0.55) | 3.26 (0.59) | 3.40 (0.59) | 3.68 (0.59) | 4.02 (0.47)* | $F_{(4, 352)} = 22.131$, $p < 0.001$, $n^2 = 0.202$, 5,4>3,2>1, $p < 0.001$ |
| Hope (+) | 2.78 (0.73) | 3.36 (0.74) | 3.52 (0.62) | 3.96 (0.60) | 4.27 (0.66)* | $F_{(4, 352)} = 30,794$, $p < 0.001$, $n^2 = 0.259$, 5,4>3,2>1, $p < 0.001$ |
| Pride (+) | 3.02 (0.77) | 3.48 (0.69) | 3.66 (0.65) | 4.00 (0.61) | 4.30 (0.62)* | $F_{(4, 352)} = 24,021$, $p < 0.001$, $n^2 = 0.214$, 5,4 >3,2>1, $p < 0.001$ |
| Boredom (–) | 2.93 (0.94) | 2.62 (0.81) | 2.26 (0.80) | 1.88 (0.69) | 1.58 (0.64)* | $F_{(4, 352)} = 22.311$, $p < 0.001$, $n^2 = 0.202$, 1,2>3>4,5, $p < 0.001$ |
| Anger (–) | 2.39 (0.89) | 2.19 (0.76) | 1.99 (0.77) | 1.73 (0.58) | 1.45 (0.76)* | $F_{(4, 352)} = 12,604$, $p < 0.001$, $n^2 = 0.125$, 1,2>3>4,5, $p < 0.001$ |
| Anxiety (–) | 2.88 (0.62) | 2.85 (0.66) | 2.63 (0.62) | 2.45 (0.61) | 2.12 (0.69)* | $F_{(4, 352)} = 11,656$, $p < 0.001$, $n^2 = 0.117$, 1,2>3,4 >5, $p < 0.001$ |
| Shame (–) | 2.49 (0.83) | 2.48 (0.85) | 2.21 (0.83) | 1.61 (0.93) | 1.67 (0.68)* | $F_{(4, 352)} = 11,714$, $p < 0.001$, $n^2 = 0.117$, 1,2>3>4,5, $p < 0.001$ |
| Helplessness (–) | 2.44 (0.99) | 2.29 (0.86) | 2.05 (0.75) | 1.63 (0.60) | 1.38 (0.62)* | $F_{(4, 352)} = 17,632$, $p < 0.001$, $n^2 = 0.167$, 1,2>3>4,5, $p < 0.001$ |
| ***Learning Achievement Emotions (TAE)*** | | | | | | $F_{(8, 724)} = 11,175$, $p < 0.001$, $n^2 = 0.110$ |
| *Positive* (+) | 2.56 (0.64) | 2.97 (0.69) | 3.19 (0.51) | 3.52 (0.58) | 3.70 (0.64)* | $F_{(4, 362)} = 22,124$, $p < 0.001$, $n^2 = 0.196$; 5,4>3>2,1, $p < 0.001$ |
| *Negative (–)* | 2.74 (0.61) | 2.68 (0.60) | 2.57 (0.58) | 2.34 (0.38) | 2.24 (0.51)* | $F_{(4, 362)} = 8,259$, $p < 0.001$, $n^2 = 0.084$; 5,4<3<2,1, $p < 0.001$ |
| | | | | | | $F_{(32,1432)} = 3,590$, $p < 0.001$, $n^2 = 0.074$ |
| Enjoyment (+) | 2.53 (0.71) | 2.88 (0.72) | 3.09 (0.56) | 3.34 (0.68) | 3.52 (0.63)* | $F_{(4, 362)} = 13.866$, $p < 0.001$, $n^2 = 0.133$, 5,4>3>2,1, $p < 0.001$ |
| Hope (+) | 2.58 (0.69) | 2.96 (0.78) | 3.26 (0.59) | 3.63 (0.67) | 3.85 (0.76)* | $F_{(4, 362)} = 23.574$, $p < 0.001$, $n^2 = 0.207$, 5,4>3>2>, $p < 0.001$ |
| Pride (+) | 2.58 (0.68) | 3.08 (0.73) | 3.23 (0.58) | 3.59 (0.52) | 3.75 (0.71)* | $F_{(4, 362)} = 18.643$, $p < 0.001$, $n^2 = 0.171$, 5,4>3>2,1, $p < 0.001$ |
| Relief (–) | 3.15 (0.82) | 3.57 (0.74) | 3.57 (0.80) | 3.77 (0.82) | 3.68 (0.78)* | $F_{(4, 362)} = 2.736$, $p < 0.05$, $n^2 = 0.029$, 1>4,5 $p < 0.05$ |
| Anger (–) | 2.54 (0.64) | 2.36 (0.64) | 2.25 (0.71) | 1.95 (0.58) | 1.79 (0.58)* | $F_{(4, 362)} = 10.643$, $p < 0.001$, $n^2 = 0.105$, 1,2>3>4,5, $p < 0.001$ |
| Anxiety (–) | 3.15 (0.80) | 3.16 (0.90) | 2.98 (0.86) | 2.76 (0.78) | 2.57 (0.82)* | $F_{(4, 362)} = 5.130$, $p < 0.001$, $n^2 = 0.054$, 1,2>3>4,5, $p < 0.001$ |
| Shame (–) | 2.30 (0.86) | 2.11 (0.89) | 1.94 (0.80) | 1.60 (0.59) | 1.52 (0.68)* | $F_{(4, 362)} = 7.778$, $p < 0.001$, $n^2 = 0.079$, 1,2>3>4,5, $p < 0.001$ |
| Helplessness (–) | 2.55 (0.76) | 2.22 (0.88) | 2.11 (0.80) | 1.62 (0.61) | 1.52 (0.51)* | $F_{(4, 361)} = 13.824$, $p < 0.001$, $n^2 = 0.133$, 1,2>3>4,5, $p < 0.001$ |
| | | | | | | $F_{(8, 1816)} = 30.135$ $p < 0.001$, $n^2 = 0.130$ |
| ***Engagement* (+)** | 2.84 (0.62) | 3.18 (0.63) | 3.42 (0.47) | 3.64 (0.59) | 4.04 (0.51)* | $F_{(4, 908)} = 61.006$ $p < 0.001$, $n^2 = 0.212$, 5>4>3>2>1 $p < 0.001$ |
| ***Burnout* (–)** | 2.83 (0.55) | 2.49 (0.67) | 2.26 (0.43) | 2.00 (0.50) | 1.74 (0.47)* | $F_{(4, 908)} = 60.421$ $p < 0.001$, $n^2 = 0.210$, 5<4<3<2<1 $p < 0.001$ |
| | | | | | | $F_{(24,3624)} = 13.425$, $p < 0.001$, $n^2 = 0.082$ |
| Vigor (+) | 2.55 (0.70) | 2.89 (0.70) | 3.21 (0.68) | 3.46 (0.71) | 3.87 (0.61)* | $F_{(4, 908)} = 58.317$, $p < 0.001$, $n^2 = 0.204$, 1,2<3<4,5, $p < 0.001$ |
| Dedication (+) | 3.18 (0.70) | 3.68 (0.76) | 3.82 (0.68) | 4.02 (0.61) | 4.26 (0.61)* | $F_{(4, 908)} = 36.020$, $p < 0.001$, $n^2 = 0.137$, 1,2<3<4,5, $p < 0.001$ |
| Absorption(+) | 2.79 (0.87) | 2.96 (0.80) | 3.24 (0.78) | 3.45 (0.79) | 3.87 (0.70)* | $F_{(4, 908)} = 33.448$, $p < 0.001$, $n^2 = 0.129$, 1,2<3<4,5, $p < 0.001$ |
| Depletion (–) | 3.13 (0.72) | 2.78 (0.87) | 2.60 (0.76) | 2.30 (0.76) | 2.07 (0.75)* | $F_{(4, 908)} = 20.831$, $p < 0.001$, $n^2 = 0.113$, 1,2>3>4,5, $p < 0.001$ |
| Cynism (–) | 2.62 (0.84) | 2.35 (0.97) | 2.09 (0.80) | 1.83 (0.71) | 1.59 (0.80)* | $F_{(4, 908)} = 27.498$, $p < 0.001$, $n^2 = 0.108$, 1,2>3>4,5, $p < 0.001$ |
| Lack of effect (–) | 2.75 (0.59) | 2.33 (0.55) | 2.11 (0.50) | 1.87 (0.45) | 1.56 (0.40)* | $F_{(4, 908)} = 80.415$, $p < 0.001$, $n^2 = 0.262$, 1,2>3>4,5, $p < 0.001$ |

*Type 1 (Low Self-Regulation, and Low Regulatory Teaching); Type 2 (Low Self-Regulation and High Regulatory Teaching); Type 3 (Medium Self-Regulation and Medium Regulatory Teaching); Type 4 (High Self-Regulation and Low Regulatory Teaching); Type 5 (High Self-Regulation and High Regulatory Teaching). For more information, see* ***Table 6****.*

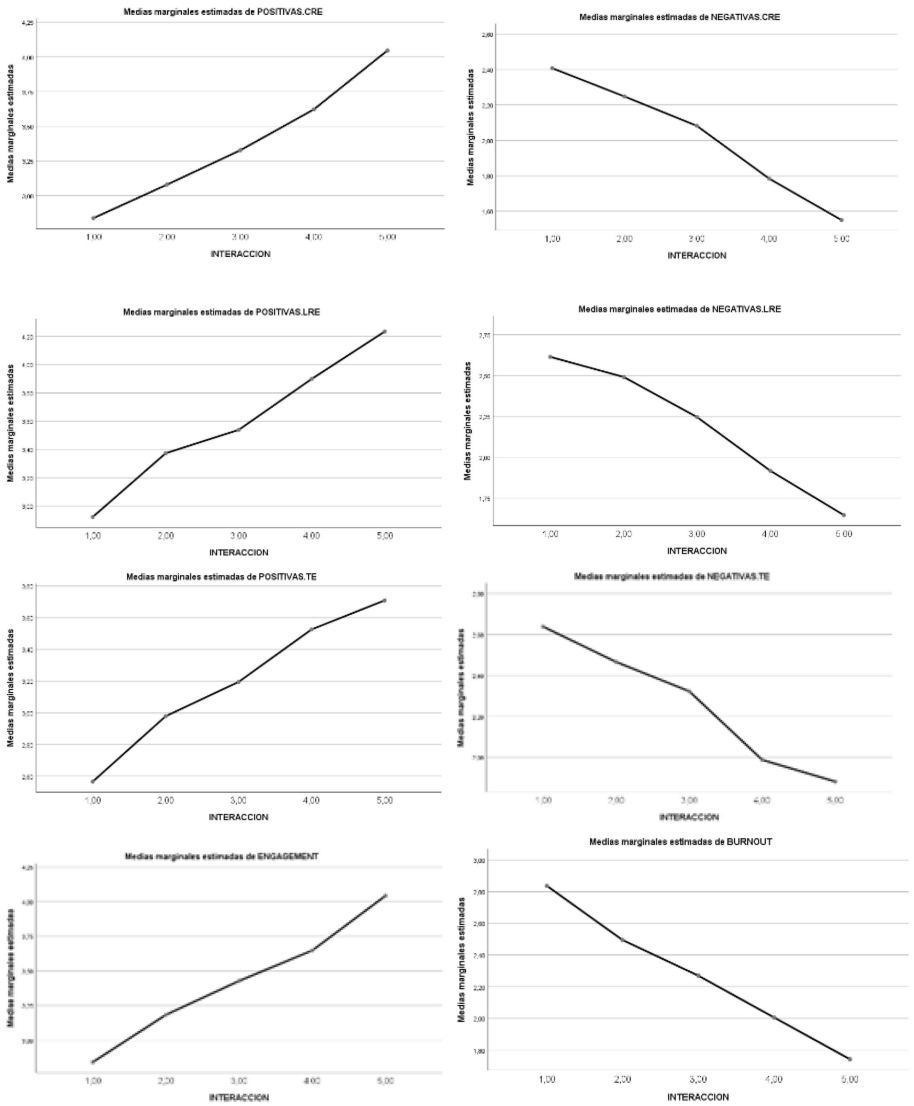


**FIGURE 2 |** Graphic representation of the effects of the five types of interactions (levels 1–5) in *achievement emotions* (positive and negative) and in engagement-burnout, in the three situations: class (CRE), study (LRE), and exam (TAE).

process—taking into account his/her own high expectancy-value—will probably experience their teaching situation with positive emotionality, while a teacher who teaches in a non-regulating or dysregulating fashion will have greater negative emotionality. This interesting hypothesis should be tested in the future.

## CONCLUSIONS AND IMPLICATIONS

### Conclusions

The most interesting result of this study has to do with the *cumulative or combined effect,* of the effects produced jointly by both variables. This is seen in the consistent, linear function that explains the combined effect of each variable on university students' emotional experience, as well as their place on the engagement-burnout continuum. This effect is especially important because it shows that all students benefit from external regulation, while they are also harmed by non-regulation or dysregulation. Similarly, it shows that students with high self-regulation call for and are more committed to highly regulatory contexts. This step forward in the interactive, contextualized study of students' achievement emotions represents progress toward consolidating contextualized (i.e., third level) *molar psycho-educational models* in real settings, and not only knowledge about relations between achievement emotions and personality variables, in *molecular-level models* (de la Fuente et al., 2019). This contribution allows us to more accurately and interactively reconceptualize the relative weight of variables pertaining to the subject and to the teaching context, when explaining university students'

experiences with achievement emotions. A remarkable similarity was found between emotional experiences in the different situations -class, study and test- (Pekrun, 2006; Pekrun and Perry, 2014), which may suggest a certain *unified emotional experience* or an experience of the teaching-learning process as one overall stimulus.

### Implications for the Practice of Educational Psychology

Several implications from this investigation can be noted. First, it is important to know students' level of *self-regulation*, so that personalized intervention programs may be applied. If average levels of self-regulation in university students involve non-regulated behaviors (mid-level in positive and negative emotions) or dysregulated behaviors (high level of negative and low level of positive emotions), university guidance and counseling services ought to detect and help these types of students, as they begin their university studies, to promote stress management and coping strategies, and so minimize the impact of negative effects from the university experience. Certain programs in current use might help toward this end (de la Fuente, 2015c), either in a face-to-face format or through online technology tools (de la Fuente et al., 2018).

Second, there is an essential need to evaluate and know the level of effective teaching, and to detect the different contexts of regulatory teaching, especially when these are non-regulating or dysregulating, because of their negative emotional on students' emotional experiences. The academic experiences of emotional disconnection (boredom) and of negative emotionality (anger, anxiety, shame, hopelessness) have been amply associated with academic failure and dropout (Putwain et al., 2018, 2019; Reindla et al., 2018). There is also a need to observe experiences of satisfaction (enjoyment, hope, engagement), that these might be maintained and promoted within the university community. Therefore, university teacher training programs should include the knowledge, skills and attitudes of the teacher to promote positive emotions in students.

## DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

This studies involving human participants were reviewed and approved by Comité de Ética de la Investigación. Universidad de Navarra. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JF has coordinated the R&D Project, has made the general design, data analysis, and first writing of the manuscript. JM-V has reviewed the design and analysis of data. FP-S has collected the data sample and has revised the manuscript. AG-U has collected the data sample and has revised the manuscript. MV has reviewed the previous evidence and the theoretical foundation. PP has provided the translation of the instruments and validated them in Spanish.

## FUNDING

R&D Project PGC2018-094672-B-I00 (Ministry of Science and Education, Spain), and UAL18-SEJ-DO31-A-FEDER (University of Almería, Spain), and the European Social Fund.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02070/full#supplementary-material

## REFERENCES

Ainley, M., and Hidi, S. (2014). "Interest and enjoyment," in *International Handbook of Emotions in Education*, eds R. Pekrun and L. Linnenbrink-Garcia (New York, NY: Routledge), 205–227.

Bigg (2001). *Teaching for Quality Learning at University. 3rd Edn.* Buckingham: Open University Press.

Burr, J., and Dallaghan, J. L. B. (2019). The relationship of emotions and burnout to medical students' academic performance. *Teach. Learn. Med.* doi: 10.1080/10401334.2019.1613237. [Epub ahead of print].

Cheng, H., Deighton, J., Wolpert, M., Chapman, B. P., Kornilaki, E. N., Treglown, L., et al. (2017). Hay fever in childhood, traits Neuroticism and Conscientiousness as independent predictors of the occurrence of hay fever in adulthood. *J. Health Psychol.* 21, 2367–75. doi: 10.1177/1359105315576784

de la Fuente, J. (2015a). *Learning-Related Emotions Questionarie.* Spanish versión. University of Almería.

de la Fuente, J. (2015b). *Test-Related Emotions Questionarie.* Spanish versión. University of Almería.

de la Fuente, J. (2015c). *Competence for Studying, Learning and Performance Under Stress: Self-Help Guide for University Students, Graduates and Professional Examination Candidades*. Almería: Education & Psychology I+D+I, e-Publishing Series I+D+I.

de la Fuente, J. (2017). Theory of self- vs. externally-regulated learning$^{TM}$: fundamentals, evidence, and applicability. *Front. Psychol.* 8:1675. doi: 10.3389/fpsyg.2017.01675

de la Fuente, J. (2019). *The Utility Model for the SRL vs ERL Theory.* Trade Mark in Process. Pamplona: University of Navarra.

de la Fuente, J., González-Torres, M. A., Aznarez, M., Martínez-Vicente,. J. M., Peralta-Sánchez, F. J., and Vera, M. M. (2019). Implications of unconnected micro, molecular and molar level research in psychology: the case of executive functions, self-regulation and external regulation. *Front. Psychol.* 10:1919. doi: 10.3389/fpsyg.2019.01919

de la Fuente, J., López, M., Zapata, L., Sollinas, G., and Fadda, S. (2015a). "Improving mental health trough and online self-assessment and self-help e-utility in university students," in *Progress in Education*, Vol. 33, ed R. V. Nata (New York, NY: Nova Publisher), 63–74.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., González-Torres, M. C., Artuch, R., and Garzón-Umerenkova, A. (2018). Satisfaction with the self-assessment of university students through e-coping with academic stress utility$^{TM}$. *Front. Psychol.* 9:1932. doi: 10.3389/fpsyg.2018.01932

de la Fuente, J, Sander, P, Martínez-Vicente, J. M., Vera, M. M., Garzón, A., and Fadda, S. (2017). Combined effect of levels in personal self-regulation and regulatory teaching on meta-cognitive, on meta-motivational, and on academic achievement variables in undergraduate students. *Front. Psychol.* 8:232. doi: 10.3389/fpsyg.2017.00232

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Cardelle-Elawar, M., Sander, P., Justicia, F., et al. (2012). Regulatory teaching and self-regulated learning in college students: confirmatory validation study of the IATLP scales. *Electron. J. Res. Educ. Psychol.* 10, 839–866. doi: 10.25115/ejrep.v10i27.1511

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Sander, P., and Cardelle-Elawar, M. (2015b). The role of personal self-regulation and regulatory teaching to predict motivational-affective variables, achievement, and satisfaction: a structural model. *Front. Psychol.* 6:399. doi: 10.3389/fpsyg.2015.00399

Dicke, T., Marsh, H. W., Parker, P. D., Pekrun, R., Guo, J., and Televantou, I. (2018). Effects of school-average achievement on individual self-concept and achievement: unmasking phantom effects masquerading as true compositional effects. *J. Educ. Psychol.* 110, 1112–1126. doi: 10.1037/edu0000259

D'Mello, S. (2013). A selective meta-analysis on the relative incidence of discrete affective states during learning with technology. *J. Educ. Psychol.* 105, 1082–1099. doi: 10.1037/a0032674

Dormann, C., Demerouti, E., and Bakker, A. B. (2017). "A model of positive and negative learning: learning demands and resources, learning engagement, critical thinking, and fake news detection," in *Positive Learning in the Age of Information (PLATO)–A Blessing or a Curse?* eds O. Zlatkin-Troitschanskaia, G. Wittum, and A. Dengel (Wiesbaden: Springer), 305–335.

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., and Lüdtke, O. (2018). Emotion transmission in the classroom revisited: a reciprocal effects model of teacher and student enjoyment. *J. Educ. Psychol.* 110, 628–639. doi: 10.1037/edu0000228

Frenzel, A. C., Pekrun, R., and Goetz, T. (2007). Perceived learning environment and students' emotional experiences: a multilevel analysis of mathematics classrooms. *Learn. Instruct.* 17, 487–493. doi: 10.1016/j.learninstruc.2007.09.001

Frenzel, A. C., Pekrun, R., Goetz, T., Daniels, L. M., and. Durksen, T. L., Becker-Kurz, B., et al. (2016). Measuring enjoyment, anger, and anxiety during teaching: the Teacher Emotions Scales (TES). *Contemp. Educ. Psychol.* 46, 148–163. doi: 10.1016/j.cedpsych.2016.05.003

Garzón-Umerenkova, A., de la Fuente, J., Amate, J., Paoloni, P. V., Fadda, S., and Fiz, J. (2018). A linear empirical model of self-regulation on flourishing, health, procrastination, and achievement, among university students. *Front. Psychol.* 9:536. doi: 10.3389/fpsyg.2018.00536

Gentsch, K., Loderer, K., Soriano, C., Fontaine, J. R., Eid, M., Pekrun, R., et al. (2018). Effects of achievement contexts on the meaning structure of emotion words. *Cognit. Emot.* 32, 379–388. doi: 10.1080/02699931.2017.1287668

Goetz, T., Frenzel, A., C., Hall, N. C., Nett, U. E., Pekrun, R., and Lipnevich, A. A. (2014). Types of boredom: an experience sampling approach. *Motiv. Emot.* 38, 401–419. doi: 10.1007/s11031-013-9385-y

Goetz, T., Frenzel, A. C., and Pekrun, R. (2007a). Regulation von Langeweile im Unterricht. Was Schülerinnen und Schüler bei der "Windstille der Seele" (nicht) tun [Regulation of boredom during classroom instruction]. *Unterrichtswissenschaft* 35, 312–333.

Goetz, T., Frenzel, A. C., Pekrun, R., Hall, N. C., and Lüdtke, O. (2007b). Between- and within-domain relations of students' academic emotions. *J. Educ. Psychol.* 99, 715–733. doi: 10.1037/0022-0663.99.4.715

Goetz, T., Kleine, M., Pekrun, R., vom Hofe, R., Blum, W., Zirngibl, A., et al. (2004). Leistung und emotionales Erleben im Fach Mathematik: Längsschnittliche Mehrebenenanalysen [Achievement and emotions in mathematics: Longitudinal multi-level analysis]. *Z. Pädag. Psychol.* 18, 174–183. doi: 10.1024/1010-0652.18.34.201

Khosa, D. K., and Volet, S. E. (2014). Productive group engagement in cognitive activity and metacognitive regulation during collaborative learning: can it explain differences in students' conceptual understanding? *Metacognit. Learn.* 9, 287–307. doi: 10.1007/s11409-014-9117-z

Leiter, M. P., and Marlach, C. (2017a). Burnout and engagement: contributions to a new visión. *Burnout Res.* 5 55–57. doi: 10.1016/j.burn.2017.04.003

Leiter, M. P., and Marlach, C. (2017b). Latent burnout profiles: a new approach to understanding theburnout experience. *Burnout Res.* 3, 89–100. doi: 10.1016/j.burn.2016.09.001

Linnenbrink-Garcia, L., and Pekrun, R. (Eds.). (2011). Students' emotions and academic engagement. *Contemp. Educ. Psychol.* 36, 1–3. doi: 10.1016/j.cedpsych.2010.11.004

Lüftenegger, M, Klug, J, Harrer, K, Langer, M, Spiel, C, and Schober, B (2016). Students' achievement goals, learning-related emotions and academic achievement. *Front. Psychol.* 7:603. doi: 10.3389/fpsyg.2016.00603

Mainhard, T., Oudman, S., Hornstra, L., Bosker, R. J., and Goetz, T. (2018). Student emotions in class: The relative importance of teachers and their interpersonal relations with students. *Learn. Instruct.* 53, 109–119. doi: 10.1016/j.learninstruc.2017.07.011

Maslach, C., and Jackson, S. E. (1981). The measurement of experienced burnout. *J. Occup. Behav.* 2, 99–113. doi: 10.1002/job.4030020205

Maslach, C., and Leiter, M. P. (1997). *The Truth About Burnout: How Organizations Cause Personal Stress and What to Do About It*. San Francisco, CA: Jossey-Bass.

Miller, W. R., and Brown, J. M. (1991). "Self-regulation as a conceptual basis for the prevention and treatment of addictive behaviors," in *Self-Control and the Addictive Behaviours*, eds N. Heather, W. R. Miller, and J. Greely (Sydney, NSW: Maxwell Macmillan), 3–79.

Muis, K. R., Chevrier, M., and Singh, C. A. (2018). The role of epistemic emotions in personal epistemology and self-regulated learning. *Educ. Psychol.* 53, 165–184. doi: 10.1080/00461520.2017.1421465

Murayama, K., Goetz, T., Malmberg, L.-E., Pekrun, R., Tanaka, A., and Martin, A. J. (2017). "Within-person analysis in educational psychology: Importance and illustrations," in *British Journal of Educational Psychology Monograph Series II: Psychological Aspects of Education—Current Trends: The Role of Competence Beliefs in Teaching and Learning*, eds D. W. Putwain and K. Smart (Oxford: Wiley), 71–87.

Paoloni, P. V. R. (2014). Emociones en contextos académicos. Perspectivas teóricas e implicaciones para la práctica educativa en la universidad [Emotions in academic contexts. Theoretical perspectives and implications for educational practice in the university. *Electr Journ. Res. In Educ. Psyc.* 12, 567–596. doi: 10.14204/ejrep.34.14082

Paris, S., and Winograd, P. (2003). *The Role of Self-Regulated Learning in Contextual Teaching: Principals and Practices for Teacher Preparation*. Washington, DC: Office of Educational Research and Improvement (ED).

Pekrun, R. (1992). The impact of emotions on learning and achievement: Towards a theory of cognitive/motivational mediators. *Appl. Psychol.* 41, 359–376. doi: 10.1111/j.1464-0597.1992.tb00712.x

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educ. Psychol. Rev.* 18, 315–341. doi: 10.1007/s10648-006-9029-9

Pekrun, R. (2014). *Emotions and Learning (Educational Practices Series, Vol. 24)*. Geneva: International Academy of Education (IAE) and International Bureau of Education (IBE) of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Pekrun, R., Cusack, A., Murayama, K., Elliot, A. J., and Thomas, K. (2014a). The power of anticipated feedback: effects on students' achievement goals and achievement emotions. *Learn. Instruct.* 29, 115–124. doi: 10.1016/j.learninstruc.2013.09.002

Pekrun, R., Elliot, A. J., and Maier, M. A. (2009). Achievement goals and achievement emotions: testing a model of their joint relations with academic performance. *J. Educ. Psychol.* 101, 115–135. doi: 10.1037/a0013383

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., and Perry, R. P. (2011). Measuring emotions in students' learning and performance: the achievement emotions questionnaire (AEQ). *Contemp. Educ. Psychol.* 36, 36–48. doi: 10.1016/j.cedpsych.2010.10.002

Pekrun, R., Goetz, T., and Perry, R. P. (2005). *Academic Emotions Questionnaire (AEQ)*. User's manual. Department of Psychology, University of Munich.

Pekrun, R., Hall, N. C., Goetz, T., and Perry, R. P. (2014b). Boredom and academic achievement: testing a model of reciprocal causation. *J. Educ. Psychol.* 106, 696–710. doi: 10.1037/a0036006

Pekrun, R., and Linnenbrink-Garcia, L. (2014). *International Handbook of Emotions in Education*. New York, NY: Routledge.

Pekrun, R., Muis, K. R., Frenzel, A. C., and Goetz, T. (2017a). *Emotions at School*. New York: Taylor & Francis; Routledge.

Pekrun, R., Murayama, K., Marsh, H. W., Goetz, T., and Frenzel, A. C. (2019). Happy fish in little ponds: testing a compositional effects model of achievement and emotion. *J. Pers. Soc. Psychol.* doi: 10.1037/pspp0000230

Pekrun, R., and Perry, R. P. (2014). "Control-value theory of achievement emotions," in *International Handbook of Emotions in Education*, eds R. Pekrun and L. Linnenbrink-Garcia (New York, NY: Taylor & Francis), 120–141.

Pekrun, R., and Stephens, E. J. (2012). "Academic emotions," in *APA Educational Psychology Handbook, Vol. 2: Individual Differences and Cultural and Contextual Factors*, ed K. R. Harris (Washington, DC: American Psychological Association), 3–31.

Pekrun, R., Vogl, E., Muis, K. R., and Sinatra, G. M. (2017b). Measuring emotions during epistemic activities: the epistemically-related emotion scales. *Cognit. Emot.* 31, 1268. doi: 10.1080/02699931.2016.1204989

Pichardo, M. C., Cano, F., Garzón-Umerenkova, A., de la Fuente, J., Peralta-Sánchez, F. J., and Amate-Romera, J. (2018). Self-Regulation Questionnaire (SRQ) in Spanish adolescents: factor structure and Rasch analysis. *Front. Psychol.* 9:1370. doi: 10.3389/fpsyg.2018.01370

Pichardo, M. C., Justicia, F., de la Fuente, J., Martínez-Vicente, J. M., and y García-Berbén, A. B. (2014). Factor Structure of the Self-Regulation Questionnaire (SRQ) at Spanish Universities. *Span. J. Psychol.* 17, e62, 1–8. doi: 10.1017/sjp.2014.63

Pishghadam, R., Baghaei, P., and Seyednozadi, Z. (2017). Introducing emotioncy as a potential source of test bias: a mixed rasch modeling study. *Int. J. Test.* 17, 127–140. doi: 10.1080/15305058.2016.1183208

Pishghadam, R., and Khajavy, G. H. (2014). Development and validation of the student stroke scale and examining its relation with academic motivation. *Stud. Educ. Eval.* 43, 109–114. doi: 10.1016/j.stueduc.2014.03.004

Putwain, D. W., Becker, S., Symes, W., and Pekrun, R. (2018). Reciprocal relations between students' academic enjoyment, boredom, and achievement over time. *Learn. Instruct.* 54, 73–81. doi: 10.1016/j.learninstruc.2017.08.004

Putwain, D. W., Pekrun, R., Nicholson, L. J., Symes, W., Becker, S., and Marsh, H. W. (2019). Control-value appraisals, enjoyment, and boredom in mathematics: a longitudinal latent interaction analysis. *Am. Educ. Res. J.* 55, 1339–1368. doi: 10.3102/0002831218786689

Reeve, J., Jang, H., Carrell, D., Jeon, S., and Barch, J. (2004). Enhancing students's engagement by incresting teachers'authonomy support. *Motiv. Emot.* 28, 147–169. doi: 10.1023/B:MOEM.0000032312.95499.6f

Reindla, M., Tulisb, M., and Dreselc, M. (2018). Associations between friends, academic emotions and achievement: Individual differences in enjoyment and boredom. *Learn. Individ. Differ.* 62, 164–173. doi: 10.1016/j.lindif.2018.01.017

Roehrig, A. D., Turner, J. E., Arrastia, M. C., Christesen, E., McElhaney, S., and Jakiel, L. M. (2012). "Effective teachers and teaching: characteristics and practices related to positive student outcomes," in APA *Educational Psychology Handbook*, Vol. 2, eds K. A. Harris, S. Graham, and T. Urdan (Washington, DC: American Psychological Association), 501–527.

Salanovaa, M., Schaufeli, W., Martineza, I., and Breso, E. (2010). How obstacles and facilitators predict academic performance: the mediating role of study burnout and engagement. *Anxiety Stress Coping* 23, 53–70. doi: 10.1080/10615800802609965

Schutz, P. A., and Pekrun, R. (eds.). (2010). *Emotion in Education. Chinese Edn.* Shanghai: East China Normal University Press.

Shaufeli, W. R., Martínez, I. S., Marqués, A., Salanova, S., and Bakker, A. B. (2002). Burnout and engagement in university students. A cross-national study. *J. Cross Cult. Psychol.* 33, 464–481. doi: 10.1177/0022022102033005003

Stark, L., Malkmus, E., Stark, R., Brünken, R, and Park, B. (2017). Learning-related emotions in multimedia learning: An application of control-value theory. *Learn. Instruct.* 58, 42–52. doi: 10.1016/j.learninstruc.2018.05.003

Stoeber, J., Childs, J. H., Hayward, J. A., and Feast, A. R. (2011). Passion and motivation for studying: predicting academic engagement and burnout in university students. *Educ. Psychol.* 31, 513–528. doi: 10.1080/01443410.2011.570251

Uludag, O., and Yaratan, H. (2010). The effects of burnout on engagement: an empirical study on tourism students. *J. Hosp. Leis. Sport Tour. Educ.* 9, 13–23. doi: 10.3794/johlste.91.243

Vermunt, D. H. M. (1989). "The interplay between internal and external regulation of learning, and the design of process-oriented instruction," in *Paper Presented at the Conference of the European Association of Research on Learning and Instruction* (Madrid).

Vermunt, J. D. (2007). The power of teaching-learning environments to influence student learning. *Br. J. Educ. Psychol. Monogr. Series* 4, 73–90. doi: 10.1348/000709906X162406

Yerdelen, S., and Sungur, S. (2019). Multilevel investigation of students' self-regulation processes in learning science: classroom learning environment and teacher effectiveness. *Int. J. Sci. Math. Educ.* 17, 89–110. doi: 10.1007/s10763-018-9921-z

**Conflict of Interest Statement:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 09 January 2020
doi: 10.3389/fpsyg.2019.02794

# The Role of Perception of Support in the Classroom on the Students' Motivation and Emotions: The Impact on Metacognition Strategies and Academic Performance in Math and English Classes

*Ruben Trigueros[1], José M. Aguilar-Parra[1]*, Remedios Lopez-Liria[2]*, Adolfo J. Cangas[1], Jerónimo J. González[3] and Joaquín F. Álvarez[1]*

*[1] Department of Psychology, University of Almería, Almería, Spain, [2] Department of Nursing Science, Physiotherapy and Medicine, University of Almería, Almería, Spain, [3] Department of Psychology, University of Burgos, Burgos, Spain*

OPEN ACCESS

**Edited by:**
*Meryem Yilmaz Soylu, University of Nebraska-Lincoln, United States*

**Reviewed by:**
*Therese N. Hopfenbeck, University of Oxford, United Kingdom*
*Valeska Valentina Grau, Pontifical Catholic University of Chile, Chile*

***Correspondence:**
*José M. Aguilar-Parra*
*jmaguilar@ual.es*
*Remedios Lopez-Liria*
*rll040@ual.es*

**Specialty section:**
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

**Received:** *12 June 2019*
**Accepted:** *27 November 2019*
**Published:** *09 January 2020*

**Citation:**
*Trigueros R, Aguilar-Parra JM, Lopez-Liria R, Cangas AJ, González JJ and Álvarez JF (2020) The Role of Perception of Support in the Classroom on the Students' Motivation and Emotions: The Impact on Metacognition Strategies and Academic Performance in Math and English Classes. Front. Psychol. 10:2794. doi: 10.3389/fpsyg.2019.02794*

According to various studies and the Cambridge University Student Barometer, Spanish students have the worst academic results in mathematics and English among the European Union countries. The objective of this study has been to analyze the influence of the teacher on motivation, positive emotions, metacognition strategies, and the academic performance of the students in those classes. We analyzed responses from 604 students of English and 547 students of mathematics, aged between 13 and 19 years. The teacher plays a relevant role in the motivation and emotions generated in the students, issues that determine decision making in the students' learning and academic performance.

**Keywords: motivation, mathematics, English, emotions, academic performance, teacher**

## INTRODUCTION

School failure in the secondary education stage is mainly due to the low motivation of students due to the lack of response of the educational establishment to the interests of the students (Cerda et al., 2016; Sánchez, 2016). In this sense, 22.2% of students who study mathematics during the secondary stage would not reach level 2, in the use of algorithms, formulas, procedures, or basic conventions (Goikoetxea and Jáuregui, 2008). On the other hand, according to the 2017 Cambridge University Student Barometer, the English level for Spanish adolescents is well below countries such as Denmark, Germany, France, or Italy, occupying 21st place (out of 27) in Europe (Education First, 2018). These educational levels have highlighted the marked deficiencies present in the Spanish educational system, which is sometimes unable to motivate and enthuse students toward their own learning. In this sense, teachers play a key role in promoting the students' interest in learning and achieving academic goals (Oriol-Granado et al., 2017). For this reason, it is necessary to analyze the emotional and motivational processes inherent to the students toward math and English classes as well as the influence on learning strategies and academic achievement.

Self-determination theory (SDT) suggests the influence that the teacher can have upon their students takes place through two interpersonal styles – support for autonomy versus controlling

behavior (Haerens et al., 2015). Support for autonomy refers to the encouragement by the teacher to the students' own initiative as well as their mental and physical self-development (Hagger et al., 2007). Conversely, the use of controlling behaviors where external pressures prevail and the use of coercive means and impositions by the teacher are perceived by students as the origin of their behavior, undermining their own initiative, effort, and personal self-knowledge (Trigueros-Ramos et al., 2017). In particular, it is believed that the role the teacher adopts could influence the development of the students' psychological needs (PNs) in a significant way.

According to SDT, these PNs constitute a series of psychological mechanisms that act as behavioral regulators for competence, autonomy, and relatedness (Deci and Ryan, 2014). Competence is the ability to skillfully perform the actions carried out; autonomy is those actions that are carried out for internal reasons, without external pressures, whereas relatedness is the feeling of belonging to a social group (Deci and Ryan, 2014). These three PNs are clearly linked to one another, so if one increases, the other will do so also; that is, students who feel more autonomous when participating in the decision-making process feel effective when performing actions and feel integrated into their social reference group, thus experiencing greater PN satisfaction. They also tend to experience self-determined motivation that is related to assimilating new information, commitment to learning, and the development of new strategies (Clayton et al., 2010). On the other hand, if students experience a feeling of abandonment during classes, minimal success in their actions, a lack of decision making, and activities that are overly monotonous or repetitive, they feel their PNs are thwarted, non-self-determined motivation that is related to activity abandonment, a lack of commitment, and the manifestation of maladaptive behaviors (Deci and Ryan, 2016).

In this way, the PN and the role played by teachers during their classes can influence student motivation (Trigueros et al., 2019c). According to SDT, there are three different types of motivation: intrinsic, extrinsic, and amotivation, ordered from more to less self-determined. Intrinsic motivation is related to behavior based on one's own choice, the capacity for personal decision making and initiative – students tend to stick to particular actions out of the simple pleasure and enjoyment that the action provokes, facilitating behavioral adaptation that leads to self-regulation (Ricard and Pelletier, 2016). Conversely, extrinsic motivation is related to participation in events due to external pressures or acquired obligations (Ryan and Deci, 2017). Finally, amotivation means the complete absence of motivation (Ryan and Deci, 2017). These last two types of motivation lead to a lack of self-regulation concerning adaptive behavior since they tend to move away from the actions for the absence of rewards or external social recognition (Deci and Ryan, 2016). Therefore, the social environment would be fundamental for the student to experience PN satisfaction and hence a self-determined motivation (Deci and Ryan, 2016).

Despite the importance of the teacher and PNs on student motivation, emotions are also relevant to the study time and academic effort (Van den Broeck et al., 2008). Emotions constitute an evaluative assessment of an external situation, which produces both a psychological and physiological activation in the body and determine our actions, indirectly influencing academic performance (Schukajlow et al., 2017), a relationship mediated by the motivational processes (Elliot and Pekrun, 2007). In this way, positive emotions would influence the intrinsic motivation, for example, when a certain task is completed successfully or when positive expectations increase motivation to favor implementation and further performance.

The studies so far existing (Trigueros and Navarro, 2019) have made special reference to the adoption of positive adaptive behaviors generated by classes in relation to students, focusing especially on the main objective set by Organic Law 8/2013 (LOMCE), which is the adoption of adaptative habits outside school. In this sense, the LOMCE promotes interdisciplinary learning of the different subjects belonging to the curriculum. So the adoption of certain learning strategies of students can be used in one or several subjects in order that they can achieve the educational objective.

Metacognition strategies are those that allow students to observe their own learning process using various resources that serve to plan, monitor, and evaluate their own progress (Rosen et al., 2011). An example of these metacognitive strategies is the realization of concept maps, summaries, reflective reading, and others. This implies the implementation of a series of skills based on the capacities to argue, recognize different relationships, evaluate evidence and authority, issue conclusions, and make correct inferences (Aydìn, 2015). It is therefore necessary to foster educational models that try to promote the use of these strategies, since they tend to succeed in achieving academic goals by linking learning to everyday situations and promoting awareness of limitations when reasoning, thinking, and facing problems (Saiz and Fernández, 2012). The Metacognitive and Affective of Self-Regulation Learning Model (MASRL; Efklides, 2011) tries to explain the relationship between the self-regulation of cognition and motivation and its effect on behavior through the generation of strategies that regulate it. Specifically, students' cognitive, metacognitive, and motivational characteristics lead to decisions related to commitment to a particular task and self-regulation. However, any decision can be modified or substituted depending on the task processing management and associated experiences (Reeve et al., 2007; Reeve, 2012). In such a way, students may have the belief that they are going to have to take a very easy exam, but while studying the subject, they may have the feeling that the exam may be more difficult than they originally believed so they decide to modify the way they study in order to face the exam with guarantee.

Studies focusing on students' motivational and emotional processes toward math and English classes are scarce although there are some that have focused on motivation (Kim et al., 2014; Pham and White, 2018), self-efficiency (Skaalvik et al., 2015), or attitudes (Oroujlou and Vahedi, 2011). The Kiemer et al. (2015) study demonstrated that the importance of productive discourse in the classroom on the part of the teacher and the promotion of positive experiences regarding autonomy, competence, and relatedness favor meaningful learning through the students' intrinsic motivation and the increase in interest toward math and science subjects. On the other hand, Kim et al. (2014) analyzed

how the perception of self-efficiency and effort regulation positively mediated the effects of motivation on academic performance with high school math students who were studying in a virtual way. In another study, Soenens et al. (2012) showed that high levels of autonomy support perceived by high school students were related to a series of positive consequences such as motivation to study, learning, and academic performance. Conversely, the control strategies perceived by students were related to less motivation and vague academic expectations.

In terms of emotions, Pekrun et al. (2012), in a study on high school students, showed how positive emotions had a positive influence on motivation, the use of strategies for meaningful learning, and academic performance. On the other hand, Pekrun et al. (2017) highlighted the importance of positive emotions on the students' academic achievement in math and vice versa. A study conducted by Pekrun et al. (2009) with 216 high school students demonstrated that intrinsic motivation predicted positive emotions, and these, in turn, predicted academic achievement and performance.

The objective of this research has been to analyze how the teacher's role influences the students' emotional and motivational processes and their consequences regarding the use of metacognition strategies and academic performance. Two studies have been designed with independent samples, covering the entire secondary school, one for English language learners and the other for math students, posing the following hypotheses (see **Figures 1**, **2**):

(1) The support perceived by students regarding their autonomy would positively predict PN satisfaction and negatively predict PN thwarting.
(2) Conversely, the psychological control perceived would act inversely on satisfaction and thwarting.
(3) PN satisfaction would positively predict academic motivation and positive emotions.
(4) PN thwarting would negatively predict both academic motivation and positive emotions.
(5) Positive emotions would positively predict academic motivation, metacognition strategies, and academic performance.
(6) Academic motivation would positively predict metacognition strategies and academic performance.
(7) Metacognition strategies would positively predict academic performance.

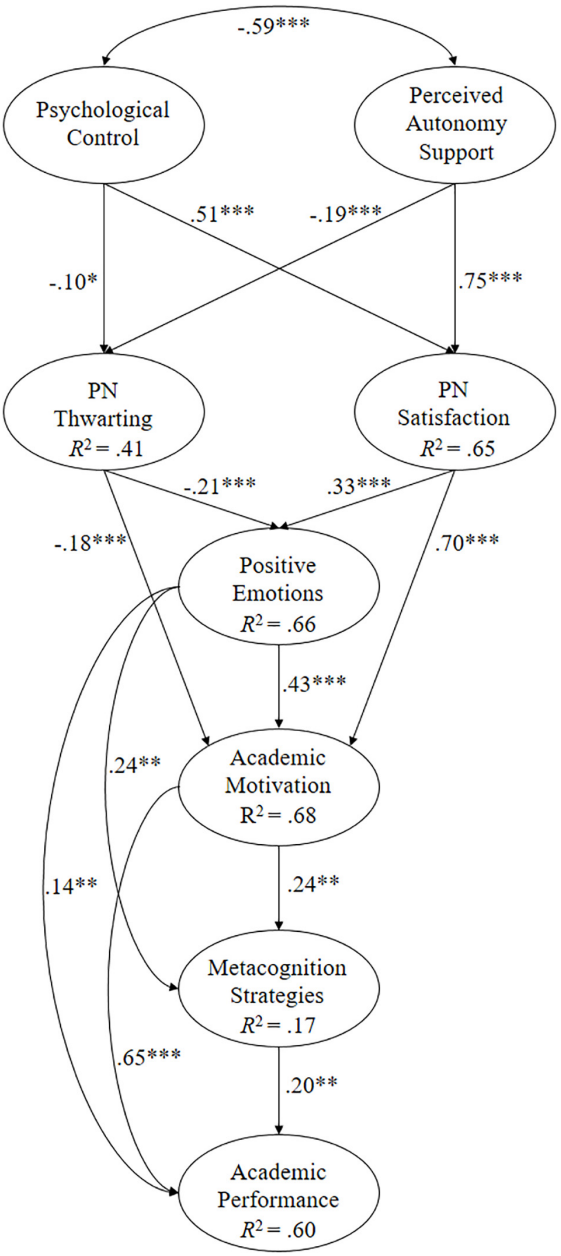


**FIGURE 1 |** Of structural equations showing the relationships between the different variables. All parameters are standardized and statistically significant. ***$p < 0.001$, **$p < 0.01$, and *$p < 0.05$.

# MATERIALS AND METHODS

## Participants

For the English study, 604 students participated, 321 boys and 283 girls, aged between 13 and 19 years ($M$ = 15.73; $SD$ = 1.30). On the other hand, the math study involved 547 students (289 boys and 258 girls) aged between 13 and 19 years ($M$ = 15.94; $SD$ = 1.31). With the participation of this sample, the entire secondary education is encompassed.

The groups were from different compulsory secondary education centers in Almeria Province. The inclusion criteria for the studies were voluntary participation and written informed consent given by parents (given the participants were under age).

## Instruments

### Perceived Autonomy Support

A short version of the Teacher as Social Context Questionnaire (TASC; Belmont et al., 1988) was used. A scale consisting of eight items that assessed a single factor in perceived autonomy support (e.g., my teacher listens to my ideas) was scored using

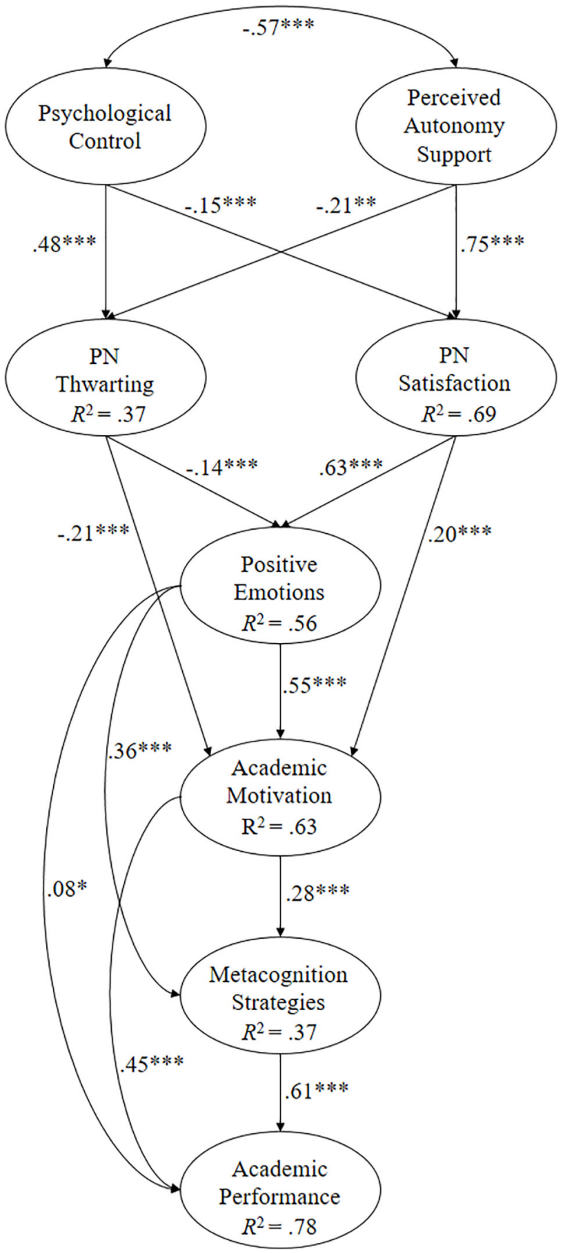


**FIGURE 2 |** Of structural equations showing the relationships between the different variables. All parameters are standardized and statistically significant. ***$p < 0.001$, **$p < 0.01$, and *$p < 0.05$.

a Likert-type scale ranging from 1 (*completely disagree*) to 7 (*completely agree*).

## Psychological Control

The psychologically controlling teaching scale (PCTS; Soenens et al., 2012) was used, in a version validated and adapted by Trigueros et al. (2020) for the physical education (PE) context. On this scale, only the word *physical education* was replaced with either English or math (in each case), with the heading "My teacher of English or mathematics." (depending on the study). This scale consisted of seven items with a single factor, responded to with a Likert-type scale ranging from 1 (*totally disagree*) to 5 (*totally agree*).

## Basic Psychological Needs Satisfaction

The version used by Menéndez and Fernández-Rio (2018) was validated and adapted to the Spanish PE context from Basic PNs in PE (BPN-PE; Vlachopoulos et al., 2011). The scale comprised a total of 12 items, four items corresponding to autonomy, four items corresponding to competition, and four items corresponding to relatedness. In the scale, only the word *physical education* was replaced by either English or math (in each case). The scale was preceded with the heading "In my English or math classes." (depending on the student sample). The responses were collected on a Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*).

## Basic Psychological Needs Thwarting

This is part of the version adapted to the Spanish PE (Trigueros et al., 2019d) context from the Scale of PNs Frustration in physical exercise (EFNP; Sicilia et al., 2013). The scale was composed of a total of 12 items, divided equally into three factors (autonomy, competence, and relatedness). In the scale, only the word *physical education* was replaced by English or math (in each case). The scale was preceded with the heading "In my English or math classes" (depending on the study). The responses were collected on a Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*).

## Positive Emotions

The Emotions State in PE Classes questionnaire was used (Trigueros et al., 2019a). The questionnaire's header was adapted to the context of the two samples. The scale consisted of a total of 32 items distributed among the eight factors – four being negative (e.g., anxiety, embarrassment, boredom, and hopelessness) and four positive (e.g., fun, pride, tranquility, and confidence), making use of the items referencing these last factors. Students had to respond to questions on a Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*).

## Academic Motivation Toward Learning

The version used was validated and adapted from the Academic Self-Regulation Scale (Vansteenkiste et al., 2009) to the Spanish context by Trigueros et al. (2019b). It consisted of 24 items, grouped into six factors that measured intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation. The students responded using a Likert-type scale ranging from 1 (*not true at all*) to 7 (*totally true*).

The relative autonomy index (RAI) was used to evaluate academic motivation. RAI was calculated as recommended by Vallerand (2007), assigning a weight to each type of motivation according to its place in the motivational continuum. The following formula was used to calculate the RAI: (3 × Intrinsic Mot.) + (2 × Integrated Reg.) + (1 × Identified Reg.) − (1 × Introjected Reg.) − (2 × External Reg.) − (3 × Amotivation). This index has proven itself to

be valid and reliable in several works, being used to obtain a value for quantifying the level of self-determination.

### Learning Focus

In order to measure the metacognition strategy, the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) was used after being validated and adapted to the Spanish context by Roces et al. (1995). Only 12 items were used that made reference to metacognition strategies. The students responded using a Likert-type scale ranging from 1 (*not true at all*) to 5 (*completely true*).

### Academic Performance

To measure academic performance, the grades obtained over the academic year were taken into account in the subjects of English and math, respectively. The grades were distributed in the following way: 1 (fail), 2 (pass), 3 (good), 4 (very good), and 5 (excellent).

## Procedure

This study followed all procedural ethics with regard to the ethical treatment of human participants. It has requested permission to conduct this study, which was approved by the Bioethics Committee in Human Research of the University of Almería (Ref: UALBIO 2019/014). Furthermore, we have obtained written informed consent from the parents/legal guardians of all participants of the study, because they were underage students. Also, previously, the parents/legal guardians were informed of the objective and the procedure of this study in writing.

First, we contacted various educational centers in Almeria Province, asking for permission to give the questionnaires to their students after informing them of the study objectives. Then the scales were administered to the participants under the supervision of a survey expert (a member of the research group), who explained and resolved any queries that arose when filling out the questionnaires. The time estimated to complete the questionnaires was around 25 min.

## Data Analysis

First, the descriptive statistics were calculated, and with the Pearson correlation, the correlation between the study variables was analyzed. Subsequently, the hypothesized predictive model was tested using a structural equation model (SEM). To test the effects of mediation between the model variables, the premises established by Baron and Kenny (1986) were taken into account: (a) significant correlations between the independent and dependent variables; (b) significant correlations between the independent variable and the mediators; (c) significant correlations between the mediators and the dependent variable; (d) the prior significant relationship between the independent and dependent variables that ceases being significant when relationships between the independent variable and the mediators and between the mediators and the dependent variable are controlled.

For the SEM, the maximum likelihood estimation method was used with the bootstrapping procedure in the AMOS 19 statistical package. The following indexes were used to analyze the model's goodness of fit: the chi square coefficient, the chi square to its degrees of freedom ($\chi^2/df$), the comparative fit index (CFI), the incremental fit index (IFI), the root mean square error of approximation (RMSEA) plus its 90% confidence interval (CI), and the standardized root mean square residual (SRMR). Generally, values are considered acceptable if they are below 5 $\chi^2/df$ (Bentler, 1990), likewise for CFI and IFI values equal to or above 0.90, RMSEA values below 0.08, and SRMR values of 0.06 or less (Hu and Bentler, 1999).

# RESULTS

## Preliminary Analysis

In **Table 1**, one can observe that the average scores for the English students were moderate. Only psychological control and PN frustration were below the questionnaire's arithmetic mean. The same thing occurred for the math students (see **Table 2**).

The reliability analysis using Cronbach's alpha for the English students produced a value of 0.82 for perceived psychological control, 0.85 for perceived autonomy support, 0.89 for PN thwarting, 0.92 for PN satisfaction, 0.94 for positive emotions, and 0.82 for the metacognition strategy.

The reliability analysis using Cronbach's alpha for math students produced a value of 0.96 for perceived psychological control, 0.92 for perceived autonomy support, 0.85 for PN thwarting, 0.72 for PN satisfaction, 0.95 for the metacognition strategy, and 0.92 for positive emotions.

After the Pearson correlation analysis was conducted in both studies [math students (**Table 2**) and English students (**Table 1**)], it was observed how psychological control related positively with PN thwarting and negatively for perceived autonomy support, PN satisfaction, positive emotions, academic motivation, metacognition strategy, and academic performance.

Perceived autonomy support correlated negatively with PN thwarting and positively with PN satisfaction, positive emotions, academic motivation, metacognition strategy, and academic performance.

PN thwarting correlated negatively with respect to PN satisfaction, positive emotions, academic motivation, metacognition strategy, and academic performance.

Conversely, PN satisfaction correlated positively with positive emotions, academic motivation, metacognition strategy, and academic performance.

Positive emotions correlated positively with the RAI academic, metacognition strategy, and academic performance.

Academic motivation correlated positively with respect to the metacognition strategy and academic performance; and finally, the metacognition strategy correlated positively with academic performance.

## Structural Equation Model

When the predictive relationship model hypothesized for English students was tested (**Figure 1**), the following fit indices were revealed: $\chi^2(122, N = 604) = 512.27$, $p < 0.001$; $\chi^2/df = 4.20$;

**TABLE 1 |** Descriptive statistics and the correlation between the English model variables.

| Variables | *M* | *DT* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Perceived autonomy support | 4.48 | 1.34 | | −0.57** | 0.64** | −0.40** | −0.59** | 0.59** | 0.27** | 0.49** |
| 2. Psychological control | 1.82 | 1.06 | | | −0.43** | 0.54** | −0.51** | −0.54** | −0.27** | −0.44** |
| 3. PNS | 4.08 | 1.21 | | | | −0.45** | 0.65** | 0.66** | 0.28** | 0.55** |
| 4. PNT | 2.59 | 1.21 | | | | | −0.48** | −0.54** | −0.18** | −0.44** |
| 5. Positive emotions | 4.95 | 1.51 | | | | | | 0.79** | 0.35** | 0.67** |
| 6. Academic motivation | 11.49 | 16.05 | | | | | | | 0.35** | 0.77** |
| 7. Metacognition strategy | 3.26 | 0.72 | | | | | | | | 0.31** |
| 8. Academic performance | 3.78 | 1.31 | | | | | | | | |

***p < 0.01. PNT, psychological needs thwarting; PNS, psychological needs satisfaction.*

**TABLE 2 |** Descriptive statistics and the correlation between the math model variables.

| Variables | *M* | *DT* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Perceived autonomy support | 4.44 | 1.29 | | −0.52** | 0.63** | −0.42** | 0.57* | 0.55** | 0.36** | 0.46** |
| 2. Psychological control | 1.81 | 1.02 | | | −0.43* | 0.55** | −0.50** | −0.49** | −0.27** | −0.40** |
| 3. PNS | 4.33 | 1.16 | | | | −0.58** | 0.68** | 0.69** | 0.45* | 0.57** |
| 4. PNT | 2.64 | 1.34 | | | | | −0.52** | −0.52** | −0.37** | −0.55** |
| 5. Positive emotions | 4.93 | 1.46 | | | | | | 0.78** | 0.53** | 0.63** |
| 6. Academic motivation | 11.58 | 15.43 | | | | | | | 0.55** | 0.73** |
| 7. Metacognition strategy | 4.02 | 1.11 | | | | | | | | 0.80** |
| 8. Academic performance | 3.82 | 1.29 | | | | | | | | |

**p < 0.05; **p < 0.01. PNT, psychological needs thwarting; PNS, psychological needs satisfaction.*

CFI = 0.95; IFI = 0.95; RMSEA = 0.073 (90% CI = 0.066–0.079); and SRMR = 0.043.

The following are the relationships obtained between the different factors making up the English model (**Figure 1**):

(a) The correlation between psychological control and support for autonomy was negative ($\beta = -0.59$, $p < 0.001$).
(b) Psychological control positively predicted PN thwarting ($\beta = 0.51$, $p < 0.001$) and, in turn, negatively predicted PN satisfaction ($\beta = -0.10$, $p < 0.05$).
(c) Autonomy support positively predicted PN satisfaction ($\beta = 0.75$, $p < 0.001$) and negatively predicted PN thwarting ($\beta = -0.19$, $p < 0.001$).
(d) PN satisfaction positively predicted positive emotions ($\beta = 0.70$, $p < 0.001$) and academic motivation ($\beta = 0.33$, $p < 0.001$).
(e) PN thwarting negatively predicted positive emotions ($\beta = -0.21$, $p < 0.001$) and academic motivation ($\beta = -0.18$, $p < 0.001$).
(f) Positive emotions positively predicted academic motivation ($\beta = 0.43$, $p < 0.001$), the metacognition strategy ($\beta = 0.24$, $p < 0.01$), and academic performance ($\beta = 0.14$, $p < 0.01$).
(g) Academic motivation positively predicted the metacognition strategy ($\beta = 0.20$, $p < 0.01$) and academic performance ($\beta = 0.65$, $p < 0.001$).
(h) The metacognition strategy positively predicted academic achievement ($\beta = 0.30$, $p < 0.05$).

When the predictive relationship model hypothesized for the math students was tested (**Figure 2**), the following fit indices were revealed: $\chi^2(122, N = 547) = 383.40$, $p < 0.001$; $\chi^2/gl = 3.14$; CFI = 0.97; IFI = 0.97; RMSEA = 0.063 (90% CI = 0.056–0.070); SRMR = 0.047.

In contrast, the relationships obtained between the different factors that make up the math model are described (**Figure 2**):

(a) The correlation between psychological control and support for autonomy was negative ($\beta = -0.57$, $p < 0.001$).
(b) Psychological control positively predicted PN thwarting ($\beta = 0.48$, $p < 0.001$) and, in turn, negatively predicted PN satisfaction ($\beta = 0.15$, $p < 0.001$).
(c) Support for autonomy positively predicted PN satisfaction ($\beta = 0.75$, $p < 0.001$) and, in turn, negatively predicted PN thwarting ($\beta = -0.21$, $p < 0.01$).
(d) PN satisfaction positively predicted positive emotions ($\beta = 0.63$, $p < 0.001$) and academic motivation ($\beta = 0.20$, $p < 0.001$).
(e) PN thwarting negatively predicted positive emotions ($\beta = -0.21$, $p < 0.001$) and academic motivation ($\beta = -0.14$, $p < 0.001$).
(f) Positive emotions positively predicted academic motivation ($\beta = 0.55$, $p < 0.001$), the metacognition strategy ($\beta = 0.36$, $p < 0.001$), and academic performance ($\beta = 0.08$, $p < 0.05$).
(g) Academic motivation positively predicted the metacognition strategy ($\beta = 0.28$, $p < 0.001$) and academic performance ($\beta = 0.45$, $p < 0.001$).

(h) The metacognition strategy positively predicted academic achievement ($\beta = 0.61$, $p < 0.001$).

# DISCUSSION

## General Discussion

The present study analyzes the areas of math and English – how the students' perception of the interpersonal teaching style affects the PNs, positive emotions, academic motivation, use of metacognition strategies, and academic performance, that is to say, how the teacher's role can influence the students in terms of offering them autonomy support rather than psychological control, with regard to PN frustration or satisfaction as well as its effects on academic motivation and positive emotions. The study considered both the positive and negative aspects that may be present in math and English classes – issues such as the teacher's controlling style or the PN satisfaction and frustration, which are frequently experienced by the students.

The results of this study show that support for autonomy positively predicts PN satisfaction and negatively predicts PN thwarting; in contrast, perceived control acts inversely on PN thwarting and satisfaction. However, studies dealing with these variables in the areas of math and English have not been found, only in PE. Accordingly, a study by Haerens et al. (2015) showed how the perception of supported autonomy and teaching control, as well as PN satisfaction and frustration, comprise different constructs that are disparately related to student motivation; that is to say, perceived autonomy support was related to self-determined motivation and PN satisfaction, which acted as a mediator for this association while the perception of controlled teaching was mainly related to non-self-determined motivation and amotivation, with PN thwarting acting as a mediator in this relationship. On the other hand, the study by Hein et al. (2015) showed how the students' perception of the controlling teaching style had a positive influence on feelings of anger and harassment, which promoted PN thwarting. In contrast, Yu et al. (2015) showed how support for autonomy had a positive influence on PN satisfaction, giving rise to increased student commitment. These studies show the importance of teaching and its influence on the motivational, social, and psychological development of the students as well as their PNs, since they are psychological mechanisms that act as behavioral regulators (Hagger et al., 2003; Haerens et al., 2015; Hein et al., 2015; Yu et al., 2015).

The results of this research have also shown that PN frustration negatively predicts positive emotions and academic motivation, whereas PN satisfaction inversely predicts them. Accordingly, a study by Cantú-Berrueto et al. (2016) showed how PN satisfaction led to students experiencing self-determined motivation toward PE classes while PN frustration predicted non-self-determined motivation. Similarly, Trigueros et al. (2019c) showed how PN satisfaction positively predicted motivation and negatively predicted shame; however, frustration of these needs acted inversely on the relationships. According to all these studies, PN satisfaction and/or thwarting influence emotions (Wei et al., 2005; Taylor et al., 2010; Tessier et al., 2010; Bartholomew et al., 2011), information that Wei et al. (2005) corroborate, showing how PN satisfaction negatively influences depression, stress, and shame. Likewise, Tessier et al. (2010) showed how PN satisfaction was associated positively with certain emotions such as fun, joy, and enthusiasm but negatively with boredom and disinterest. The research results described are in accordance with the principles set forth in the SDT regarding the relationship between PN and positive emotions (Deci and Ryan, 2011); this is due to the effects of PN on emotional and psychological well-being (Tessier et al., 2010; Trigueros et al., 2019c). This study is based on the idea put forward by Deci and Ryan (2014) that PN thwarting can trigger a series of maladaptive consequences that lead to disinhibition and/or behavior that is contrary to personal well-being, the inverse occurring in the case of PN satisfaction.

On the other hand, the analyzed results indicate that positive emotions predict academic motivation, meaningful learning strategies, and academic achievement in a positive way, information that is in line with other studies carried out in the university student population, where positive emotions showed this relationship with intrinsic motivation, self-regulation of academic behavior, and academic performance (Villavicencio and Bernardo, 2013; Pekrun et al., 2017). These findings indicate that student emotions are related to their control, motivation, use of learning strategies, and academic performance (Pekrun et al., 2017).

Finally, motivation showed a positive relationship with metacognition strategies and academic performance. Similarly, metacognition strategies showed a positive relationship with academic achievement. Such findings have been described in research on the university student population (Wolters and Hussain, 2015) and students engaged in distance learning (Broadbent, 2017). These could be explained by the fact that metacognitive strategies are procedures that facilitate information processing by selecting, organizing, and regulating cognitive processes (Karpicke et al., 2009). For their use, it is necessary that students show great interest in the subject, namely, an intrinsic motivation toward it, since it requires conscious planning and use of these strategies to facilitate academic performance (Zimmerman, 2008).

Among the limitations, it is necessary to point out that this is a correlational study, so it does not allow one to extrapolate the cause–effect relationships – the results obtained could have different interpretations depending on the context. Furthermore, in the present study, we have not been able to carry out a comparative study of the results according to the school year or the age of the students. In addition, the SEMs have the limitation that their relationships are unidirectional. On the other hand, there may be other factors that significantly influence student achievement and academic performance, in addition to the variables considered. Finally, in the future, comparative studies should be carried out between the different countries of the European Union in relation to the motivation, emotion, and metacognitive strategies of high school students in the areas of math and English, being able to introduce new variables such as emotional intelligence and critical thinking, because those factors infer on the performance and motivation according to different studies (Homayouni, 2011; Galla and Wood, 2012).

## Discussion of Math Context

The present study is pioneering in jointly demonstrating the importance of the variables of emotions, motivation for learning, and the students' attributional style in the area of math. In this sense, the practices derived from the study point to the need to incorporate motivational and emotional components for the training of students and teachers. It is important to provide educators with information on the role of motivation and positive emotions in the success and adaptation of students in the educational context and on how to develop the internal attributional style of their pupils. Teachers, and parents, must provide learning environments that promote autonomy over external control. When learning is achieved through procedures that support the adolescents' involvement, the sense of self-determination and understanding of the material to be learned are enhanced. Teachers should accompany students in the learning process by transmitting their passion and enthusiasm for knowing, promoting feelings of self-efficacy and academic self-competence as the basis for educational success.

## Discussion of English Context

This study contributes to the area of teaching a foreign language in which the motivational, emotional, and attributional processes of secondary school students in that area have been taken into account. In this way, valuable pedagogical implications can be deduced so that teachers can integrate into their teaching situations that favor student reflection before, during, and after entering the classroom. It is vital, for example, that teachers take into account the following:

(1) The importance and impact of the classroom atmosphere affect students in their interest, enthusiasm, commitment, and motivation during instruction or class time. Thus, we suggest to teachers, based on the current study and what we know from previous best practice studies, the following recommendations: creating an atmosphere in class that increases comfort and confidence and developing good classroom relationships. To achieve this, the teacher should be accessible, not distant or intimidating, and should understand students' mistakes and doubts; likewise, the teacher should try to connect and interact with students on a more personal level.

(2) The program, including both content and organization, is another important point that affects students' levels of commitment and motivation, and therefore, teachers should consider every aspect of it in relation to the impact on instruction and what takes place in class. The organization of the program, including homework and time spent on corrections, should be considered relevant.

(3) Students' academic performance should be assessed by teachers in a way that can better reflect what has been taught and addressed during the regular class period, rather than creating additional challenges or challenges.

(4) Teachers should use different expressions and vocabulary to explain, which allows students to activate their previous knowledge and use it to construct and understand what is new.

# CONCLUSION

Ultimately, this model helps us to understand the emotional and motivational processes that favor academic performance in the subjects of English and math, demonstrating good robustness in the university environment. In addition, the importance of teaching based on support for student autonomy, in order to increase their interest and motivation toward these subjects, is highlighted. In this way, students show more willingness to use different strategies for meaningful learning, resulting in increased learning, and academic performance.

# DATA AVAILABILITY STATEMENT

The datasets generated in this article are not publicly available. Requests to access the datasets should be directed to corresponding author (JA-P).

# AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

# REFERENCES


Aydìn, S. (2015). An analysis of the relationship between high school students' self-efficacy, metacognitive strategy use and their academic motivation for learn biology. *J. Educ. Train. Stud.* 4, 53–59.

Baron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51:1173. doi: 10.1037//0022-3514.51.6.1173

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., and Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: assessing the darker side of athletic experience. *J. Sport Exerc. Psychol.* 33, 75–102. doi: 10.1123/jsep.33.1.75

Belmont, M., Skinner, E., Wellborn, J., and Connell, J. (1988). *Teacher as Social Context: A Measure of Student Perceptions of Teacher Provision of Involvement, Structure, and Autonomy Support*. Rochester, NY: University of Rochester.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol. Bull.* 107:238. doi: 10.1037/0033-2909.107.2.238

Broadbent, J. (2017). Comparing online and blended learner.s self-regulated learning strategies and academic performance. *Internet High. Educ.* 33, 24–32. doi: 10.1016/j.iheduc.2017.01.004

Cantú-Berrueto, A., Castillo, I., López-Walle, J., Tristán, J., and Balaguer, I. (2016). Estilo interpersonal del entrenador, necesidades psicológicas básicas: un estudio en futbolistas universitarios mexicanos. *Rev. Iberoam. Psicol. Ejercicio Deport.* 11, 263–270.

Cerda, G., Ortega Ruiz, R., Casas, J. A., del Rey, R., and Pérez, C. (2016). Predisposición desfavorable hacia el aprendizaje de las matemáticas: una propuesta para su medición. *Estudios Pedagógicos* 42, 53–63. doi: 10.4067/s0718-07052016000100004

Clayton, K., Blumberg, F., and Auld, D. P. (2010). The relationship between motivation, learning strategies and choice of environment whether traditional

or including an online component. *Br. J. Educ. Technol.* 41, 349–364. doi: 10.1111/j.1467-8535.2009.00993.x

Deci, E. L., and Ryan, R. M. (2011). Self-determination theory. *Handb. Theor. Soc. Psychol.* 1, 416–433.

Deci, E. L., and Ryan, R. M. (2014). "Autonomy and need satisfaction in close relationships: relationships motivation theory," in *Human Motivation and Interpersonal Relationships: Theory, Research, and Applications*, ed. N. Weinstein, (Dordrecht: Springer), 53–73. doi: 10.1007/978-94-017-8542-6_3

Deci, E. L., and Ryan, R. M. (2016). "Optimizing students' motivation in the era of testing and pressure: a self-determination theory perspective," in *Building Autonomous Learners*, eds W. C. Liu, J. C. K. Wang, and R. M. Ryan, (Singapore: Springer).

Education First (2018). *Índice EF de Nivel de Inglés*. Lucerne: Education First.

Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: the MASRL model. *Educ. Psychol.* 46, 6–25. doi: 10.1080/00461520.2011.538645

Elliot, A. J., and Pekrun, R. (2007). Emotion in the hierarchical model of approach-avoidance achievement motivation. *Emot. Educ.* 2007, 57–73. doi: 10.1016/b978-012372545-5/50005-8

Galla, B. M., and Wood, J. J. (2012). Emotional self-efficacy moderates anxiety-related impairments in math performance in elementary school-age youth. *Pers. Ind. Diff.* 52, 118–122. doi: 10.1016/j.paid.2011.09.012

Goikoetxea, M. J., and Jáuregui, P. (2008). Fracaso escolar en matemáticas. *Rev. Didáctica Mate.* 49, 56–61.

Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., and Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychol. Sport Exerc.* 16, 26–36. doi: 10.1016/j.psychsport.2014.08.013

Hagger, M. S., Chatzisarantis, N. L., Culverhouse, T., and Biddle, S. J. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: a trans-contextual model. *J. Educ. Psychol.* 95:784. doi: 10.1348/000709910X487023

Hagger, M. S., Chatzisarantis, N. L. D., Hein, V., Pihu, M., Soós, I., and Karsai, I. (2007). The perceived autonomy support scale for exercise settings (PASSES): development, validity and cross-cultural invariance in young people. *Psychol. Sport Exerc.* 8, 632–653. doi: 10.1016/j.psychsport.2006.09.001

Hein, V., Koka, A., and Hagger, M. S. (2015). Relationships between perceived teachers' controlling behaviour, psychological need thwarting, anger and bullying behaviour in high-school students. *J. Adolesc.* 42, 103–114. doi: 10.1016/j.adolescence.2015.04.003

Homayouni, A. (2011). Personality traits and emotional intelligence as predictors of learning English and Math. *Proc. Soc. Behav. Sci.* 30, 839–843. doi: 10.1016/j.sbspro.2011.10.163

Hu, L., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55. doi: 10.1080/10705519909540118

Karpicke, J. D., Butler, A. C., and Roediger, H. L. III (2009). Metacognitive strategies in student learning: do students practise retrieval when they study on their own? *Memory* 17, 471–479. doi: 10.1080/09658210802647009

Kiemer, K., Gröschner, A., Pehmer, A. K., and Seidel, T. (2015). Effects of a classroom discourse intervention on teachers' practice and students' motivation to learn mathematics and science. *Learn. Instr.* 35, 94–103. doi: 10.1016/j.learninstruc.2014.10.003

Kim, C., Park, S. W., and Cozart, J. (2014). Affective and motivational factors of learning in online mathematics courses. *Br. J. Educ. Technol.* 45, 171–185. doi: 10.1111/j.1467-8535.2012.01382.x

Menéndez, J. I., and Fernández-Rio, J. (2018). Versión española de la escala de necesidades psicológicas básicas en educación física. *Rev. Inter. Med. Cienc. Actividad Física Deport.* 18, 119–133.

Oriol-Granado, X., Mendoza-Lira, M., Covarrubias-Apablaza, C. G., and Molina-López, V. M. (2017). Emociones positivas, apoyo a la autonomía y rendimiento de estudiantes universitarios: el papel mediador del compromiso académico y la autoeficacia. *Rev. Psicodidáctica* 22, 45–53. doi: 10.1016/s1136-1034(17)30043-6

Oroujlou, N., and Vahedi, M. (2011). Motivation, attitude, and language learning. *Proc. Soc. Behav. Sci.* 29, 994–1000. doi: 10.1016/j.sbspro.2011.11.333

Pekrun, R., Elliot, A. J., and Maier, M. A. (2009). Achievement goals and achievement emotions: testing a model of their joint relations with academic performance. *J. Educ. Psychol.* 101:115. doi: 10.1037/a0013383

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., and Perry, R. P. (2012). Measuring emotions in students' learning and performance: the achievement emotions questionnaire (AEQ). *Contemp. Educ. Psychol.* 36, 36–48. doi: 10.1016/j.cedpsych.2010.10.002

Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., and Goetz, T. (2017). Achievement emotions and academic performance: longitudinal models of reciprocal effects. *Child Dev.* 88, 1653–1670. doi: 10.1111/cdev.12704

Pham, C., and White, C. (2018). "Rural students' motivation for learning english: implications for transition to tertiary education," in *English Tertiary Education in Vietnam*, ed. J. Albright, (London: Routledge), 150–162.

Pintrich, P. R., Smith, D., Garcia, T., and McKeachie, W. J. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire*. Ann Arbor, MI: The Regents of the University of Michigan.

Reeve, J. (2012). "A self-determination theory perspective on student engagement," in *Handbook of Research on Student Engagement*, eds S. L. Christenson, A. Reschly, and C. Wylie, (New York, NY: Springer).

Reeve, J., Ryan, R. M., Deci, E. L., and Jang, H. (2007). "Understanding and promoting autonomous self-regulation: a self-determination theory perspective," in *Motivation and Self-Regulated Learning: Theory, Research, and Application*, eds D. Schunk, and B. Zimmerman, (Mahwah, NJ: Lawrence Erlbaum).

Ricard, N. C., and Pelletier, L. G. (2016). Dropping out of high school: the role of parent and teacher self-determination support, reciprocal friendships and academic motivation. *Contemp. Educ. Psychol.* 44, 32–40. doi: 10.1016/j.cedpsych.2015.12.003

Roces, C., Tourón, J., and González Torres, M. C. (1995). Validación preliminar del CEAM II. *Psicológica* 16, 347–366.

Rosen, L. D., Lim, A. F., Carrier, L. M., and Cheever, N. A. (2011). An empirical examination of the educational impact of text message-induced task switching in the classroom: educational implications and strategies to enhance learning. *Psicol. Educ.* 17, 163–177. doi: 10.5093/ed2011v17n2a4

Ryan, R. M., and Deci, E. L. (2017). *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. New York, NY: Guilford Publications.

Saiz, C. Y., and Fernández, S. (2012). Pensamiento crítico y aprendizaje basado en problemas cotidianos. *Rev. Docencia Univ.* 10, 325–346.

Sánchez, G. R. (2016). Atribución de motivación de logro y rendimiento académico en matemática. *PSIQUEMAG* 4, 81–98.

Schukajlow, S., Rakoczy, K., and Pekrun, R. (2017). Emotions and motivation in mathematics education: theoretical considerations and empirical contributions. *ZDM* 49, 307–322. doi: 10.1007/s11858-017-0864-6

Sicilia, A., Ferriz, R., and Sáez-Alvarez, P. (2013). Validación española de la escala de frustración de las necesidades psicológicas (EFNP) en el ejercicio físico. *Psychol. Soc. Educ.* 5, 1–19.

Skaalvik, E. M., Federici, R. A., and Klassen, R. M. (2015). Mathematics achievement and self-efficacy: relations with motivation for mathematics. *Int. J. Educ. Res.* 72, 129–136. doi: 10.1016/j.ijer.2015.06.008

Soenens, B., Sierens, E., Vansteenkiste, M., Dochy, F., and Goossens, L. (2012). Psychologically controlling teaching: examining outcomes, antecedents, and mediators. *J. Educ. Psychol.* 104, 108–120. doi: 10.1037/a0025742

Taylor, I. M., Ntoumanis, N., Standage, M., and Spray, C. M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: a multilevel linear growth analysis. *J. Sport Exerc. Psychol.* 32, 99–120. doi: 10.1123/jsep.32.1.99

Tessier, D., Sarrazin, P., and Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students motivation and psychological need satisfaction in sport-based physical education. *Contemp. Educ. Psychol.* 35, 242–253. doi: 10.1016/j.cedpsych.2010.05.005

Trigueros, R., Aguilar-Parra, J. M., Cangas, A. J., and Álvarez, J. F. (2019a). Validation of the scale of emotional states in the physical education context. *Sustainability* 11:5006. doi: 10.3390/su11185006

Trigueros, R., Aguilar-Parra, J. M., López-Liria, R., and León-Estrada, I. (2019b). Adaptación y validación de la escala de motivación académica en secundaria con la incorporación de la regulación integrada y la desmotivación. *Rev. Iberoam. Diagn. Eval. Avaliação Psicol.* (in press).

Trigueros, R., Maldonado, J. J., Vicente, F., Ortiz, L., González-Bernal, J. J., and González-Santos, J. (2019c). Adaptación y validación al contexto de la educación física de la escala de la frustración de las necesidades psicológicas en el ejercicio físico, con la inclusión de la novedad como necesidad psicológica. *Rev. Psicol. Deport.* (in press).

Trigueros, R., Mínguez, L. A., González-Bernal, J. J., Aguilar-Parra, J. M., Padilla, D., and Álvarez, J. F. (2019d). Validation of the satisfaction scale of basic psychological needs in physical education with the incorporation of the novelty in the Spanish context. *Sustainability* 11:6250. doi: 10.3390/su11226250

Trigueros, R., Aguilar-Parra, J. M., González-Santos, J., and Cangas, A. J. (2020). Validación y adaptación de la escala de control psicológico del profesor hacia las clases de educación física y su efecto sobre las frustraciones de las necesidades psicológicas básicas. *Retos* 37, 167–173.

Trigueros, R., and Navarro, N. (2019). La influencia del docente sobre la motivación, las estrategias de aprendizaje, pensamiento crítico de los estudiantes y rendimiento académico en el área de Educación Física. *Psychol. Soc. Educ.* 11, 137–150. doi: 10.25115/psye.v10i1.2230

Trigueros-Ramos, R., Fernández-Campoy, J. M., Alías, A., Aguilar-Parra, J. M., and Segura, M. C. L. (2017). Adaptación y validación española del controlling coach behaviors scale (CCBS). *Int. J. Dev. Educ. Psychol.* 2, 417–428.

Vallerand, R. J. (2007). Intrinsic and extrinsic motivation in sport and physical activity. *Handb. Sport Psychol.* 3, 59–83. doi: 10.1002/9781118270011.ch3

Van den Broeck, A., Vansteenkiste, M., De Witte, H., and Lens, W. (2008). Explaining the relationships between job characteristics, burnout, and engagement: the role of basic psychological need satisfaction. *Work Stress* 22, 277–294. doi: 10.1080/02678370802393672

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., and Lens, W. (2009). Motivational profiles from a self-determination perspective: the quality of motivation matters. *J. Educ. Psychol.* 101:671. doi: 10.1037/a0015083

Villavicencio, F. T., and Bernardo, A. B. (2013). Positive academic emotions moderate the relationship between self-regulation and academic achievement. *Br. J. Educ. Psychol.* 83, 329–340. doi: 10.1111/j.2044-8279.2012.02064.x

Vlachopoulos, S. P., Katartzi, E. S., and Kontou, M. G. (2011). The basic psychological needs in physical education scale. *J. Teach. Phys. Educ.* 30, 263–280. doi: 10.1123/jtpe.30.3.263

Wei, M., Shaffer, P. A., Young, S. K., and Zakalik, R. A. (2005). Adult attachment, shame, depression, and loneliness: the mediation role of basic psychological needs satisfaction. *J. Counse. Psychol.* 52, 591–601. doi: 10.1037/0022-0167.52.4.591

Wolters, C. A., and Hussain, M. (2015). Investigating grit and its relations with college students' self-regulated learning and academic achievement. *Metacogn. Learn.* 10, 293–311. doi: 10.1007/s11409-014-9128-9

Yu, C., Li, X., and Zhang, W. (2015). Predicting adolescent problematic online game use from teacher autonomy support, basic psychological needs satisfaction, and school engagement: a 2-year longitudinal study. *Cyberpsychol. Behav. Soc. Netw.* 18, 228–233. doi: 10.1089/cyber.2014.0385

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. *Am. Educ. Res. J.* 45, 166–183. doi: 10.3102/0002831207312909

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 21 January 2020
doi: 10.3389/fpsyg.2019.03074

# Cyberbullying in the University Setting. Relationship With Emotional Problems and Adaptation to the University

*María Carmen Martínez-Monteagudo[1]*, Beatriz Delgado[1], José Manuel García-Fernández[1] and Cecilia Ruíz-Esteban[2]*

[1] Department of Developmental Psychology and Didactic, Faculty of Education, University of Alicante, Alicante, Spain,
[2] Department of Developmental and Educational Psychology, Faculty of Psychology, University of Murcia, Murcia, Spain

Little scientific attention has been paid to the problem of cyberbullying in the university environment, compared to similar studies conducted on adolescents. This study attempts to analyze the predictive capacity of certain emotional problems (anxiety, depression, and stress) and university adaptation with respect to cyberbullying in victims and aggressors. The European Cyberbullying Intervention Project Questionnaire, the Depression Anxiety Stress Scale-21 and the Student Adaptation to College Questionnaire were administered to a sample of 1282 university students (46.33% male) aged between 18 and 46. The results suggest that high levels of depression and stress increase the probability of being a cyberbullying victim, while high levels of depression increase the probability of being a cyberbullying aggressor. Similarly, the personal–emotional and social adaptation of students are found to be predictor variables of being a cyberbullying victim, in that high levels of personal–emotional and social adaptation decrease the probability of being a victim, while high levels of personal–emotional, academic and institutional adaptation decrease the probability of being a cyberbullying victim. The results of this study are of special relevance, since they indicate that intervention programs should consider the influence of emotional intelligence, as well as the relevance students' adaptation to university.

**Keywords: cyberbullying, anxiety, depression, stress, adaptation to university**

OPEN ACCESS

***Edited by:***
*Jesus de la Fuente, University of Navarra, Spain*

***Reviewed by:***
*Ana Miranda, University of Valencia, Spain*
*Judit García-Martín, University of Salamanca, Spain*

****Correspondence:***
*María Carmen Martínez-Monteagudo*
*maricarmen.martinez@ua.es*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *07 November 2019*
***Accepted:*** *28 December 2019*
***Published:*** *21 January 2020*

***Citation:***
*Martínez-Monteagudo MC, Delgado B, García-Fernández JM and Ruíz-Esteban C (2020) Cyberbullying in the University Setting. Relationship With Emotional Problems and Adaptation to the University. Front. Psychol. 10:3074. doi: 10.3389/fpsyg.2019.03074*

## INTRODUCTION

Currently, an increasing number of studies are examining the issue of cyberbullying in the university environment (Faucher et al., 2014; Zalaquett and Chatters, 2014), revealing that higher education is not free from this phenomenon. Cyberbullying is defined as "willful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices" (Hinduja and Patchin, 2009, p. 5). The widespread use of information and communication technologies, especially by young people, has transformed the way that society accesses information and therefore, how we communicate and interact with others. Clearly, there are benefits to this; however, there are also newly arising problems associated with the inappropriate use of these new technologies. Thus, some of the phenomena that are commonly associated with the school environment such as bullying have found their equivalents in new virtual scenarios or realities. Cyberbullies, who are highly skilled in these new digital scenarios, rely on these technologies to carry out aggressive behavior toward their peers (threats, harassment, bribes,

insults, humiliation, publication of confidential information, identity theft, manipulation of photographs, recording, and dissemination of physical aggressions, etc.).

Many studies have analyzed the phenomenon in adolescence (DeSmet et al., 2015; Ho et al., 2017; Extremera et al., 2018; Quintana et al., 2019), however, lately, high prevalence rates have also been found in the university environment. So, researchers have suggested that prevalence rates of students who are victimized by electronic means during the higher education period may range from 5 to 40% (Finn, 2004; Lindsay and Krysik, 2012; Faucher et al., 2014; Zalaquett and Chatters, 2014). Finn (2004) using a broad sample of 2002 United States university students found that between 10 and 15% reported having received threatening emails or messages, with insults or harassment. Lindsay and Krysik (2012) found higher prevalence rates in a sample of 420 university students, suggesting that 43.3% indicated having suffered from cyberbullying. Faucher et al. (2014) using a sample of 1925 Canadian university students, found that 24.1% reported having been a victim of cyberbullying over the past year. Zalaquett and Chatters (2014) found that 19% of a sample of 613 university students reported having been victims of cyberbullying, whereas 5% reported having been cyberbullying aggressors. The variability in the prevalence rates is quite high, perhaps due to the different conceptualizations of cyberbullying, the distinct methodologies used or the determination of the frequency that is necessary in order to be considered cyberbullying. Despite this variability, empirical evidence confirms the presence of this problem in the university setting.

So, cyberbullying has become a concerning social issue, given its high prevalence and serious repercussions (Kowalski et al., 2012), leading to research intended to identify its potential predictors in an attempt to prevent and intervene in this area. Generally speaking, cyberbullying results from the interaction between the student's personal characteristics and the development contexts in which these characteristics unfold (Benbenishty and Astor, 2005). The university context and the changing life phase of the students during this period have some specific characteristics that differ from other life phases (childhood or adolescence) or educational cycles (primary or secondary education) which may influence cyberbullying and should therefore, be closely considered. The majority of university students are undergoing a new and changing life phase that is referred to as emerging adulthood (Arnett, 2008) in which new behavioral, cognitive and social or affective responses are being developed in response to new environmental demands. The university phase coincides with this new adult role, as it demands the handling of new scenarios that are marked by the separation from parents and friends, the creation of new social circles and the need for increased autonomy and responsibility. So, along with increased academic demands that may mark their future in the labor world, university students also face additional social and emotional challenges. Against this backdrop, many studies have found that a high number of university students face academic or emotional problems (American College Health Association, 2013). Depression, anxiety and stress have been identified in a high percentage of this population (Arrieta et al., 2013; Beiter et al., 2015; Dalky and Gharaibeh, 2018). Arrieta et al. (2013) found that the prevalence of symptoms of anxiety, depression and stress in Colombian university students was 37.4%, 56.6%, and 45.4%, respectively. Beiter et al. (2015), using a sample of 374 United States university students, found that 11%, 15%, and 11% presented severe or extremely severe levels of stress, anxiety and depression, respectively. Dalky and Gharaibeh (2018) reported even higher prevalence rates in their sample of 600 university students. Of these students, 43.2%, 58.2%, and 25.3% displayed severe or extremely severe levels of depression, anxiety and stress, respectively. Psycho-social factors and characteristics of university life (competitive academic environment, excess work, lack of solid peer relationships, pending unemployment, etc.), which are significantly distinct from those of other education levels, are associated with a decrease in student mental health (Misra and McKean, 2000; Kumaraswamy, 2013). On the other hand, regarding the relationship between cyberbullying and emotional problems (anxiety, depression and stress), a considerable number of empirical studies have found high rates of these problems in cyberbullying victims. So, the majority of studies have suggested that these students display high levels of anxiety, depression, stress, low self-concept, powerlessness, somatization, loneliness, anger, sleep disorders, concentration problems low academic performance, and absenteeism (Schenk and Fremouw, 2012; Faucher et al., 2014; Giménez et al., 2015; Na et al., 2015; Aricak and Ozbay, 2016), and even suicidal ideation (Hinduja and Patchin, 2010; Schenk and Fremouw, 2012; Jasso et al., 2018) as a result of being a victim of bullying, humiliation, harassment, etc., while the bullies display externalizing behaviors, low empathy, aggressive behavior, drug abuse and truancy (Hinduja and Patchin, 2007; Aricak, 2009), as well as anxiety, depression, psychosomatic symptoms, and suicide (Nansel et al., 2001, 2003; Seals and Young, 2003). Thus, in the university setting, emotional problems may be found in a high percentage of cases, without necessarily being associated with cyberbullying, although being a cyberbullying victim or aggressor may lead to the development of high levels of anxiety, depression and stress in students, establishing complex relations between these constructs. So, while some students experience high levels of anxiety, depression and stress during this specific academic period of change which makes them more vulnerable to suffering from or engaging in acts of cyberbullying, many of these emotional problems may result from being a victim or aggressor of cyberbullying. This latter assumption has been widely corroborated in the scientific literature (Schenk and Fremouw, 2012; Faucher et al., 2014; Aricak and Ozbay, 2016), especially with respect to the victims. So, anxiety, depression, stress and other emotional problems may be the result of the victimization, but it is also possible that depressed students, having a high level or anxiety or stress, may become victims of intimidation given their inappropriate social behavior, lack of self-esteem or inability to defend themselves due to the depression, anxiety or stress that they are experiencing. Similarly, a depressed student with high levels of anxiety or stress may have a low level of peer acceptance, leading to externalizing behaviors, and thereby turning them into aggressors. So, many studies have shown that the association between school bullying

and internalizing and social problems is reciprocal (Hodges and Perry, 1999; Sweeting et al., 2006); however, there is inconsistency with respect to the direction of causality (Kaltiala-Heino et al., 2010). To conclude, although it has been widely demonstrated that suffering from cyberbullying or being a cyberbully may result in emotional problems, there is limited empirical evidence regarding the relationship between suffering from emotional problems and its predictive capacity for being a cyberbullying victim or aggressor. Similarly, most of these studies have focused on adolescent populations, with few studies considering the university population.

On the other hand, in addition to the student's personal variables, some studies note contextual variables such as those involved in student adaptation to the academic environment. Thus, although adjustment to the university setting has been conceptualized from distinct perspectives, one of the most widely accepted perspectives was established by Baker and Siryk (1984, 1999) and Baker et al. (1985), revealing that university students tend to experience distinct types of adjustment to the university: academic adaptation (fulfilling the university's educational demands and obtaining good results), social adaptation (confronting the interpersonal demands of the university), personal–emotional adaptation (feeling good physically and psychologically), and the institutional link (feeling good about the university in general and having a quality bond with the selected institution). Many studies have suggested that poor adjustment to the university may have considerably negative effects on the student (Friedlander et al., 2007; Credé and Niehorster, 2012). In a meta-analysis, Credé and Niehorster (2012) found that students who do not adapt well to the university present poorer academic performance, fewer probabilities of completing their studies and a greater tendency to seek counseling services and experiencing loneliness, depression and stress. As for the relationship between adjustment to the university and cyberbullying, many studies have shown that suffering from bullying or cyberbullying during past academic phases (primary or secondary education) may predict a poorer university adjustment as well as psychosocial problems. Suresh and Tipandjan (2012) found that students who mentioned having been victims of cyberbullying during primary education displayed academic, interpersonal and self-esteem problems during higher education, while the university students who had suffered from cyberbullying during secondary education and those who had been victims during both earlier educational periods (primary and secondary education) presented interpersonal, family and low self-esteem problems in the university. Along these lines, Jantzer and Cashel (2017) showed that having been a victim of cyberbullying during the secondary education period may predict a poorer social and personal–emotional adjustment to the university. But there are currently few studies analyzing whether or not this adaptation to the university acts as a predictor variable to being a victim or aggressor of cyberbullying. To the best of our knowledge, the study conducted by Souza et al. (2018) is the only relevant work. These authors, using a sample of 979 Brazilian and Portuguese university students, found that newcomer adjustment and student feelings of well-being predict being a cyberbullying victim or aggressor.

This study attempts to remedy this situation by identifying variables that predict the probability of being a victim or aggressor of cyberbullying. If levels of anxiety, depression and stress or university adaptation with its distinct dimensions (academic, social, personal–emotional, and institutional), in fact predict cyberbullying, this would suggest that prevention or intervention methods should be directed specifically at these variables. So, the objective of this study is to analyze the predictive power of anxiety, depression, stress and university adaptation for being a victim or aggressor of cyberbullying in higher education. Considering the limited number of prior studies in this area, we anticipate the following: (a) high levels of anxiety, depression and stress are predictor variables of being a victim or aggressor of cyberbullying; and (b) distinct factors of university adaptation (academic adjustment, social adjustment, personal–emotional adjustment and institutional adjustment) are predictor variables of being victims or aggressors of cyberbullying.

# MATERIALS AND METHODS

## Participants

Spanish university students aged 18–46 ($M$ = 21.65; $SD$ = 4.25) participated in the study. The sample consisted of 1282 university students (46.33% males and 53.67% females) who studied in the Early Childhood Education Master's degree program (24.88%), Primary Education Master's degree program (27.77%), Psychology undergraduate degree program (17.16%), Physical Activity and Sports Science undergraduate degree program (15.83%), and undergraduate degree program in Business Administration and Management (14.36%). The ethnic composition of the sample was as follows: 90.4% Spanish, 5.38% Hispanic-American, 2.97% other Europeans, 0.73% Asian, and 0.52% Arab. Based on the Chi-squared test of distribution homogeneity, it was verified that there were no significant statistic differences between the gender × course year groups ($\chi^2 = 3.85$; $p = 0.312$) (see **Table 1**).

## Measures

### The European Cyberbullying Intervention Project Questionnaire (ECIPQ; Del Rey et al., 2015)

The Spanish version of the European Cyberbullying Intervention Project Questionnaire (ECIPQ; Del Rey et al., 2015) was used to identify the victims and aggressors of cyberbullying in higher education. The questionnaire, consisting of 22 items, assessed two factors: Cybervictimization (11 items) and Cyberaggression (11 items) responded to using a Likert-like scale of 1–5 (1 = never; 2 = once or twice; 3 = once or twice a month; 4 = once a week; 5 = more than once a week). Students were to note to what extent they have suffered from situations of victimization or have perpetrated said situations of victimization using electronic means over the past 2 months (exclusion or dissemination of rumors, receiving or making insults, identity theft, being excluded and ignored or the manipulation of images). The questionnaire has suitable rates of internal consistency

**TABLE 1 |** Distribution of the sample by sex and degree.

| | Early childhood education | Primary education | Psychology | Physical activity and sports science | Business administration and management | Total |
|---|---|---|---|---|---|---|
| Males | 92 | 136 | 76 | 161 | 129 | 594 |
| Females | 227 | 220 | 144 | 42 | 55 | 688 |
| Total | 319 | 356 | 220 | 203 | 184 | 1282 |

(Casas et al., 2013). In this study, the Cybervictimization and Cyberaggression subscale obtained suitable reliability indices (Cronbach's alpha equal to 0.86 for Cybervictimization and 0.76 for Cyberaggression).

### Depression, Anxiety Stress Scale-21 (DASS-21; Bados et al., 2005)

The Depression Anxiety Stress Scale-21 (DASS-21) is a reduced version of the Lovibond and Lovibond (1995) scale used for the assessment of depression, anxiety, and stress. Thus, the DASS-21, with a total of 21 items, considers three factors: Anxiety, Depression and Stress. The Depression subscale assessed the dysphoria, hopelessness, sadness, anhedonia, depreciation of life, self-contempt and lack of interest or involvement. The Anxiety subscale assesses aspects related to psycho-physiological activation or autonomous excitation (sweating hands, tremor, etc.), and subjective experiences of anxiety. Finally, the Stress subscale assesses the difficulty in being relaxed, nervous excitation, agitation, irritability, and impatience. This test has a satisfactory convergent validity and suitable discriminant validity (Lovibond and Lovibond, 1995; Crawford and Henry, 2003). Reliability, assessed using Cronbach's alpha, was found to be acceptable for the three scales (Lovibond and Lovibond, 1995; Bados et al., 2005). In this study, the reliability indices were adequate, having Cronbach's alphas of 0.87, 0.90, and 0.86 for the factors of Anxiety, Depression and Stress, respectively.

### Student Adaptation to College Questionnaire (SACQ; Baker and Siryk, 1999)

Student adjustment was measured using the Spanish version of the SACQ (Rodríguez et al., 2012). The SACQ is a questionnaire consisting of 67 items that are responded to on a Likert-like scale of 9 points, from 1 (does not apply to me at all) to 9 (applies very strongly to me). This questionnaire assessed how the students adjusted to the university based on four dimensions: Academic Adjustment, Social Adjustment, Personal–Emotional Adjustment, and Institutional Attachment. The Academic Adjustment dimension assesses how the students faced the educational demands, considering aspects such as motivation to complete the academic requirements, academic effort and satisfaction with the academic environment (e.g., "I am up to date on the works that I am asked to complete"). The Social Adjustment dimension assesses student success with respect to interpersonal and social demands of the university environment (e.g., "In the university, I am meeting people and making friends"). The Personal–Emotional Adjustment dimension assesses the psychological state of the student and the level of general psychological anguish (e.g., "It is difficult for me to handle the stress produced by the university"). Finally, the Institutional Adjustment dimension assesses the student satisfaction with the universal experience in general, and the quality of the relationship between the student and the institution (e.g., "I am thinking about definitively quitting the university"). High scores in the distinct dimensions indicate a better student adjustment. The Spanish validation of the questionnaire received suitable internal consistency indices (Academic Adjustment $\alpha = 0.90$; Social Adjustment $\alpha = 0.85$; Personal–Emotional Adjustment $\alpha = 0.89$; and Institutional Adjustment $\alpha = 0.85$). In this study, the four subscales were found to have suitable reliability, with Cronbach values equaling 0.86 (Academic Adjustment), 0.79 (Social Adjustment), 0.86 (Personal–Emotional Adjustment), and 0.89 (Institutional Adjustment).

## Procedure

Individualized interviews were conducted with the directors of the university departments, in order to determine the study plan and to request their collaboration. The assessment instruments were administered collectively in the classrooms, highlighting the voluntary nature of the student participation and the confidentiality of the data. The mean administration time for the questionnaires was 10 min for the ECIPQ, 10 min for the DASS-21 and 15 min for the SACQ. The administration of questionnaires was carried out during the 2017–2018 academic year. The ethics committee of the University of Alicante granted the informed consent for the study to be conducted. The ethical principles of the Helsinki Declaration were considered with respect to research with human beings.

## Statistical Analyses

First, the prevalence rates were calculated for cybervictims and cyberaggressors from the total sample. To do so, victims and aggressors were considered from those obtaining scores that were higher than the mean score plus a standard deviation for the Cybervictimization and Cyberaggression factor, respectively. To examine the predictive or classificatory capacity of anxiety, depression, stress, and university adaptation on cyberbullying, a binary logistic regression analysis was conducted following the forward stepwise regression procedure based on the Wald test. The logistic model permits the estimation of the probability of an occurrence of an event or result (e.g., being a cyberbully) in the presence of one or more predictors (e.g., university adaptation). This probability is estimated using the so-called odds ratio (OR) statistic. If the OR is higher than one indicates that the increase of the independent variable leads to an increase in the probability of the occurrence of the event. On the other hand, an OR value lower than one indicates that an increase in the independent variable leads to a decrease of the probability of occurrence of

the event (De Maris, 2003). The variables (victims and aggressor) were dichotomized as a function of percentiles 25 and 75, with the objective of identifying the low or high presence of the construct. The proportion of cases correctly classified by the logistic models calculated ranged between 81.4% (depression and stress) and 81.8% (personal–emotional adjustment and social adjustment) in the sample of victims, and between 80.3% (depression) and 80.5% (personal–emotional adjustment, academic adjustment, and institutional adjustment) in the sample of aggressor.

## Ethics Statement

All standards for research with human subjects were respected, in accordance with the ethical principles of the Helsinki Declaration (World Medical Association, 2013) and the Ethics Committee of the University of Alicante.

# RESULTS

## Prevalence of Cybervictimization and Cyberaggression

Results indicate that 7% ($n$ = 89) of the sample mentioned having been the victim of cyberbullying over the past 2 months, whereas 7.7% ($n$ = 98) mentioned having been aggressor over the past 2 months.

## Prediction of Being a Victim or Aggressor of Cyberbullying With Respect to Anxiety, Depression, Stress and University Adaptation

Regarding the prediction of being victim or aggressor of cyberbullying with respect to anxiety, depression and stress, the OR indicate that the probability of being a victim of cyberbullying increases 14 and 9% for each point increase on the Depression and Stress scale, respectively. As for the prediction of being a cyberbullying aggressor, the OR of the logistic model indicates that students have an 8% higher probability of being a cyberbullying aggressor for each point increase in the Depression scale (see **Table 2** and **Figure 1**).

On the other hand, regarding to university adaptation, the OR showed that the probability of being a victim of cyberbullying decreased a 13 and 16% per unit increase in the Personal–Emotional Adjustment and Social Adjustment scale, respectively, while the probability of being an aggressor of cyberbullying decreased a 16%, 11%, and 9% for each point increase in the Personal–Emotional Adjustment, Academic Adjustment, and Institutional Adjustment scale, respectively (see **Table 3** and **Figure 2**).

**TABLE 2 |** Logistic regression for the probability of being a cyberbullying victim or aggressor based on level of anxiety, depression and stress.

| | *B* | S.E. | Wald | *p* | OR | CI 95% |
|---|---|---|---|---|---|---|
| **Victim** | | | | | | |
| Depression | 0.13 | 0.02 | 38.82 | <0.001 | 1.14 | 1.09–1.18 |
| Stress | 0.08 | 0.02 | 12.06 | <0.001 | 1.09 | 1.036–1.137 |
| Constant | −1.94 | 0.11 | 314.86 | <0.001 | 0.14 | |
| **Aggressor** | | | | | | |
| Depression | 0.08 | 0.03 | 9.52 | <0.001 | 1.08 | 1.03–1.139 |
| Constant | −2.13 | 0.13 | 271.28 | <0.001 | 0.12 | |

*B, coefficient; S.E., standard error; p, probability; OR, odds ratio; C.I., confidence interval at 95%.*

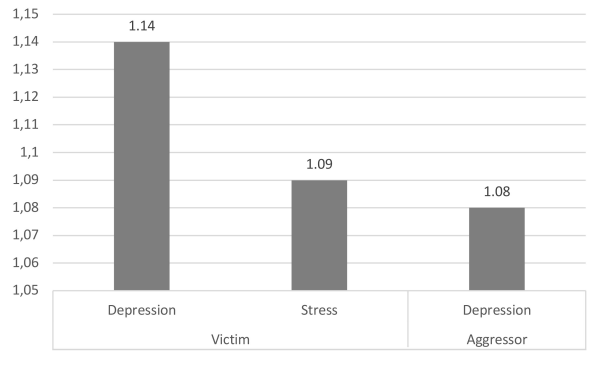


**FIGURE 1 |** Probability of being a cyberbullying victim or aggressor based on level of anxiety, depression and stress.

# DISCUSSION

The goal of the present study was to verify the predictive capacity of anxiety, depression, stress and university adaptation with respect to being a victim or aggressor of cyberbullying during higher education. Cyberbullying is an ever more prevalent social problem in developed countries and has devastating consequences for all who are involved. Therefore, numerous studies have attempted to analyze this phenomenon, particularly during the period of adolescence (DeSmet et al., 2015; Ho et al., 2017). However, despite the high prevalence that has been determined (Finn, 2004; Lindsay and Krysik, 2012; Faucher et al., 2014; Zalaquett and Chatters, 2014), few studies have used the university population in their research. Higher education students, facing a significant period of changes, as well as the specific characteristics of the university cycle, present a series of elements that substantially differ from those of other students. So, this study attempts to make up for the limited number of studies considering these students, so as to obtain objective data that permits a greater knowledge of the phenomenon, in hopes of potential prevention or intervention measures.

The results of this study indicate that a percentage of university students (7%) referred to having been cyberbullying victims, with this percentage being higher in the case of aggressors, with 7.7% confessing to having been cyberbullies. These prevalence rates for both victims and aggressors coincide with that found in prior empirical studies (Finn, 2004; Zalaquett and Chatters, 2014). On the other hand, data has revealed that some emotional problematics are predictor variables of being a cyberbullying victim or aggressor. Specifically, high depression and stress rates predicts a higher probability of being a victim of cyberbullying, whereas the probability of being

**TABLE 3 |** Logistic regression for the probability of being a cyberbullying victim or aggressor based on adaptation to the university.

| | *B* | S.E. | Wald | *p* | OR | CI 95% |
|---|---|---|---|---|---|---|
| **Victim** | | | | | | |
| Personal–emotional adjustment | −0.02 | 0.03 | 43.95 | <0.001 | 0.87 | 0.83–0.95 |
| Social adjustment | −0.22 | 0.05 | 23.30 | <0.001 | 0.84 | 0.81–0.92 |
| Constant | 0.22 | 0.26 | 0.73 | <0.001 | 1.25 | |
| **Aggressor** | | | | | | |
| Personal–emotional adjustment | −0.02 | 0.07 | 5.18 | <0.001 | 0.84 | 0.80–1.10 |
| Academic adjustment | −0.03 | 0.04 | 58.26 | <0.001 | 0.89 | 0.86–1.12 |
| Institutional adjustment | 0.52 | 0.01 | 23.72 | <0.001 | 0.91 | 0.88–0.99 |
| Constant | −3.80 | 0.61 | 0.39 | <0.001 | 0.68 | |

*B, coefficient; S.E., standard error; p, probability; OR, odds ratio; C.I., confidence interval at 95%.*

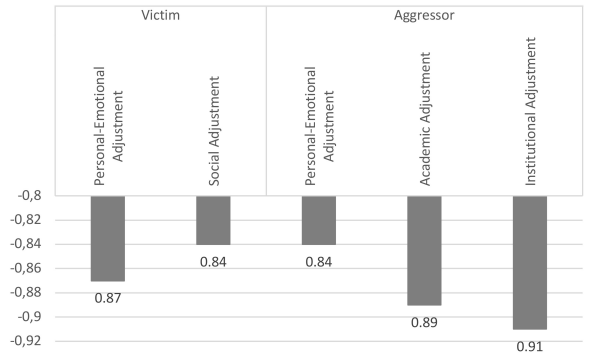


**FIGURE 2 |** Probability of being a cyberbullying victim or aggressor based on adaptation to the university.

a cyberbully increases when students have higher depression rates, supporting hypothesis 1 of this study. Unfortunately, few studies have analyzed whether these high rates are the result of predictive variables of cyberbullying in the university setting, making the comparison of results found in this study quite complex. However, it is clear that the specific characteristics of this changing period may predict emotional problems in the overall university population (Arrieta et al., 2013; Beiter et al., 2015; Dalky and Gharaibeh, 2018). However, in this study, it is also revealed that these problematics increase the probability of being the victim or aggressor of cyberbullying, making them relevant variables when attempting to prevent or intervene in cyberbullying cases. Thus, depression predicts both the probability of being an aggressor as well as of being a victim. Depression affects the student's social skills and self-confidence, leading to difficulties in establishing satisfactory contacts with peers, potentially leading to externalizing behaviors in aggressors. Vlachou et al. (2011) affirm that aggressive and dominating behavior in bullies come from feelings of unhappiness, dissatisfaction with life, depression and high levels of anger or rage. On the other hand, depressed individuals may experiment social isolation, a sense of meaningless, interpersonal problems and a negative self-image, making him/her more vulnerable. These difficulties and imbalances, together with other circumstances, may result in the student being more vulnerable to suffering from cyberbullying in the university setting due to this increased level of depression. Along these lines, Kaltiala-Heino et al. (2010) found that the relationship between depression and school bullying was bi-directional, such that depression acted as a predictor of bullying and bullying was a predictor of depression. Similar results were reported by Reijntjes et al. (2010), who concluded that there was indeed a bi-directional relationship between victimization and internalization problems, whereby being a victim of bullying predicted future emotional problems, while at the same time, depression, anxiety, anguish, insecurity or low self-esteem all predisposed the student to becoming a victim. Likewise, the stress produced in an educational environment is higher in the university setting, due to its greater demands (Putwain, 2007) placing these students at an emotional and social disadvantage and, thereby making them more vulnerable to cyberbullying.

On the other hand, this study has shown how certain university adjustment factors are predictive variables for being a victim or aggressor of cyberbullying, supporting hypothesis 2. Specifically, personal–emotional adjustment, and social adjustment are found to be predictor variables of being a victim of cyberbullying, with a greater personal–emotional and social adjustment decreasing the probability of being a victim. These results are coherent with previous studies that have found that student victims of cyberbullying have internalizing problems (anger/rage, discomfort, stress, worrying, fear, loneliness, helplessness, depression, shame, and indifference, etc.) (Schenk and Fremouw, 2012; Faucher et al., 2014; Giménez et al., 2015; Na et al., 2015; Aricak and Ozbay, 2016). It also supports studies that have suggested that these personal and emotional problems may lead to an increased risk of victimization (Garaigordobil and Oñederra, 2010; Reijntjes et al., 2010; Martínez-Monteagudo et al., 2019a), as well as the results of the first part of this study. As for social adjustment, many studies have suggested that victims display poor social adjustment (difficulties making friends, poor peer relationships, lack of social skills) as compared to non-victims (Kowalski et al., 2012). Therefore, the data from this study suggests that good personal–emotional and social adjustment acts as a protective factor for becoming a victim of mockery, humiliation or harassment through the digital media.

On the other hand, Personal–Emotional, Academic and Institutional Adjustment have been found to be predictor variables for being a cyberbully in the university setting, with the probability of being a bully decreasing as the levels of these adjustments increase. Although the lack of similar studies hinders a comparison of these results, the data agrees with that from prior studies that confirm the poor personal–emotional, academic and institutional adjustment of cyberbullies (Friedlander et al., 2007; Credé and Niehorster, 2012). So, with respect to personal–emotional adjustment, distinct studies have shown that having suitable personal and emotional skills is generally considered to be a protective factor from the

appearance of problematic behaviors such as school bullying or cyberbullying (Garaigordobil and Oñederra, 2010; Elipe et al., 2015; Martínez-Monteagudo et al., 2019a). Emotional skills help students to feel a greater level of empathy toward their classmates, which may significantly reduce their involvement in intimidating behavior; however, one of the characteristics that is typically mentioned by cyberbullies is a low level of empathy with victims, since they do not appear to demonstrate unrest or guilt as a result of their aggressions, being unable to empathize with the victim's emotions or feelings (Hinduja and Patchin, 2007; Aricak, 2009). On the other hand, bullies tend to display poor academic performance, with low integration in academic and scholastic dynamics (Egeberg et al., 2016). So, having a positive academic adjustment (motivation for completing academic requirements, making an effort academically and satisfaction with the academic environment) acts as a protective factor against engaging in aggressive behavior toward peers. As for Institutional Adjustment, referring to student satisfaction with the overall university experience and the quality of the relationship between the student and the institution, this is also a protective factor against becoming a cyberbully. Therefore, student satisfaction with the institutional climate of his/her university is a relevant factor to consider when attempting to prevent or intervene in cyberbullying. Universities differ, among other aspects, in their organizational structure, their co-habitation rules and in the type of relationships that are established between students and the rest of the educational community. So, while some universities have positive and integrating climates in which few students feel excluded from the teaching-learning process and feel like they belong to the institution, other universities have more negative climates in which it is more likely for situations of bullying to arise amongst students (Souza et al., 2018). Clearly, in the university adaptation process, the student's personal characteristics play a fundamental role, but the characteristics of the institution are also clearly important.

Likewise, we believe that future studies should attempt to determine which factors could help to better understand cyberbullying. Thus, for example, the analysis of other variables, such as social support (Worsley et al., 2019), the impulsivity or other features of self-regulation (Kokkinos et al., 2014), aggressiveness (Martínez-Monteagudo et al., 2019a), sexual orientation (Wensley and Campbell, 2012), coping styles (Hu et al., 2018), emotional intelligence or family environment (Martínez-Monteagudo et al., 2019b) can help to better understand this problem. Therefore, intervention strategies should also attempt to increase the levels of these protective factors in order to decrease the levels of risk factors associated with cyberbullying.

## Limitations and Practical Implications

Finally, this study has certain limitations including its cross-sectional nature, preventing the establishment of causality. Therefore, future studies of a longitudinal nature should be carried out. Furthermore, the assessment of the variables through only self-reporting measures may lead to biases, so other methods should also be included, such as peer assessments, evaluations by professors or observational methods. Similarly, students have been classified as victims versus non-victims, and aggressors versus non-aggressors. A latent class analysis would be necessary to provide a more thorough scenario of the cyberbullying problem. Likewise, it would be interesting to analyze whether cyberbullying, emotional intelligence and adaptation to the university acts in the same way in the different university degrees, and according to the sex of the students. Finally, it should be noted that the few studies that have been carried out with university samples make results comparison difficult. Despite these limitations, this study offers valuable information for professionals, parents, students and policy and educational institutions, which may be used to create specific prevention and intervention programs in response to cyberbullying in the university setting, thereby helping to reduce the associated negative consequences. The results of this study have some major practical implications. On the one hand, it highlights the prevalence rates of cyberbullying in the university setting, bringing light to a topic that remains to be studied by science. The numerous findings in adolescents cannot be extrapolated to the university setting, due the characteristics of the latter and the changing nature of those that are involved. So, more empirical evidence is necessary to establish specific prevention and intervention programs that are adjusted to this scenario. On the other hand, the results highlight the need to identify the university students' emotional problems, as well as their capacity to adapt to the institution, since this study shows how high depression and stress rates, in addition to having negative consequences on the student's academic, social and emotional adjustment, also act as predictive factors of cyberbullying. So, screening systems are necessary to permit the identification of those students whose high levels of emotional alterations in order to act preventatively against cyberbullying. These psychoeducational programs emphasize procedures such as cognitive restructuring, relaxation, conflict resolution, and effective communication (Dacre and Qualter, 2012; Dalky and Gharaibeh, 2018). Also, future studies may determine why certain students who also have high levels of emotional problems are less susceptible to being victims or aggressors of cyberbullying. So, for example, the social support network, self-concept or family relationships may act as a damper for cyberbullying. So, the intervention strategies should focus on strengthening these protective factors and weakening the risk factors related to cyberbullying.

On the other hand, universities should implement educational policies that permit the suitable adjustment to the university context in order to also prevent this problem. Institutional programs should provide a safe environment of well-being for the students that permits them not only to develop suitably academically, but also personally and emotionally. The institutional prevention policies should promote active student participation against cyberbullying, establishing programs on prevention and awareness of responsible Internet use, establishing activities to develop socio-emotional and pro-social skills, promoting social awareness, the ability to resolve conflicts and coping strategies that permit them to handle distinct situations, as well as feelings of belonging and a connection to the university community.

Although cyberbullying causes major imbalances in all educational stages, perhaps in the university environment students are more unprotected (see Myers and Cowie, 2019, for a review). Cyberbullying in the university context has differentiating characteristics of the school environment that can make difficult to detect and intervene in it. The university victims of cyberbullying have reached the age of majority, beginning with their adult stage. Given this new scenario, society expects that the necessary coping resources will be available in the face of adverse situations. However, such strategies are not achieved solely because of the transition from the stage of secondary to university education. In this way, victims may not report that they are mocked, intimidated, blackmailed, etc. because they might be ashamed of not being able to solve such situations, associating this fact with a lack of maturity (Orel et al., 2017). Added to this idea, the legal implications that cyberbullying might entail are present, as they are victims and stalkers who have reached the age of majority (Myers and Cowie, 2019). Likewise, observers express less empathy and less sensitivity to the anguish of their peers in this educational stage. It is therefore necessary to improve the systems and advice to students to help them; establishing comprehensive systems in which the professionals involved are trained to deal with this problem (Myers and Cowie, 2019). Thus, researchers and specialists need to continue collaborating to design interventions and methods that allow granting useful tools for future generations to safely surf the internet.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the University of Alicante. The parent or legal guardians of all participants gave written informed consent in accordance with the Declaration of Helsinki (World Medical Association, 2013).

## AUTHOR CONTRIBUTIONS

MM-M conceived the study, participated in its design, coordination, and the statistical analyses, and drafted the manuscript. BD participated in the design of the study and data interpretation, and assisted in drafting the manuscript. JG-F assisted with the study conception and participated in the statistical analyses. All authors read and approved the final manuscript. CR-E performed a critical review of the manuscript and assisted with interpretation of the findings.

## REFERENCES


American College Health Association (2013). *American College Health Association-National College Health Assessment II: Reference Group Executive Summary Fall 2012*. Hanover, MD: American College Health Association.

Aricak, O. T. (2009). Psychiatric symptomatology as a predictor of cyberbullying among university students. *Eurasian J. Educ. Res.* 34, 167–184.

Aricak, O. T., and Ozbay, A. (2016). Investigation of the relationship between cyberbullying, cybervictimization, alexithymia and anger expression styles among adolescents. *Comput. Hum. Behav.* 55, 278–285. doi: 10.1016/j.chb.2015.09.015

Arnett, J. J. (2008). *Adolescencia y Adultez Emergente: Un Enfoque Cultural [Adolescence and Emerging Adulthood: A Cultural Approach]*. México: Pearson Prentice Hall.

Arrieta, K., Díaz, S., and González, F. (2013). Síntomas de depresión, ansiedad y estrés en estudiantes de odontología: prevalencia y factores relacionados [Symptoms of depression, anxiety and stress among dental students: prevalence and related factors]. *Rev. Colomb. de Psiquiatr.* 42, 173–181. doi: 10.1016/s0034-7450(13)70004-0

Bados, A., Solanas, A., and Andrés, R. (2005). Psychometric properties of the spanish version of depression, anxiety and stress scales (DASS). *Psicothema* 17, 679–683.

Baker, R. W., McNeil, O. V., and Siryk, B. (1985). Expectation and reality in freshman adjustment to college. *J. Couns. Psychol.* 32, 94–103. doi: 10.1037/0022-0167.32.1.94

Baker, R. W., and Siryk, B. (1984). Measuring adjustment to college. *J. Couns. Psychol.* 31, 179–189. doi: 10.1037/0022-0167.31.2.179

Baker, R. W., and Siryk, B. (1999). *SACQ: Student Adaptation to College Questionnaire Manual*. Los Angeles, CA: Western Psychological Services.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi: 10.1016/j.jad.2014.10.054

Benbenishty, R., and Astor, R. A. (2005). *School Violence in Context: Culture, Neighborhood, Family, School, and Gender*. New York, NY: Oxford University Press.

Casas, J. A., Del Rey, R., and Ortega-Ruiz, R. (2013). Bullying and cyberbullying: convergent and divergent predictor variables. *Comput. Hum. Behav.* 29, 580–587. doi: 10.1016/j.chb.2012.11.015

Crawford, J. R., and Henry, J. D. (2003). The depression anxiety stress scales (DASS): normative data and latent structure in a large non-clinical sample. *Br. J. Clin. Psychol.* 42, 111–131. doi: 10.1348/014466503321903544

Credé, M., and Niehorster, S. (2012). Adjustment to college as measured by the Student adaptation to college questionnaire: a quantitative review of its structure and relationships with correlates and consequences. *Educ. Psychol. Rev.* 24, 133–165. doi: 10.1007/s10648-011-9184-5

Dacre, L., and Qualter, P. (2012). Improving emotional intelligence and emotional self-efficacy through a teaching intervention for university students. *Learn. Individ. Differ.* 22, 306–312. doi: 10.4040/jkan.2018.48.6.708

Dalky, H. F., and Gharaibeh, A. (2018). Depression, anxiety, and stress among college students in Jordan and their need for mental health services. *Nurs. Forum* 54, 205–212. doi: 10.1111/nuf.12316

De Maris, A. (2003). "Logistic regression," in *Research Methods in Psychology*, eds J. A. Schinka, and W. F. Velicer, (New York, NY: John Wiley and Sons), 509–532.

Del Rey, R., Casas, J. A., Ortega-Ruiz, R., Schultze, A., Scheithauer, H., Smith, P., et al. (2015). Structural validation and cross-cultural robustness of the European cyberbullying intervention project questionnaire. *Comput. Hum. Behav.* 50, 141–147. doi: 10.1016/j.chb.2015.03.065

DeSmet, A., Aelterman, N., Bastiaensens, S., Cleemput, K. V., Poels, K., Vandebosch, H., et al. (2015). Secondary school educators' perceptions and practices in handling cyberbullying among adolescents: a cluster analysis. *Comput. Educ.* 88, 192–201. doi: 10.1016/j.compedu.2015.05.006

Egeberg, G., Thorvaldsen, S., and Ronning, J. A. (2016). "The impact of cyberbullying and cyber harassment on academic achievement," in *Digital Expectations and Experiences in Education*, ed. E. Elstad, (Netherlands: Sense Publishers), 183–204. doi: 10.1007/978-94-6300-648-4_11

Elipe, P., Moran-Merchán, J. A., Ortega-Ruíz, R., and Casas, J. A. (2015). Perceived emotional intelligence as a moderator variable between cybervictimization and its emotional impact. *Front. Psychol.* 6:486. doi: 10.3389/fpsyg.2015.00486

Extremera, N., Quintana, C., Mérida, S., and Rey, L. (2018). Cyberbullying victimization, self-esteem and suicidal ideation in adolescence: does emotional

intelligence play a buffering role? *Front. Psychol.* 9:367. doi: 10.3389/fpsyg.2018.00367

Faucher, C., Jackson, M., and Cassidy, W. (2014). Cyberbullying among university students: gendered experiences, impacts, and perspectives. *Educ. Res. Int.* 2014:698545. doi: 10.1155/2014/698545

Finn, J. (2004). A survey of online harassment at a university campus. *J. Interpers. Violence* 19, 468–481. doi: 10.1177/0886260503262083

Friedlander, L. J., Reid, G. J., Shupak, N., and Cribbie, R. (2007). Social support, self-esteem, and stress as predictors of adjustment to university among first-year undergraduates. *J. Coll. Stud. Dev.* 48, 259–274. doi: 10.1353/csd.2007.0024

Garaigordobil, M., and Oñederra, J. A. (2010). *La Violencia Entre Iguales: Revisión Teórica y Estrategias de Intervención [Peer Violence: Theoretical Review and Intervention Strategies]*. Madrid: Pirámide.

Giménez, A. M., Hunter, S. C., Durkin, K., Arnaiz, P., and Maquillón, J. J. (2015). The emotional impact of cyberbullying: differences in perceptions and experiences as function of role. *Comput. Educ.* 82, 228–235. doi: 10.1016/j.compedu.2014.11.013

Hinduja, S., and Patchin, J. (2007). Offline consequences of online victimization. *J. Sch. Violence* 6, 89–112. doi: 10.1300/J202v06n03_06

Hinduja, S., and Patchin, J. W. (2009). *Bullying Beyond the Schoolyard: Preventing and Responding to Cyberbullying*. Thousand Oaks, CA: Corwin Press.

Hinduja, S., and Patchin, J. W. (2010). Bullying, cyberbullying, and suicide. *Arch. Suicide Res.* 14, 206–221. doi: 10.1080/13811118.2010.494133

Ho, S. S., Chen, L., and Ng, A. (2017). Comparing cyberbullying perpetration on social media between primary and secondary school students. *Comput. Educ.* 109, 74–84. doi: 10.1016/j.compedu.2017.02.004

Hodges, E., and Perry, D. (1999). Personal and interpersonal antecedents and consequences of victimization by peers. *J. Pers. Soc. Psychol.* 76, 677–685. doi: 10.1177/0143034312445244

Hu, Q., Bernardo, A. B. I., Lam, S., and Cheang, P. K. (2018). Individualism-collectivism orientations and coping styles of cyberbullying victims in Chinese culture. *Curr. Psychol.* 37, 65–72. doi: 10.1007/s12144-016-9490-7

Jantzer, A. M., and Cashel, M. L. (2017). Bullying victimization, college adjustment and the role of coping. *J. Coll. Stud. Dev.* 58, 283–289. doi: 10.1353/csd.2017.0020

Jasso, J. L., López, F., and Gámez, M. (2018). Assessing the links of sexting, cybervictimization, depression, and suicidal ideation among university students. *Arch. Suicide Res.* 22, 153–164. doi: 10.1080/13811118.2017.1304304

Kaltiala-Heino, R., Fröjd, S., and Marttumen, M. (2010). Involvement in bullying and depression in a 2-year follow-up in middle adolescence. *Eur. Child Adol. Psych.* 19, 45–55. doi: 10.1007/s00787-009-0039-32

Kokkinos, C. M., Antoniadou, N., and Markos, A. (2014). Cyber-bullying: an investigation of the psychological pro- file of university student participants. *J. Appl. Dev. Psychol.* 35, 204–214. doi: 10.1080/02673843

Kowalski, R. M., Limber, S. P., and Agatston, P. W. (2012). *Cyberbullying: Bullying in the Digital Age*, 2nd Edn, Malden, MA: Wiley-Blackwell.

Kumaraswamy, N. (2013). Academic stress, anxiety and depression among college students- a brief review. *Int. Rev. Soc. Sci. Hum.* 5, 135–143.

Lindsay, M., and Krysik, J. (2012). Online harassment among college students: a replication incorporating new Internet trends. *Inf. Commun. Soc.* 15, 703–719. doi: 10.1080/1369118X.2012.674959

Lovibond, S., and Lovibond, P. (1995). *Manual for the Depression Anxiety Stress Scales*. Sydney: Psychology Foundation.

Martínez-Monteagudo, M. C., Delgado, B., García-Fernández, J. M., and Rubio, E. (2019a). Cyberbullying, aggressiveness, and emotional intelligence in adolescence. *Int. J. Environ. Res. Public Health* 16:5079. doi: 10.3390/ijerph16245079

Martínez-Monteagudo, M. C., Delgado, B., Inglés, C. J., and García-Fernández, J. M. (2019b). Cyberbullying in the university setting. Relationship with family environment and emotional intelligence. *Comput. Hum. Behav.* 91, 220–225. doi: 10.1016/j.chb.2018.10.002

Misra, R., and McKean, M. (2000). College student's academic stress and its relation to their anxiety, time management, and leisure satisfaction. *Am. J. Health Stud.* 16, 41–51.

Myers, C., and Cowie, H. (2019). Cyberbullying across the lifespan of education: issues and interventions from school to university. *Int. J. Environ. Res. Public Health* 16:1217. doi: 10.3390/ijerph16071217

Na, H., Dancy, B. L., and Park, C. (2015). College student engaging in cyberbullying victimization: cognitive appraisals, coping strategies, and psychological adjustments. *Arch. Psychiat. Nurs.* 29, 155–161. doi: 10.1016/j.apnu.2015.01.008

Nansel, T., Overpeck, M., Haynie, D., Ruan, J., and Scheidt, P. (2003). Relationships between bullying and violence among US youth. *Arch. Pediatr. Adolesc. Med.* 157, 348–353. doi: 10.1001/archpedi.157.4.348

Nansel, T., Overpeck, M., Pilla, R., Ruan, W., Simons-Mortin, B., and Scheidt, P. (2001). Bullying behaviours among US youth: prevalence and association with poor adjustment. *JAMA* 285, 2094–2100.

Orel, A., Campbell, M., Wozencroft, E., and Kimpton, M. (2017). Exploring university students' coping strategy intentions for cyberbullying. *J. Interpers. Violence* 32, 446–462. doi: 10.1177/0886260515586363

Putwain, D. (2007). Researching academic stress and anxiety in students: some methodological considerations. *Br. Educ. Res. J.* 33, 207–219. doi: 10.1080/01411920701208258

Quintana, C., Rey, L., and Worthing, E. L. (2019). The relationship between forgiveness, bullying, and cyberbullying in adolescence: a systematic review. *Trauma Violence Abuse* 21:1524838019869098. doi: 10.1177/1524838019869098

Reijntjes, A., Kamphuis, J. H., Prinzie, P., and Telch, M. J. (2010). Peer victimization and internalizing problems in children: a meta-analysis of longitudinal studies. *Child Abuse Negl.* 34, 244–252. doi: 10.1016/j.chiabu.2009.07.009

Rodríguez, M. S., Tinajero, C., Guisande, M. A., and Páramo, M. F. (2012). The student adaptation to college questionnaire (SACQ) for use with Spanish students. *Psychol. Rep.* 111, 624–640. doi: 10.2466/08.10.20.pr0.111.5.624-640

Schenk, A. M., and Fremouw, W. J. (2012). Prevalence, psychological impact, and coping of cyberbully victims among college students. *J. Sch. Violence* 11, 21–37. doi: 10.1080/15388220.2011.630310

Seals, D., and Young, J. (2003). Bullying and victimization: prevalence and relationship to gender, grade level, ethnicity, self-esteem, and depression. *Adolescence* 38, 735–747.

Souza, S. B., Veiga, A. M., Ferreira, A. I., and Costa, P. (2018). University students' perceptions of campus climate, cyberbullying and cultural issues: implications for theory and practice. *Stud. High Educ.* 4, 2072–2087. doi: 10.1080/03075079.2017.1307818

Suresh, S., and Tipandjan, A. (2012). School bullying victimization and college adjustment. *J. Ind. Acad. Appl. Psychol.* 38, 68–73.

Sweeting, H., Young, R., West, P., and DerNo, G. (2006). Peer victimization and depression in early-mid adolescence: a longitudinal study. *Br. J. Educ. Psychol.* 76, 577–594. doi: 10.1348/000709905X49890

Vlachou, M., Andreou, E., Botsoglou, K., and Didaskalou, E. (2011). Bully/victim problems among preschool children: a review of current research evidence. *Educ. Psychol. Rev.* 23, 329–358. doi: 10.1007/s10648-011-9153-z

Wensley, K., and Campbell, M. A. (2012). Heterosexual and nonheterosexual young university students' involvement in traditional and cyber forms of bullying. *Cyberpsychol. Behav. Soc. Netw.* 15, 649–654. doi: 10.1089/cyber.2012.0132

World Medical Association (2013). *Declaration of Helsinki. Ethical Principles for Medical Research in Humans*. Ferney-Voltaire: World Medical Association.

Worsley, J. D., McIntyre, J. C., and Rhiannon, C. (2019). Cyberbullying victimisation and mental distress: testing the moderating role of attachment security, social support, and coping styles. *Emot. Behav. Diff.* 24, 20–35. doi: 10.1080/13632752.2018.1530497

Zalaquett, C. P., and Chatters, S. J. (2014). Cyberbullying in college: frequency, characteristics, and practical implications. *Sage Open* 4, 1–8. doi: 10.1177/2158244014526721

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 31 January 2020
doi: 10.3389/fpsyg.2020.00022

# Effects of Levels of Self-Regulation and Regulatory Teaching on Strategies for Coping With Academic Stress in Undergraduate Students

*Jesús de la Fuente[1,2]*, Jorge Amate[3], María Carmen González-Torres[2], Raquel Artuch[4], Juan Manuel García-Torrecillas[5,6,7] and Salvatore Fadda[8]*

*[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] School of Psychology, University of Almería, Almería, Spain, [3] Provincial Educational Authority, Almería, Spain, [4] School of Education, International University of La Rioja, Logroño, Spain, [5] Research Unit, Torrecardenas Hospital, Almería, Spain, [6] Instituto de Investigación Biosanitaria ibs, Granada, Spain, [7] Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública, Madrid, Spain, [8] Prevention Service, University of Sassari, Sassari, Italy*

OPEN ACCESS

**Edited by:**
*Lawrence Jun Zhang, University of Auckland, New Zealand*

**Reviewed by:**
*Norzarina Mohd-Zaharim, University of Science Malaysia, Malaysia*
*Dušana Šakan, Faculty of Legal and Business Studies Dr Lazar Vrtakiæ, Serbia*

***Correspondence:**
*Jesús de la Fuente*
*jdlfuente@unav.es*

**Specialty section:**
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

**Received:** *30 August 2019*
**Accepted:** *07 January 2020*
**Published:** *31 January 2020*

**Citation:**
*de la Fuente J, Amate J, González-Torres MC, Artuch R, García-Torrecillas JM and Fadda S (2020) Effects of Levels of Self-Regulation and Regulatory Teaching on Strategies for Coping With Academic Stress in Undergraduate Students. Front. Psychol. 11:22. doi: 10.3389/fpsyg.2020.00022*

The *SRL vs. ERL Theory*$^{TM}$ predicts that regulation-related factors in the student and in the context combine to determine the student's levels in emotional variables, stress, and coping strategies. The objective of the present research was to test this prediction in the aspect of coping strategies. Our hypothesis posed that students' level of self-regulation (low–medium–high), in combination with the level of regulation promoted in teaching (low–medium–high), would determine the type of strategies students used to cope with academic stress; the interaction of these levels would focus coping strategies either toward emotions or toward the problem. A total of 944 university students completed validated questionnaires on self-regulation, regulatory teaching, and coping strategies, using an online tool. ANOVAs and MANOVAs (3 × 1; 3 × 3; 5 × 1) were carried out, in a quasi-experimental design by selection. Level of self-regulation and level of regulatory teaching both had a significant effect on the type of coping strategies used. The most important finding was that the combined level of self-regulation and external regulation, on a five-level scale or heuristic, predicted the type of coping strategies that were used. In conclusion, the fact that this combination can predict type of coping strategies used by the student lends empirical support to the initial theory. Implications for the teaching–learning process at university and for students' emotional health are discussed.

**Keywords: SRL vs. ERL theory, academic stress, coping strategies, university, students**

## INTRODUCTION

The study of students' emotional experiences in the teaching and learning context has yielded much research on aspects previously unconsidered by the cognitivist paradigm (Linnenbrink-Garcia and Pekrun, 2011; Goetz et al., 2014; Lüftenegger et al., 2016; Murayama et al., 2017; Duffy et al., 2018; Gentsch et al., 2018; Loderer et al., 2018; Collie et al., 2019; Harley et al., 2019; Hirvonena et al., 2019). In the present study, our effort has focused on explaining the degree to which emotional

processes facilitate or interfere in cognitive processes (Rusk et al., 2011; Moffa et al., 2016; Putwain, 2018).

## Academic Stress at University

In the university context, due to the difficulty of meeting the demands and requirements of study, the experience of stress is an important phenomenon that has captured research interest (Martín et al., 2003; Cabanach et al., 2007; Willcoxson et al., 2011; D'Mello, 2013; Pidgeon and Pickett, 2017; Scharp and Dorrance, 2017). Research on *academic stress* in this context, from the perspective of Clinical and Health Psychology, has prioritized individual predictive or explanatory factors, with particular focus on differentiating factors like personality variables, anxiety, or cognitive differences (Palmer and Rodger, 2009; Saklofske et al., 2012; Dicke et al., 2018; Cassady et al., 2019). From an Educational Psychology perspective, however, it seems reasonable to approach the study of stress as a contextualized phenomenon within the teaching-learning process (Mainhard et al., 2018). On one hand, the learning process can by accompanied by the experience of stress and by the use of resources for managing stress (coping strategies), depending on characteristics of the individual (Shaw et al., 2017; Rapillard et al., 2019). On the other hand, the context, or teaching process, can give rise to stressful experiences and to the use of stress management methods (Frenzel et al., 2018; Gentsch et al., 2018; Collie et al., 2019). The present research report adopts an interactive student-teacher approach to academic stress, analyzing stress that arises from the interaction of the student's learning process with characteristics of the teaching process.

## Coping Strategies as a Variable of the Teaching and Learning Process

Coping strategies are a psychological construction referring to knowledge, skills and strategic behaviors that people use to manage emotions occurring within a situation of stress (Fimian et al., 1989; Chartier et al., 2011; Freire et al., 2018); for this reason, they are considered meta-emotional skills (de la Fuente et al., 2017a). Multiple models have been proposed for categorizing these skills, beginning with the initial model proposed by Lazarus and Folkman (1984/1986) and Lazarus (1999). In essence, two types of strategies have been described: (1) those that seek to minimize negative emotional states, i.e., *emotion-focused strategies;* and (2) those that address the cause of the stressful experience or of overtaxed personal resources, i.e., *problem-focused strategies*. In the initial research it was assumed that stress was associated only with negative emotionality; however, the reformulated versions of the theoretical model assumed that it was possible to combine mixed coping strategies (Folkman, 1997, 2008, 2011).

### Coping Strategies in the Learning Process

Prior research on motivational and affective factors of learning in university contexts has also recognized the importance of the different types of coping strategies used by university students. Some examples have addressed the role of religious coping (Francis et al., 2018), the role of health habits as a coping strategy (Tada, 2017), how coping strategies related to well-being (Park and Adler, 2003; Bhullar et al., 2014; Freire et al., 2016), types of coping and their relationship to resilience, academic coping within a religious vs. secular context (González-Torres and Artuch, 2014). The associations between coping strategies, anxiety and engagement-burnout have also been established (de la Fuente et al., 2015a).

### Coping Strategies in the Teaching Process

Some prior research has analyzed *coping strategies* from the teacher's standpoint: their methods of coping (Gustems-Carnicer et al., 2019), and their levels of stress (Browers and Tomic, 2000; Alson, 2019). From a complementary viewpoint, teacher effectiveness at university has been measured in terms of students' well-being and good teacher-student relations (Lekwa et al., 2018; Aldrupa et al., 2019). Evidence has also shown the influence of teachers' personality characteristics in effective teaching (Kim et al., 2019).

### Combined Effect of Teaching and Learning Process Variables on Coping Strategies

However, the effect of this combination on types of coping strategies used by university students, as a consequence of the teaching and learning process, has not been sufficiently established (de la Fuente et al., 2016, 2017b). The present research, therefore, focuses on how combined levels of *Student Self-Regulation* (SR) (learning process) and *Teaching Effectiveness* (teaching process) determine types of coping strategies in students. This research report is part of a series of complementary papers that present evidence of the combined effects of these two types of variables on students' emotional variables (de la Fuente et al., 2019).

## SRL vs. ERL Theory as a Research Heuristic in the Teaching and Learning Process

The theory of *Self- vs. Externally- Regulated Learning* is founded conceptually on the assumptions below (see de la Fuente, 2017). It is a further development of the concept of self-regulated learning from B. J. Zimmerman's model (Zimmerman, 2001, 2008; Zimmerman and Labuhn, 2012) and of Vermunt's concept of self-regulation and external regulation (Vermunt, 1998, 2005; Vermunt and Vermetten, 2004; Vermunt et al., 2014; Vermunt and Donche, 2017). The theoretical model of SRL vs. ERL defines different types of regulation along a behavioral continuum. This continuum is useful for analyzing the *teaching and learning process*:

(1) With regard to the *learning process*, the model defines three levels of student regulation in a learning situation:
*Self-Regulation* represents a *high degree of self-regulation* or *positive proactivity*, that is, active and adequate regulation of one's own behavior (level 3 of SR).
*Non-Regulation* (NR) refers to a lack of proactivity or *a medium level of self-regulation*. This is the conceptual equivalent of *reactivity* (level 2 of SR).

*Dysregulation* (DR) is negative proactivity or a *low level of self-regulation.* The individual actively manages his or her own behavior toward inadequate purposes (level 1 of SR).

In summary, level of SR, as a personal characteristic of the student, predisposes an equivalent level of self-regulated learning (Zimmerman, 2001, 2008; Zimmerman and Labuhn, 2012).

(2) With regard to the *teaching process,* this model defines several levels of regulatory teaching (RT), or levels of teaching effectiveness. The present model is more explicit than Zimmerman's SRL model (Zimmerman, 2001, 2008; Zimmerman and Labuhn, 2012), since it specifically defines the value of each level of teaching effectiveness for predisposing self-regulated learning, an aspect not clearly defined in the previous model.

*Externally Regulatory (ER) teaching* or *highly effective teaching*. In this context, the teaching prompts students toward well-directed proactivity and SR. This type of teaching context provides many external indicators that increase the likelihood of self-regulated behavior (before, during and after) (Level 3 RT).

*Externally Non-regulatory* (ENR) *teaching* or *moderately effective teaching.* Whether at the beginning, middle or end of learning acts, there are no external indicators or promptings that encourage self-regulated or dysregulated behavior, or that increase the likelihood of one or the other. A non-regulatory context requires the student to engage in a moderate level of self-regulated behavior, given that contextual elements offer no direction (Level 2 RT).

*Externally Dys-Regulatory* (EDR) *teaching* or *ineffective teaching*. Dysregulation, that is, inadequate or negative proactivity, is actively promoted in this context. The individual who wishes to practice self-regulated learning in this type of context must make a great effort (Level 1 RT).

(3) Effects of the *combined levels of self-regulation and external regulation* can be predicted. Human learning takes its shape when the individual's self-regulating ability (SR) and the external regulatory features of the context (ER) are combined. Five types of interactions are possible (de la Fuente et al., 2019). According to this principle, coping strategies are predisposed by mediating factors, both internal (self-regulation, SR: levels 1–3) and external (external regulation, ER: levels 1–3). This theoretical model requires that *subject x context* interactions be specified, addressing an insufficiency of the initial theoretical model of Self-Regulated Learning (Zimmerman, 2001, 2008; Zimmerman and Labuhn, 2012).

## Aims and Hypothesis

Based on the models and previous empirical data, the following objectives were identified: (1) to establish whether the university students' personal regulation levels and the regulatory levels of their context, independently of each other, determined the type of coping strategies used; (2) to establish whether the combined levels of SR and RT, as described in the interactivity model proposed above, were associated with the type of coping strategies used. Based on these objectives, the *hypothesis* established that a *graded increase in level of regulation* (internal and external) would give rise to (1) a proportionate decrease in emotion-focused strategies, and (2) a proportionate increase in problem-focused coping strategies. By contrast, a *graded decrease in level of regulation* (internal and external) would give rise to (1) a proportionate increase in emotion-focused strategies, and (2) a proportionate decrease in problem-focused coping strategies.

# MATERIALS AND METHODS

## Participants

To establish interdependence relations among low-medium-high levels of SR, and RT, we used a total sample of 944 undergraduate students from two universities of Spain. The sample was composed of students enrolled in Psychology, Primary Education, and Early Childhood Education degrees; 82.7% were women and 17.3% were men. Their ages ranged from 19 to 45, with a mean age of 22.25 ($\sigma_X$ = 6.3) years. Of the total sample, 28.3% were first-year students, 40.3% were in second year, 14.5% in third year, and 16.5% were in the fourth year of the degree program.

## Instruments

### Self-Regulation

This variable was measured using the *Short Self-Regulation Questionnaire (SSRQ)* (Miller and Brown, 1991). Previously validated in Spanish samples (Pichardo et al., 2014, 2018), it possesses acceptable validity and reliability values, similar to the English version. The original SRQ (Brown et al., 1999) evaluates subjects' SR of behavior, understood as the ability to plan and manage their own behavior in a flexible way, according to the desired outcomes. Although the questionnaire has been adapted to educational contexts, it was initially designed within the field of addictive behaviors. The authors, using squared multiple correlation coefficients, carried out an initial design of 63 items (26 reverse) that constituted 7 scales: (1) informational input, which refers to a person's ability to obtain information on their current state from their environment; (2) self-evaluation, where this information is compared to personal goals, rules and expectations; (3) instigation to change, the person's perception of any existing discrepancies between their current state and their desired state; (4) search for ways to reduce discrepancies; (5) planning for change, that is, strategies or actions for carrying out the change process; (6) implementation of the change strategies; and (7) evaluation of progress toward a goal. The English version of the instrument has mainly been used with university students. Different studies have analyzed the SRQ's psychometric properties, establishing several factorial solutions. Carey et al. (2004), using a sample of 391 American undergraduate students between the ages of 17 and 24, established a one-factor solution composed of 31 items, which led the authors to propose a new measure: the Short SRQ (SSRQ). Correlation between the two versions was strong ($r$ = 0.96), suggesting that the short version is a good alternative to the full scale.

The *Short SRQ* is composed of four factors (goal setting-planning, perseverance, decision making and learning from

mistakes) and 17 items (all of them with saturations greater than 0.40); the confirmatory factor structure is consistent ($\chi^2 = 250.83$, $df = 112$, CFI = 0.90, GFI = 0.92, AGFI = 0.90, RMSEA = 0.05). *Internal consistency* was acceptable for the total of questionnaire items ($\alpha = 0.86$) and for the factors of goal setting-planning ($\alpha = 0.79$; six items), decision making ($\alpha = 0.72$; three items) learning from mistakes ($\alpha = 0.72$; five items), and perseverance ($\alpha = 0.73$; three items). *Correlations* have been studied between each item and its factor total, between the factors, and between each factor and the complete questionnaire, with good results for all, except for the decision-making factor, which showed a weaker correlation with other factors (range: 0.41–0.58). Correlations of the long and short Spanish versions (long SRQ with 32 items and short SRQ with 17 items), to the original long questionnaire, are better for the short version (short Spanish to long English questionnaire: $r = 0.85$ and short Spanish to long Spanish: $r = 0.94$; $p < 0.01$) than for the long Spanish version (long Spanish to long English: $r = 0.79$; $p < 0.01$). For more information, please, see: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01919/full#supplementary-material.

### Regulatory Teaching (Teaching Effectiveness)

The *Scales for Assessment of the Teaching-Learning Process, ATLP, student version* (de la Fuente et al., 2012) were used to evaluate students' perception of the teaching process. The scale entitled *Regulatory Teaching* is Dimension 1 of the confirmatory model. ATLP-D1 comprises 29 items structured along five factors: Specific RT, regulatory assessment, preparation for learning, satisfaction with the teaching, and general RT. The scale was validated in university students (de la Fuente et al., 2012) and showed a factor structure with adequate fit indices ($\chi^2 = 590.626$; $df = 48$, $p < 0.001$, CF1 = 0.938, TLI = 0.939, NFI = 0.950, NNFI = 0.967; RMSEA = 0.068) and adequate internal consistency (ATLP D1: $\alpha = 0.83$; Specific RT, $\alpha = 0.897$; regulatory assessment, $\alpha = 0.883$; preparation for learning, $\alpha = 0.849$; satisfaction with the teaching, $\alpha = 0.883$ and general RT, $\alpha = 0.883$). The ATLP is a self-report instrument to be completed by the teacher and the students, available in Spanish and English versions. It also includes a qualitative part where students can make recommendations for improving each of the processes evaluated. As for external validity, results are also consistent, since there are different interdependent relationships among perceptions of variables that exist in an academic environment. For more information, please, see: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01919/full#supplementary-material.

### Coping Strategies

The *Coping Strategies Scale,* EEC (Chorot and Sandín, 1987) was used, in a short validated Spanish version, EEC-Short (de la Fuente, 2014). Although the original instrument contained 90 items, the validation produced a first-order structure of 64 items and a second order with 10 factors and two dimensions, both of them significant, with adequate fit values in the latter [$\chi^2 = 878{,}75$; $df(77\text{-}34) = 43$, $p < 0.001$; NFI = 0.901; RFI = 0.945; IFI = 0.903; TLI = 0.951; CFI = 0.903, RMSEA = 0.07]. Reliability measures are Cronbach alpha of 0.93 (complete scale), 0.93 (first half) and 0.90 (second half), Spearman–Brown of 0.84 and Guttman of 0.80. The scale assesses two dimensions: D1: Emotion-focused coping (0.95) and D2: Problem-focused coping (0.91). The emotion-focused strategies were: F1. Avoidant distraction (0.79); F7. Reducing anxiety and avoidance (0.88); F8. Preparing for the worst (0.80); F9. Emotional venting and isolation (0.91); and F11. Resigned acceptance (0.86). The problem-focused strategies were: F2. Seeking help and counsel (0.92); F5. Self-instructions (0.82); F10. Positive reappraisal and firmness (0.87); F12. Communicating feelings and social support (0.89); and F13. Seeking alternative reinforcement (0.80). See **Table 1**.

## Procedure

Participants voluntarily completed the scales using an online *platform* (de la Fuente et al., 2015b). A total of ten specific teaching-learning processes were evaluated, covering different university subjects that were taught within a 2-year period. Based on Biggs' 3P model (Biggs, 2001), *Presage* variables (SR) were assessed in September-October of 2017 and 2018; *Process* variables (Coping Strategies) and *Product* variables (RT) were assessed in May-June of 2017 and 2018. The students self-reported on: (1) self-regulation characteristics (SR) at the beginning of the academic year; (2) coping strategies (CS) and RT at the end of the course. Each group of students only evaluated one teaching-learning process. The procedure was approved by the respective Ethics Committees of each university, in the context of two R&D Projects (2018–2021).

## Data Analysis

### Effects of Regulation Levels

Through cluster analysis, continuous independent variables were transformed into discrete dependent variables with three

**TABLE 1 |** Types of coping strategies and examples of items in the short EEC version.

| ***Emotion-focused coping* (D1)** | ***Example of items*** |
|---|---|
| F1. Avoidant distraction | I get away and forget the problem temporarily (change of environment) |
| F7. Reducing anxiety and avoidance | I practice some kind of sport in order to reduce my anxiety or tension |
| F8. Preparing for the worst | I prepare myself for the worst |
| F9. Emotional venting and isolation | I act irritable and aggressive toward others |
| F11. Resigned acceptance | I accept the problem as it is, since I cannot do anything about it |
| ***Problem-focused coping* (D2)** | |
| F2. Seeking help and counsel | I talk with people I know who can do something to solve my problem |
| F5. Self-instructions | I set out a plan of action and try to carry it out |
| F10. Positive re-appraisal and firmness | I try to see positive aspects of the situation |
| F12. Comunicating feelings and social support | I feel better if I explain my problem to friends or family members |
| F13. Seeking alternative reinforcement | I start new activities (studies, etc.) |

levels (low-medium-high). Using an *ex post*-facto design, a 3 K-means cluster analysis was first conducted to establish low-medium-high groups in the two variables: Personal SR and RT. For the SR variable, values of Low = 2.70; Medium = 3.48; High = 4.20 formed the centers of the clusters, and ranges were as follows: low, 1.00–3.09; medium, 3.10–3.84; and high, 3.85–5.00. For the RT variable, Low = 2.72; Medium = 3.58; High = 4.34 formed the centers of the clusters, and ranges were: Low, 1.00–2.34; Medium, 2.35–2.83; and High, 2.84–5.00. In addition, several ANOVAs and MANOVAs were carried out, in order to ascertain the effect of low-medium-high levels on the dependent variable, coping strategies. Also, using a 3-factor design (low-medium-high SR levels) × 3 (low-medium-high levels of RT), several MANOVAs were conducted, taking these levels as independent variables. Finally, based on the low–medium–high groups in both variables (SR and RT), five combinations were configured, according to the proposed theoretical model (see **Table 2**). MANOVAs were conducted to establish statistical suitability of these groupings, as well as the effects on the defined dependent variables, with Pillai's trace and Sheffé test index.

### A Combination Typology for Understanding Coping Strategies

The multivariate analyses (MANOVAs) showed a statistically significant main effect of the five combination types of low-medium-high levels of SR and RT (see de la Fuente et al., 2019, p.12, and **Table 2**):

*Combination 1* presented a statistically significant low level in *SR* and low level in *RT (1 and 1)*. The **average of regulation levels is 1.0**, and the **rank** is **1**. The regulation range is low SR and low RT, associated with a *low level of self-regulation* or *high level of dysregulation*. Consequently, the effects are a *high level of emotion-focused coping strategies and a low level of problem-focused coping strategies.*

*Combination 2* had a statistically significant low level in *SR* and medium level in *RT,* or vice versa *(2 and 1, or 1 and 2).* The **average of regulation levels is 1.5,** and the **rank** is **2.** The regulation range is low-medium SR and low-medium RT, and vice versa, associated with a *medium-low level of self-regulation or medium-high level of dys-regulation*. Consequently, the effects are a *medium-high level of emotion-focused coping strategies and medium-low levels of problem-focused coping strategies.*

*Combination 3* presented a statistically significant medium SR level and medium RT level *(2 and 2)*. The **average of regulation levels is 2.0,** and the **rank** is **3**. The regulation range is medium SR and medium RT, associated with a *medium level of self-regulation or dys-regulation*. Consequently, the effects are a *medium level of emotion-focused coping strategies* and *medium level of problem-focused coping strategies.*

*Combination 4* had a statistically significant medium SR with high RT or high SR with medium RT (*2 and 3,* or *3 and 2*). The **average of regulation levels is 2.5**, and the **rank** is **4.** The regulation range is high SR-medium RT, or medium SR-high RT, associated with a medium-high level of *self-regulation* or medium-low level of *dys-regulation*. Consequently, the effects are a *medium-low level of emotion-focused coping strategies and medium-high level of problem-focused coping strategies.*

*Combination 5* presented a statistically significant high SR and high RT *(3 and 3).* The **average of regulation levels is 3.0**, and the **rank** is **5.** The regulation range is high SR-high RT, associated with a *high level* of *self-regulation* and low level of *dys-regulation*. Consequently, the effects are a *low level of emotion-focused coping strategies* and *high level of problem-focused coping strategies.*

## RESULTS

## Interdependent Simple Effects of Levels of Personal Self-Regulation (SR) and Levels of Regulatory Teaching (RT) on Stress Coping Strategies

### Effect of Self-Regulation on Stress Coping Strategies

A statistically significant effect was noted of the *IV SR* (low-medium levels) on total *Coping Strategies.* The statistically significant partial effect of the *IV SR* (low-medium-high levels) was maintained for the two dimensions of *Emotion-focused Coping Strategies* and *Problem-focused Coping Strategies,* the latter showing greater statistical significance.

A statistically significant main effect of the *IV SR* (low-medium-high levels) was noted on the factors of *Emotion-focused Coping Strategies.* Also, the statistically significant partial

**TABLE 2 |** Combinations between parameters of the model hypothesized in SRL vs. ERL Theory: the *Utility Model*™ (de la Fuente et al., 2019, p. 12).

| *Combination Levels* | | *Regulation mean/rank* | *Regulation Range* | *Emotions Stress* | | | *Coping Facors* and *Effect* | *Strateg.** |
|---|---|---|---|---|---|---|---|---|
| **SR Level (range)** | **RT Level (range)** | | | > | = | < | | |
| **3** (3.85 – 5.00) **H** | **3** (2.84 – 5.00) **H** | 3.0/**5** | **High-High:** *High Regulation* | ++ | | − | *Low* | *+Pr/−Em* |
| **2** (3.10 – 3.84) **M** | **3** (2.84 – 5.00) **H** | 2.5/**4** | **Medium-High**: *Regulation* | + | | − | *M-L* | *+Pr/−Em* |
| **3** (3.85 – 5.00) **H** | **2** (2.35 – 2.83) **M** | 2.5/**4** | **High-Medium**: *Regulation* | + | | − | *M-L* | *+Pr/−Em* |
| **2** (3.10 – 3.84) **M** | **2** (2.35 – 2.83) **M** | 2.0/**3** | **Medium:** *Non-regulation* | + | | − | *M* | *=Pr/ = Em* |
| **2**(3.10 – 3.84) **M** | **1** (1.00 – 2.34) **L** | 1.5/**2** | **Medium-Low**: *Dysregulation* | − | = | + | *M-H* | *+Em/−Pr* |
| **1** (1.00 – 3.09) **L** | **2** (2.35 – 2.83) **M** | 1.5/**2** | **Low-Medium**: *Dysregulation* | − | | + | *M-H* | *+Em/−Pr* |
| **1** (1.00 – 3.09) **L** | **1** (1.00 – 2.34) **L** | 1.0/**1** | **Low-Low:** *High Dysregulation* | − − | | + | *High* | *+Em/−Pr* |

*H, High; M, Medium; L, Low; Emotions: + (positives) vs. − (negatives). *Dependent Variable in this study: Coping Strategies: Pr, Problem-focused Coping; Em, Emotion-focused Coping.*

effect of the *IV SR* (low-medium-high levels) was maintained for *F1* (Avoidant distraction), *F7* (Reducing anxiety and avoidance), *F8 (*Preparing for the worst), with greater statistical significance for factors *F9* (Emotional venting and isolation) and *F11* (Resigned acceptance), for university students with lower levels of SR. Complementarily, a statistically significant main effect of the *IV SR* (low–medium–high levels), was noted on the factors of *Problem-focused Coping Strategies*. Also, the statistically significant partial effect of the *IV SR* (low-medium-high levels) was maintained for *F2* (Seeking help), *F5* (Self-Instructions), *F10* (Positive re-appraisal and firmness), *F12* (Communicating feelings and social support), *F13* (Seeking alternative reinforcement). See **Table 3**.

### Effects of Regulatory Teaching on Stress Coping Strategies

There was a statistically significant effect of the *IV RT* (low–medium–high levels) on *total* Coping Strategies. The statistically significant partial effect of the *IV RT (low–medium levels)* was maintained in the dimensions of *Coping Strategies*. There was a statistically significant partial effect of the *IV SR* (low–medium–high levels) for the two dimensions of *Emotion-focused Coping* and *Problem-focused Coping Strategies,* the latter again showing greater statistical effect.

A statistically significant main effect of the *IV RT* (low–medium–high levels) was noted on the factors of *Emotion-focused Coping Strategies*. Also, the statistically significant partial effect of the *IV RT* (low-medium-high levels) was maintained for *F1* (Avoidant distraction), *F7* (Reducing anxiety and avoidance), *F8* (Preparing for the worst), *F11* (Resigned acceptance) and especially, in the use of strategy *F9* (Emotional venting and isolation) for low levels of RT. Complementarily, a statistically significant main effect of the *IV RT* (low–medium–high levels) was noted in the factors of *Problem-focused Coping Strategies*. Also, the statistically significant partial effect of the *IV SR* (low–medium–high levels) was maintained for *F2* (Seeking help), *F12* (Communicating feelings and social support), *F13* (Seeking alternative reinforcement), and with greater statistical significance for the factors *F5* (Self-instructions) and *F10* (Positive re-appraisal and firmness) for high levels of external regulation (RT). See **Table 3**.

## Interdependent Complex Effects (3 × 3) of the Levels of Self-Regulation (SR) With Levels of Regulatory Teaching (RT) on Stress Coping Strategies

### Effect on Total Coping Strategies and Dimensions

The *IV SR* (low–medium–high levels) did not show any significant effect in total *Coping Strategies,* but it did produce a statistically significant main effect on the dimensions or factors of coping stress. The statistically significant partial effect of the *IV SR* (low–medium–high levels) was maintained for the two dimensions of *Emotion-focused Coping Strategies* and *Problem-focused Coping Strategies*.

A statistically significant effect of the *IV RT* (low-medium-high levels) was noted in *total* Coping Strategies. The statistically significant partial effect of *IV RT* (low–medium levels) was maintained in the *dimensions* of *Coping Strategies*. The statistically significant partial effect of the *IV RT* (low–medium–high levels) was maintained for the two dimensions of *Emotion-focused Coping Strategies* and *Problem-focused Coping Strategies*.

### Effect on Specific Factors of Emotion-Focused Coping Strategies

The *IV SR* (low-medium-high levels) was observed to have a statistically significant main effect on the *Factors of Emotion-focused Coping Strategies.* A statistically significant effect appeared of the *IV RT* (low-medium levels) on the *Factors of Emotion-focused Coping Strategies.* There was no statistically significant effect of the interaction SR × RT.

The statistically significant partial effect of the *IV SR* (low–medium–high levels) was maintained for *F1* (Avoidant distraction), *F7* (Reducing anxiety), *F8* (Preparing for the worst), *F9* (Emotional venting and isolation), and *F11* (Resigned acceptance), where the last three factors have greater statistical significance, for students with a lower level of SR. Complementarily, a statistically significant partial effect of the *IV RT* (low–medium–high levels) was maintained for *F1* (Avoidant distraction), *F7* (Reducing anxiety), *F8* (Preparing for the worst), *F9* (Emotional venting and isolation), and *F11* (Resigned acceptance), the last two factors having greater statistical significance, for students with a lower level of RT. There were no significant interaction effects of SR × RT for coping factors in Emotion-focused Coping Strategies. See **Table 4**.

### Effect on Specific Factors of Problem-Focused Coping Strategies

A statistically significant main effect of the *IV SR* (low–medium–high levels) was noted on the *Factors of Problem-focused Coping Strategies.* There was a statistically significant effect of the *IV RT* (low-medium-high levels) on the *Factors of Problem-focused Coping Strategies.* There was no significant effect of the SR × RT interaction.

The statistically significant partial effect of the *IV SR* (low–medium–high levels) was maintained for *F2* (Seeking help*)*, *F5* (Self-Instructions), *F10* (Positive re-appraisal), *F12* (Communicating feelings and social support), and *F13* (Alternative reinforcement). Complementarily, a statistically significant partial effect of the *IV RT* (low-medium-high levels) was maintained for *F2* (Seeking help), *F5* (Self-Instructions), *F10* (Positive re-appraisal), *F12* (Communicating feelings and social support), and *F13* (Alternative reinforcement). There were no significant interactions of SR × RT for coping factors in the Emotion-focused Coping Strategies. See **Table 4** and **Figures 1**, **2**.

## Combination Typology for Understanding Stress Coping Strategies

### Preliminary Analysis

The MANOVA showed statistically significant differences in the levels of SR and RT variables among the five groups, showing them to be adequately configured according to what is established in **Table 4**. See the statistical effects in the **Table 5**.

**TABLE 3 |** Interdependence relations between low–medium–high levels of *Self-Regulation (SR)* and *Regulatory Teaching (RT)* as independent variables, in strategies for coping with stress.

| ***DVs*** | ***Self-Regulation (SR)*** | | | | ***Effects*** |
|---|---|---|---|---|---|
| | ***1. Low*** | ***2.Medium*** | ***3. High*** | ***Average*** | |
| | **(*n* = 240)** | **(*n* = 429)** | **(*n* = 275)** | **(*n* = 944)** | |
| Coping Strategies | | | | | |
| *Total* | 2.66 (0.28) | 2.66 (0.26) | 2.71 (0.28)* | 2.67 (0.27) | $F$ (2, 941) = 3.265 (Pillai's), $p < 0.05$; $n^2 = 0.007$, pw = 0.622 |
| *Dimensions* | | | | | $F$(4,1882) = 40.770 (Pillai's), $p < 0.00l$, $n^2 = 0.080$, pw = 1.0 |
| D1. Emotion-focused | 2.51 (0.34)* | 2.43 (0.30) | 2.37 (0.32) | 2.43 (0.32) | $F$(2,941) = 12.892, $p < 0.001$, $n^2 = 0.026$, 1 > 2 > 3 |
| D2. Problem-focused | 2.80 (0.34) | 2.89 (0.31) | 3.00 (0.33)* | 2.92 (0.75) | $F$(2,941) = 38.765, $p < 0.001$, $n^2 = 0.076$, 1 < 2 < 3* |
| *Emotion-focused strategies (factors)* | | | | | $F$(10,1858) = 21.011 (Pillai's), $p < 0.001$, n2 = 0.107 |
| F1. Avoidant distraction | 2.33 (0.51)* | 2.27 (0.48) | 2.20 (0.51) | 2.26 (0.50) | $F$(2,1056) = 4.431, $p < 0.01$, $n^2 = 0.008$; 1 > 3 |
| F7. Reducing anxiety | 3.11 (0.64)* | 3.05 (0.59) | 2.91 (0.69) | 3.02 (0.64) | $F$(2,1056) = 7.954, $p < 0.001$, $n^2 = 0.015$, 1 > 2 > 3 |
| F8. Preparing for the worst | 2.83 (0.47)* | 2.66 (0.46) | 2.56 (0.46) | 2.67 (0.47) | $F$(2,1056) = 24.302, $p < 0.001$, $n^2 = 0.044$; 1 > 2 > 3 |
| F9. Emotional venting | 2.09 (0.48)* | 1.90 (0.42) | 1.68 (0.37) | 2.67 (0.47) | $F$(2,1056) = 68.259, $p < 0.001$, $n^2 = 0.114$; 1 > 2 > 3* |
| F11. Resigned acceptance | 2.29 (0.56)* | 2.05 (0.47) | 1.78 (0.48) | 2.04 (0.53) | $F$(2,1056) = 74.507, $p < 0.001$, $n^2 = 0.124$; 1 > 2 > 3* |
| *Problem-focused strategies (factors)* | | | | | $F$(10,2132) = 19391 (Pillai's), $p < 0.001$, $n^2 = 0.125$ |
| F2. Seeking help | 2.80 (0.73) | 2.95 (0.65) | 3.05 (0.66)* | 2.87 (0.86) | $F$(2,1069) = 9,713 (Pillai's), $p < 0.001$, $n^2 = 0.018$; 3 > 2 > 1 |
| F5. Self-Instructions | 2.86 (0.44) | 3.05 (0.88) | 3.07 (0.43) | 3.29 (0.39)* | $F$(2,1069) = 86.880, $p < 0.001$, $n^2 = 0.125$; 3 > 2 > 1* |
| F10. Positive re-appraisal | 2.77 (0.49) | 3.06 (0.42) | 3.05 (0.73) | 3.39 (0.39)* | $F$(2,1069) = 144.769, $p < 0.001$, $n^2 = 0.213$; 3 > 2 > 1* |
| F12. Communicating feelings | 2.90 (0.79) | 3.05 (0.71) | 3.17 (0.70)* | 2.57 (0.94) | $F$(2,1069) = 9.706, $p < 0.001$, $n^2 = 018$; 3 > 2 > 1 |
| F13. Alternative reinforcement | 2.79 (0.40) | 2.81 (0.41) | 2.93 (0.45)* | 2.84 (0.43) | $F$(2,1069) = 9.486, $p < 0.001$, $n^2 = 0.017$; 3 > 2,1 |
| ***DVs*** | ***Regulatory Teaching (RT)*** | | | | |
| | ***1. Low*** | ***2. Medium*** | ***3. High*** | ***average*** | |
| | **(*n* = 159)** | **(*n* = 390)** | **(*n* = 293)** | **(*n* = 842)** | |
| ***Coping Strategies*** | | | | | |
| *Total* | 2.60 (0.28) | 2.63 (0.25) | 2.74 (0.28)* | 2.66 (0.78) | $F$(2,893) = 18.665 (Pillai's), $p < 0.001$, $n^2 = 0.043$; 3 > 2,1 |
| *Dimensions* | | | | | $F$(4,1882) = 40.770 (Pillai's), $p < 0.001$, $n^2 = 0.080$ |
| D1. Emotion-focused | 2.39 (0.33)* | 2.41 (0.30) | 2.47 (34) | 2.43 (0.32) | $F$(2,941) = 12.892 (Pillai's), $p < 0.001$, $n^2 = 0.027$, 1 > 2 > 3 |
| D2. Problem-focused | 2.81 (0.50) | 2.85 (0.32) | 3.01 (0.25)* | 2.90 (0.33) | $F$(2,941) = 38.765, $p < 0.001$, $n^2 = 0.076$; 3 > 2 > 1* |
| *Emotion-focused strategies (factors)* | | | | | $F$(10,1858) = 4.628 (Pillai's), $p < 0.001$, $n^2 = 0.036$ |
| F1. Avoidant distraction | 2.17 (0.49) | 2.26 (0.47) | 230 (0.52)* | 2.26 (0.49) | $F$(2,952) = 3.805 (Pillai's), $p < 0.05$, $n^2 = 0.008$; 3 > 1 |
| F7. Reducing anxiety | 3.00 (0.65) | 2.96 (0.58) | 3.11 (0.71)* | 3.02 (0.64) | $F$(2,952) = 4.161, $p < 0.001$, $n^2 = 0.016$, 1,2 < 3 |
| F8. Preparing for the worst | 2.61 (0.49) | 2.67 (0.46) | 2.71 (0.48) | 2.67 (0.47) | $F$(2,952) = 1.919, $p < 0.147$ ns, $n^2 = 0.004$ |
| F9. Emotional venting | 1.92 (0.44) | 1.92 (0.45) | 1.82 (0.45)* | 1.89 (0.45) | $F$(2,952) = 5.697, $p < 0.001$, $n^2 = 0.012$; 1,2 > 3* |
| F11. Resigned acceptance | 2.06 (0.56) | 2.08 (0.51) | 2.00 (0.51) | 2.05 (0.52) | $F$(2,952) = 2.258, $p < 0.08$, $n^2 = 0.005$ |
| *Problem-focused strategies (factors)* | | | | | $F$(10,1858) = 4.628 (Pillai's), $n^2 < 0.001$, $n^2 = 0.036$ |
| F2. Seeking help | 2.76 (0.72) | 2.87 (0.65) | 3.09 (0.69)* | 2.92 (0.69) | $F$(2,932) = 15.283, $p < 0.001$, $n^2 = 0.032$; 1,2 < 3 |
| F5. Self-Instructions | 2.96 (0.46) | 3.00 (0.41) | 3.18 (0.40)* | 3.05 (0.43) | $F$(2,932) = 20.309, $p < 0.001$, $n^2 = 0.042$, 1,2 < 3* |
| F10. Positive re-appraisal | 2.95 (0.56) | 2.99 (0.46) | 3.20 (0.47)* | 3.06 (0.49) | $F$(2,932) = 23.028, $p < 0.001$, $n^2 = 0.047$; 1,2 < 3* |
| F12. Communicating feelings | 2.88 (0.79) | 2.98 (0.69) | 3.18 (0.71)* | 3.03 (0.71) | $F$(2,932) = 11.865, $p < 0.001$, $n^2 = 0.025$;1,2 < 3 |
| F13. Alternative reinforcement | 2.75 (0.43) | 2.79 (0.41) | 2.92 (0.44)* | 2.83 (0.43) | $F$(2,932) = 12.290, $p < 0.001$, $n^2 = 0.026$; 1,2 < 3 |

*SR, Self-Regulation; NR, Non-regulation; DR, Dysregulation; ER, External Regulation; ENR, External Non-regulation; EDR, External Dysregulation; *Featured effect.*

## Stress Coping Strategies

There was a statistically significant main effect of the *five IV combinations of SR and RT* on Total Coping strategies [5,4 > 3,2,1]. In the case of *Emotion-focused Coping Strategies*, no statistically significant effect appeared, but in *Problem-focused Coping Strategies* there was a statistically significant effect in favor of high levels [5, 4 > 3 > 2,1]. The statistically significant partial effect was maintained for factors of *Emotion-focused Coping Strategies* (F9. *Emotional venting*, and F11. *Resigned acceptance*), and for the *Problem-focused Coping Strategies* (all

**TABLE 4 |** Interdependent complex effects (3 × 3) of low-medium-high levels of *Self-Regulation (SR)* with low–medium–high levels of *Regulatory Teaching (RT)* on stress coping strategies ($n$ = 797).

| ***SR*** | ***Low (n = 199)*** | | | ***Medium (n = 378)*** | | | ***High (n = 220)*** | | | ***Variable Effect*** | ***F(Pillai's)*** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***RT*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | | |
| ***n =*** | **48** | **106** | **45** | **72** | **190** | **116** | ***25*** | **78** | **117** | | |
| *Coping Strategies* | | | | | | | | | | | |
| *Total* | 2.58 (0.33) | 2.66 (0.26) | 2.71 (0.27) | 2.61 (0.26) | 2.62 (0.42) | 2.74 (0.27) | 2.64 (0.24) | 2.64 (0.27) | 2.73 (0.28) | SR | $F(2,788) = 0.321$, $p < 0.725$ ns, $n^2 = 0.001$ |
| | | | | | | | | | | RT | $F(2,788) = 10.660$, $p < 0.001$, $n^2 = 0.026$ |
| *Dimensions* | | | | | | | | | | SR | $F(4,1576) = 23.391$, $p < 0.001$, $n^2 = 0.056$ |
| | | | | | | | | | | RT | $F(4,1576) = 5.751$. $p < 0.00l$, $n^2 = 0.112$ |
| D1. Emotion focus | 2.47 (0.36) | 2.51 (0.33) | 2.56 (0.35) | 2.36 (0.34) | 2.40 (0.27) | 2.51 (0.32) | 2.32 (0.25) | 2.33 (32) | 2.39 (34) | SR | $F(2,788) = 10.546$, $p < 0.001$, $n^2 = 0.026$, 1 > 2 > 3 |
| | | | | | | | | | | RT | $F(2,788) = 5.079$, $p < 0.01$, $n^2 = 0.013$, 1 > 2 > 3 |
| D2. Problem focus | 2.68 (0.40) | 2.81 (0.32) | 2.87 (0.30) | 2.86 (0.30) | 2.85 (0.31) | 2.97 (0.30) | 2.97 (0.98) | 2.94 (0.32) | 3.09 (0.32) | SR* | $F(2,788) = 17.399$, $p < 0.001$, $n^2 = 0.042$, 1 < 2 < 3 |
| | | | | | | | | | | RT* | $F(2,788) = 10.856$, $p < 0.001$, $n^2 = 0.027$; 1 < 2 < 3 |
| *Emotion-focused strategies (factors)* | | | | | | | | | | SR* | $F(10,1774) = 12,225$, $p < 0.001$, $n^2 = 0.067$ |
| | | | | | | | | | | RT | $F(10,1774) = 3,329$, $p < 0.001$, $n^2 = 0.018$ |
| Fl. Avoidant distr. | 2.30 (0.42) | 2.33 (0.53) | 2.39 (0.52) | 2.14 (0.52) | 2.25 (0.44) | 235 (0.48) | 2.06 (0.47) | 2.21 (0.43) | 2.20 (0.55) | SR | $F(2,890) = 6.369$, $p < 0.001$, $n^2 = 0.014$, 1,2 > 3 |
| | | | | | | | | | | RT | $F(2,890) = 4.151$, $p < 0.01$, $n^2 = 0.016$, 1,2 > 3 |
| F7. Red. Anxiety | 3.11 (0.62) | 3.08 (0.62) | 3.24 (0.64) | 2.96 (0.63) | 2.96 (0.52) | 3.21 (0.65) | 2.76 (0.62) | 2.86 (0.83) | 2.92 (0.74) | SR | $F(2,890) = 9.019$, $p < 0.001$, $n^2 = 0.016$; 1 > 2 > 3 |
| | | | | | | | | | | RT* | $F(2,890) = 5,279$, $p < 0.001$, $n^2 = 0.012$; 1,2 < 3 |
| F8. Prep the worst | 2.73 (0.55) | 2.82 (0.45) | 2.89 (0.47) | 2.61 (0.43) | 2.65 (0.44) | 2.71 (0.48) | 239 (0.47) | 2.53 (0.46) | 2.60 (0.44) | SR* | $F(2,890) = 21.897$, $p < 0.001$, $n^2 = 0.047$; 1 > 2 > 3 |
| | | | | | | | | | | RT | $F(2,890) = 5,045$, $p < 0.001$, $n^2 = 0.012$; 1,2 > 3 |
| F9. Emotional vent | 2.10 (0.47) | 2.10 (0.47) | 2.04 (0.58) | 1.88 (0.42) | 1.90 (0.43) | 1.89 (0.40) | 1.71 (0.39) | 1.75 (0.38) | 1.64 (0.35) | SR* | $F(2,890) = 37.867$, $p < 0.001$, $n^2 = 0.047$; 1 > 2 > 3 |
| | | | | | | | | | | RT | $F(2,890) = l,511$, $p < 0.213$ ns, $n^2 = 0.003$ |
| F11. Resigned acc. | 2.28 (0.60) | 231 (0.56) | 2.27 (0.56) | 2.00 (0.52) | 2.05 (0.46) | 2.06 (0.44) | 1.70 (0.44) | 1.85 (0.45) | 1.77 (0.45) | SR* | $F(2,890) = 50.666$, $p < 0.001$, $n^2 = 0.102$; 1 > 2 > 3 |
| | | | | | | | | | | RT | $F(2,890) = 0.890$, $p < 0.412$ ns, $n^2 = 0.002$ |
| *Problem-focused strategies (factors)* | | | | | | | | | | SR | $F(10,1750) = 15,664$, $p < 0.001$, $n^2 = 0.082$ |
| | | | | | | | | | | RT | $F(10,1750) = 2,591$, $p < 0.001$, $n^2 = 0.015$ |
| F2. Seeking help | 2.57 (0.80) | 2.86 (0.71) | 3.02 (0.61) | 2.84 (0.68) | 2.88 (0.63) | 3.06 (0.66) | 3.06 (0.56) | 2.87 (0.61) | 3.12 (0.74) | SR | $F(2,878) = 4,969$, $p < 0.001$, $n^2 = 0.011$, 1,2 < 3 |
| | | | | | | | | | | RT* | $F(2,878) = 7.168$, $p < 0.001$, $n^2 = 0.016$, 1,2 < 3 |
| F5. Self-Instructions | 2.78 (0.48) | 2.87 (0.42) | 2.91 (0.43) | 3.04 (0.42) | 3.01 (0.38) | 3.11 (0.57) | 3.16 (0.46) | 3.18 (0.39) | 334 (0.62) | SR* | $F(2, 878) = 37,992$, $p < 0.001$, $n^2 = 0.080$; 1 < 2 < 3 |
| | | | | | | | | | | RT* | $F(2, 878) = 6,483$, $p < 0.001$, $n^2 = 0.015$; 1 < 2 < 3 |
| F10. Re-appraisal | 2.65 (0.58) | 2.78 (0.49) | 2.83 (0.49) | 3.05 (0.51) | 3.01 (0.41) | 3.12 (0.41) | 3.22 (0.44) | 3.28 (0.38) | 3.44 (0.37) | SR* | $F(2,878) = 69.018$, $p < 0.001$, $n^2 = 0.136$; 1 < 2 < 3 |
| | | | | | | | | | | RT | $F(2,878) = 6,237$, $p < 0.001$, $n^2 = 0.014$; 1,2 < 3 |
| F12. Comm. feelings | 2.66 (0.90) | 2.94 (0.75) | 3.12 (0.74) | 3.01 (0.72) | 2.96 (0.78) | 3.18 (0.71) | 3.23 (0.59) | 3.04 (0.64) | 3.19 (0.74) | SR | $F(2,878) = 6,896$, $p < 0.001$, $n^2 = 0.015$; 1 < 2 < 3 |
| | | | | | | | | | | RT | $F(2,878) = 5,414$, $p < 0.012$, $n^2 = 0.012$; 1 < 2 < 3 |
| F13. Altern. reinforc. | 2.67 (0.50) | 2.80 (0.38) | 2.84 (0.40) | 2.79 (0.41) | 2.76 (0.4) | 2.89 (0.42) | 2.82 (0.41) | 2.87 (0.46) | 2.96 (0.47) | SR | $F(2,878) = 5.069$, $p < 0.001$, $n^2 = 0.011$; 1 < 2 < 3 |
| | | | | | | | | | | RT | $F(2,878) = 5.069$, $p < 0.001$, $n^2 = 0.011$ |

**Statistical effect with higher F value: featured effect.*

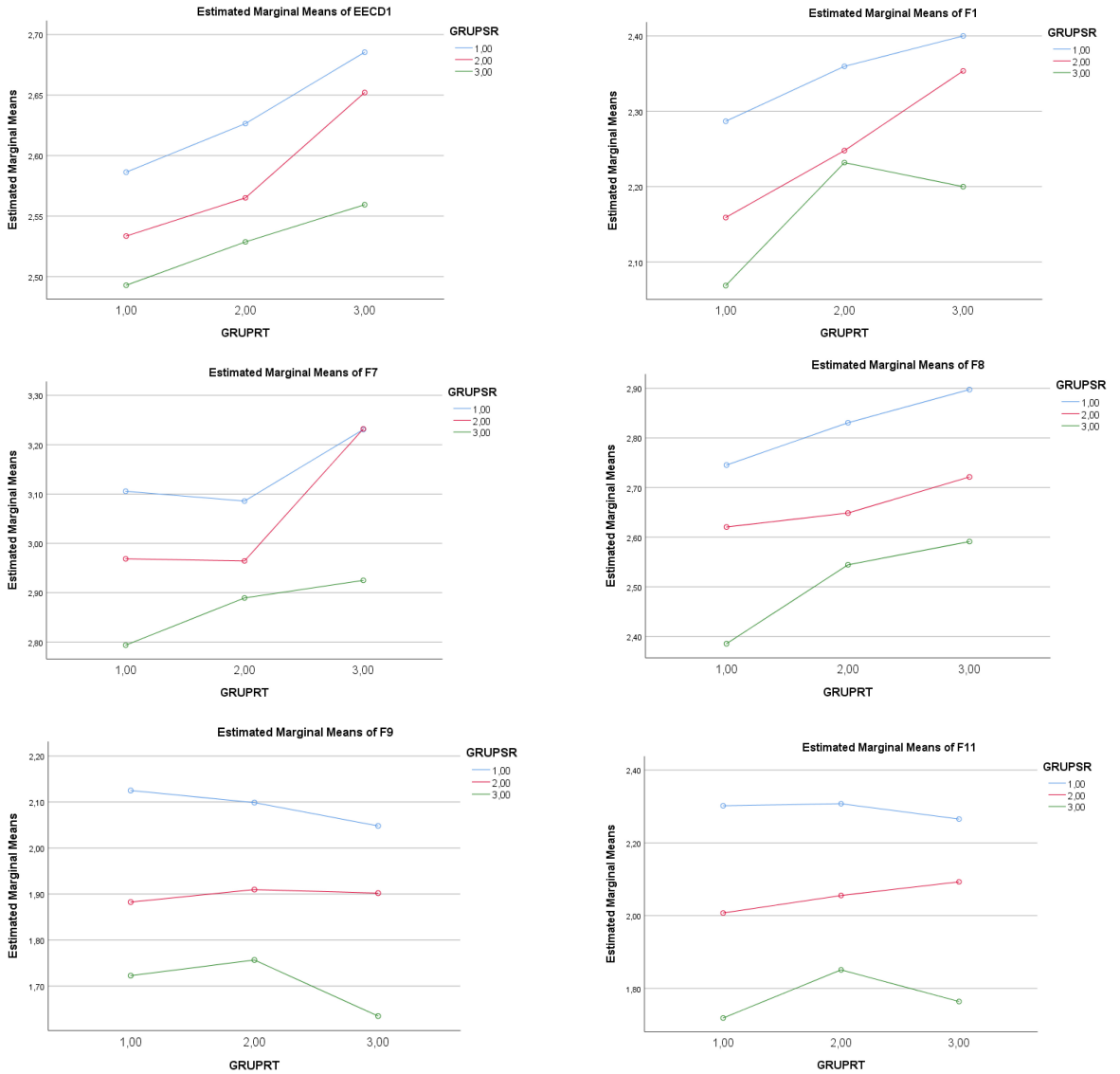


**FIGURE 1 |** Graphic representation of the effect of low(1)–medium(2)–high(3) levels in the IV *Self- Regulation* (GRUPSR) and low(1)–medium(2)–high (3) levels in the IV *Regulatory Teaching* (GRUPRT) on *Emotion-focused Coping Strategies* (EECD1)*;* EECF1. Avoidant distraction; EECF7. Reducing anxiety; EECF8. Preparing for the worst; EECF9. Emotional venting; EECF11. Resigned acceptance.

factors: 5,4 > 3,2,1). Thus, total coping behaviors progressively increased through the five levels of interaction. Overall, the clearest effects are: higher interaction levels (1–5) leading to a decrease in factors of *Emotion-focused Coping Strategies* (F8, F9, F11), and to an increase in factors of *Problem-focused Coping Strategies* (F2, F5, F10, F12, F13). See **Table 5**. A graphic representation of the differential progressive effect of combined SR and RT levels is shown in **Figures 3**, **4**.

## DISCUSSION AND CONCLUSION

SRL vs. ERL Theory (de la Fuente, 2017) predicted that university students' coping strategies could be determined, jointly, by the students' degree of *self-regulation* and by the level of contextual, *external regulation* from the teaching process. Furthermore, this type of interaction could be understood as the combination of *low-medium-high levels* of the two factors, as supported by prior evidence in this direction (de la Fuente et al., 2015a, 2017b).

For *hypotheses 1 and 2,* the results offer evidence that a (1) *graded increase in level of regulation* (internal and external) gives rise to a proportionate decrease in emotion-focused strategies, and a proportionate increase in problem-focused coping strategies. By contrast, a (2) *graded decrease in level of regulation* (internal and external) gives rise to a proportionate increase in emotion-focused strategies, and a proportionate decrease in problem-focused coping strategies. The hypothesis can be considered partially validated.

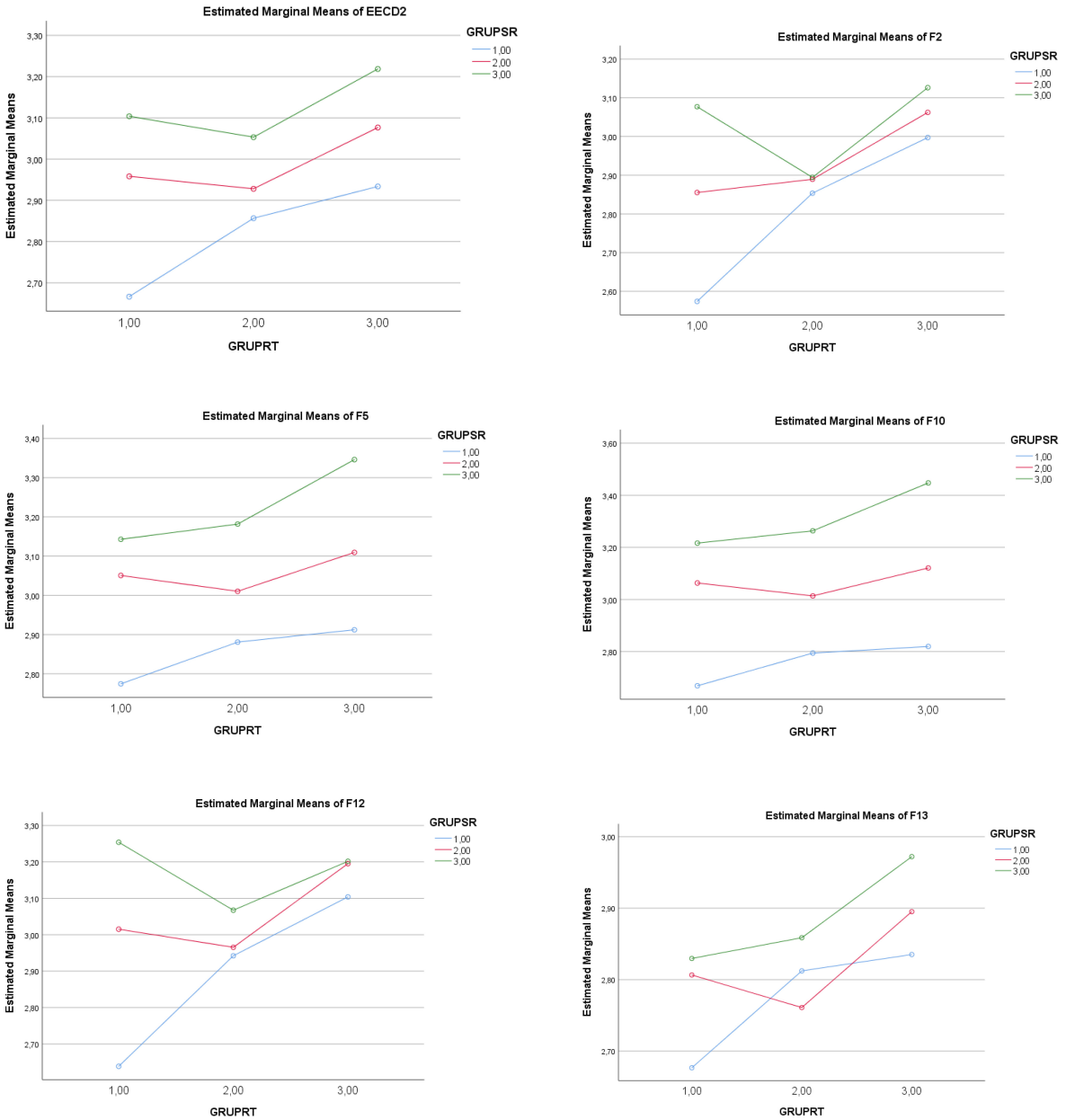


**FIGURE 2 |** Graphic representation of the effect of low(1)–medium(2)–high(3) levels in the IV *Self-regulation* (GRUPSR) and low(1)–medium(2)–high (3) levels in the IV *Regulatory Teaching* (GRUPRT) on *Problem-focused Coping Strategies*EECF2. Seeking help; EECF5. Self-Instructions; EECF10. Positive re-appraisal; EECF12. Communicating feelings; EECF13. Alternative reinforcement.

Analysis of the *simple effect* of the variables showed that level of SR positively determined the level of problem-focused strategies and negatively determined the level of emotion-focused strategies. Likewise, the level of RT showed a similar trend. This result is consistent with prior evidence from this line of research (de la Fuente et al., 2017b), as well as from other studies (Holinka, 2015; Collie et al., 2019). On the other hand, analysis of the *combined effect* of the variables showed two independent main effects, both from SR and from RT, but did not show a crossover interaction, consistently with previous evidence on the effect of these two variables on coping strategies (de la Fuente et al., 2017b, 2019). Finally, when analyzing a graded increase in the *combination level (scale of 1–5)*, the results are very consistent with the idea that the combination of the two types of regulation (person × context) significantly predicts a decrease in emotion-focused strategies and an increase in problem-focused strategies. These results are very consistent with others that our research team has recently found and reported (de la Fuente et al., 2019, p. 14), where positive achievement emotions were found to increase with higher ranking combinations of internal (SR) and

**TABLE 5 |** Effects of combination types on stress coping strategies ($n$ = 797).

| DVs | Combination Types (IVs) | | | | | Effects *post hoc* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| | (*n* = 48) | (*n* = 178) | (*n* = 260) | (*n* = 194) | (*n* = 117) | |
| *Configuration Group* | | | | | | $F(8,2050)$ = I87.65 (Pillai), $p < 0.001$, $n^2 = 0.422$ |
| *Self-Regulation* | 2.65 (37) | 3.02 (0.42) | 3.41 (0.44) | 3.80 (0.39) | 4.23 (0.29) | $F(1,1029) = 302.61$, $p < 0.001$, $n^2 = 0.302$, all $p < 0.001$ |
| *Regulatory Teaching* | 2.75 (0.32) | 3.26 (0.50) | 3.65 (0.68) | 4.04 (0.44) | 4.39 (0.30) | $F(1,1029) = 243.64$, $p < 0.001$, $n^2 = 0.614$, all $p < 0.001$ |
| *Coping strategies* | | | | | | |
| *Total* | 2.58 (33) | 2.64 (0.26) | 2.64 (0.24) | 2.70 (0.28) | 2.74 (0.29) | $F(4,792) = 5{,}046$ (Pillai), $p < 0.001$, $n^2 = 0.025$;5,4 > 3,2,1** |
| *Dimensions* | | | | | | $F(8,1584) = 13.771$ (Pillai), $p < 0.001$, $n^2 = 0.095$, *pow* = 1.0 |
| *D1. Emotion focus* | 2.47 (0.36) | 2.45 (0.34) | 2.42 (0.29) | 2.44 (0.33) | 2.39 (0.34) | $F(4,792) = 0.856$, $p < 0.490$ *ns*, $n^2 = 0.275$ |
| *D2. Problem focus* | 2.68 (0.40) | 2.83 (0.31) | 2.86 (0.31) | 2.96 (0.31) | 3.09 (0.32) | $F(4,792) = 2{,}107$, $p < 0.001$, $n^2 = 0.093$; 5,4 > 3,2 > 1** |
| *Emotion-focused factors* | | | | | | $F(20,3524) = 9{,}981$ (Pillai), $p < 0.001$, $n^2 = 0.054$, pow = 1.0 |
| Fl. Avoidant distrac. | 2.29 (0.42) | 2.26 (0.54) | 2.25 (0.46) | 2.29 (0.47) | 2.20 (0.55) | $F(4,882) = 0.808$, $p < 0.523$ ns, $n^2 = 0.004$ |
| F7. Reducing anx. | 3.12 (0.62) | 3.02 (0.62) | 2.99 (0.57) | 3.07 (0.64) | 2.93 (0.75) | $F(4,882) = 16.056$, $p < 0.001$, $n^2 = 0.069$ |
| F8. Preparing worst | 2.73 (0.55) | 2.73 (0.46) | 2.66 (0.47) | 2.64 (0.48) | 2.60 (0.44) | $F(4,882) = 1.405$, $p < 0.231$ ns, $n^2 = 0.006$ |
| F9. Emotional vent | 2.11 (0.47) | 2.00 (0.46) | 1.90 (0.46) | 1.83 (0.40) | 1.64 (0.35) | $F(4,882) = 17.753$, $p < 0.001$, $n^2 = 0.076$, 5,4 < 3 < 2,1** |
| Fll.Resigned accep. | 2.29 (0.60) | 2.18 (0.56) | 2.05 (0.49) | 1.99 (0.47) | 1.77 (0.45) | $F(4,882) = 16.319$, $p < 0.001$, $n^2 = 0.070$, 5,4 < 3 < 2,1** |
| *Problem-focused factors* | | | | | | $F(20,3524) = 9{,}981$ (Pillai), $p < 0.001$, $n^2 = 0.054$, pow = l,0 |
| F2. Seeking help | 2.57 (0.63) | 2.85 (0.70) | 2.92 (0.73) | 2.99 (0.64) | 3.12 (0.73) | $F(4,882) = 7.644$, $p < 0.001$, $n^2 = 0.034$, 5 > 4,3 > 2,1** |
| F5. Self-Instructions | 2.77 (0.47) | 2.94 (0.43) | 3.00 (0.40) | 3.14 (37) | 3.34 (36) | $F(4,882) = 30{,}614$, $p < 0.001$, $n^2 = 0.122$, 5 > 4 > 3 > 2,1** |
| F10. Reappraisal | 2.66 (0.57) | 2.90 (0.51) | 2.99 (0.44) | 3.18 (0.40) | 3.44 (0.77) | $F(4,882) = 45.640$, $p < 0.001$, $n^2 = 0.171$ 5 > 4 > 3 > 2,1** |
| F12. Comm feelings | 2.63 (0.89) | 2.97 (0.74) | 3.01 (0.68) | 3.14 (0.68) | 3.20 (0.74) | $F(4,882) = 7.587$, $p < 0.05$, $n^2 = 0.033$, 5,4 > 3,2 > 1** |
| F13 Altern reinforc | 2.67 (0.49) | 2.81 (0.39) | 2.78 (0.40) | 2.87 (0.44) | 2.97 (0.47) | $F(4,882) = 7.100$, $p < 0.001$, $n^2 = 0.31$, 5,4,3,2 > 1** |

*Type 1 (Low Self-Regulation and Low Regulatory Teaching); Type 2 (Low Self-Regulation and High Regulatory Teaching); Type 3 (Medium Self-Regulation and Medium Regulatory Teaching); Type 4 (High Self-Regulation and Low Regulatory Teaching); Type 5 (High Self-Regulation and High Regulatory Teaching). For more information, see* ***Table 4****. **p < 0.01.*

external (RT) regulation, and negative emotions increased with lower ranking combinations of internal (SR) and external (RT) regulation. Consequently, the coping behaviors analyzed here – as a variable of emotional or meta-emotional regulation—would reflect a similar response schema for managing each type of emotionality, according to the degree of SR and RT. Nonetheless, based on results from the two studies, it is not yet possible to establish a causality relationship for types of achievement emotions or coping strategies, an aspect which remains for further empirical analyses.

## Theoretical Implications

These findings are important for this theoretical model because they lend support to the premise that both the student's lack of regulation and a lack of regulation in teaching tend toward negative emotionality, and consequently, to greater use of emotion-focused strategies, to the detriment of problem-focused strategies. By contrast, higher levels of regulation in the student and higher levels of RT both contribute to positive emotionality, tending toward a greater use of problem-focused strategies, given that emotion-focused strategies for managing negative emotionality are not needed. This supports the importance of university students' perception of the teaching process (Aldrupa et al., 2019). These tendencies are similar to those found in other studies (de la Fuente et al., 2017b, 2019), lending empirical support to the assumption that the *combination* of individual and contextual regulation characteristics delimits the level of stress, just as is predicted by SRL vs. ERL Theory (de la Fuente, 2017). In other words, students with a lower level of SR (non-regulation or dysregulation), who are exposed to non-RT processes (no external regulation or dysregulating), are the ones who produce the greatest stress factors and show the greatest symptomology of stress (de la Fuente et al., 2020; in review), leading to greater application of emotion-focused strategies and to reduced focus on the problem. The opposite occurs in the case of students with high SR who are exposed to highly RT.

This theoretical contribution allows us to progress to a broader view of the *Theory of Self-Regulated Learning* (Zimmerman, 2001, 2008; Zimmerman and Labuhn, 2012). We can infer that the context -in this case the presence or lack of *effective teaching*- may have an active regulatory role, promoting and aiding the student's SR, and becoming just as important as the university student's own SR for predicting emotional behaviors of learning and ways of coping. It also enables us to operationalize the concept of *Self-regulation vs. External-Regulation* (Vermunt, 2005, 2007; Vermunt and Donche, 2017; and further specified by Vanthournout et al., 2014), since external regulation is conceptualized not as

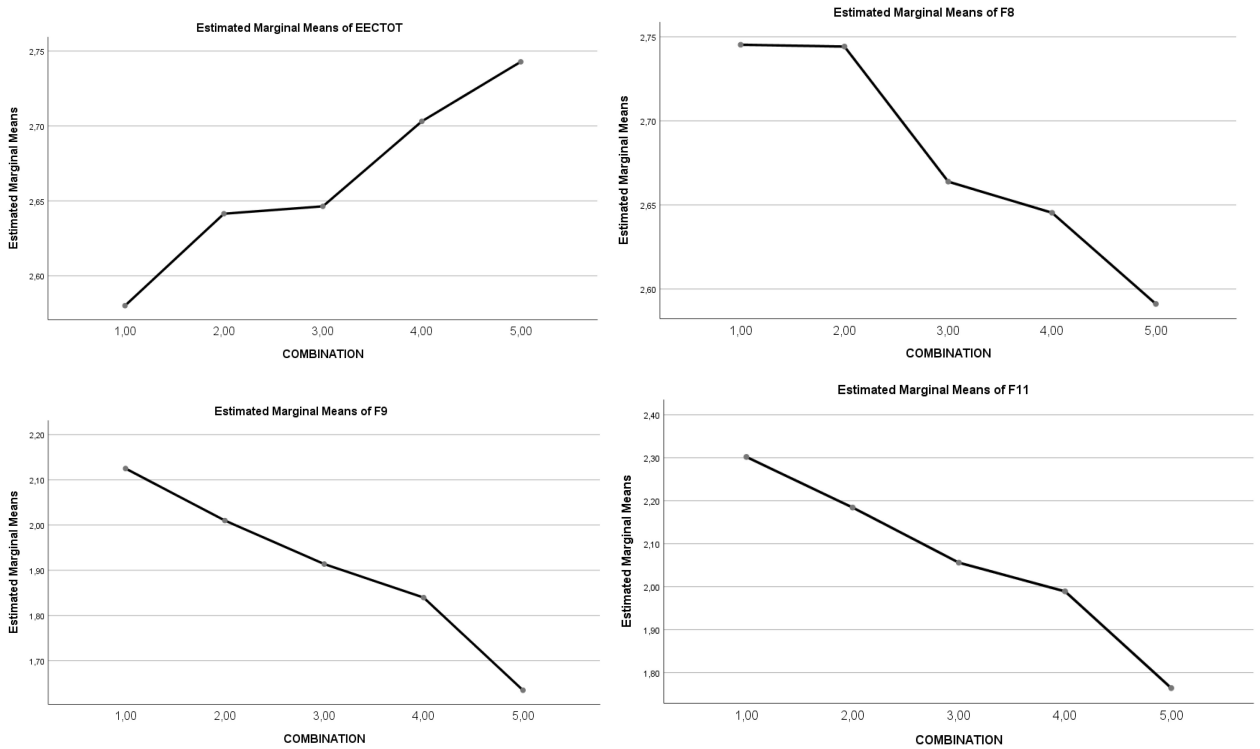


**FIGURE 3 |** Graphic representation of the effects of the combination types (levels 1–5) on *Emotion-focused Coping Strategies;* EECTOT = Total strategies; F8 = Preparing for the worst; F9 = Emotional venting; F11 = Resigned acceptance.

the opposite of internal, self-regulation, but as something that fosters SR, thereby resolving certain recent criticisms (Hederich-Martínez and Camargo, 2019).

The coping strategy labeled F9 (*emotional venting and isolation*) requires special attention. It is plausible that this dysregulatory behavior is a link between students' *learning and achievement problems* and certain *health problems* -alcohol intake, substance abuse or behavioral excesses (Freire et al., 2016; Garzón-Umerenkova et al., 2018; Kamijo and Yukawa, 2018). In other words, although the causes of learning and achievement problems can be both internal to the student (cognitive, meta-cognitive, motivational or meta-motivational in origin) and external, in the teaching process (its adjustment or maladjustment), what is certain is that the meta-emotional factors addressed here are significant in health predictions. Prior evidence has shown that negative emotionality, lack of confidence and lack of resilience correlate positively to the *surface approach* and negatively to the *deep approach* (de la Fuente et al., 2017a). It is therefore necessary to take this combination into account in the prevention of stress factors in university teaching-learning processes (Palmer and Rodger, 2009; Alonso-Tapia et al., 2018).

## Limitations and Future Directions

The present research study has several limitations worth mentioning. The sample should be improved by adding university students from different degree programs. The degree to which stress factors are determined by the student's personality variables (presage) also remains to be verified, as well as the connection between such variables and variables that explain good learning (as a process) and academic achievement (as a product). Other studies from our research team have already reported the importance of achievement emotions in different situations –in class, study time, testing (de la Fuente et al., 2019)—and upcoming studies will address these complex relations.

One especially important aspect for future investigation is the relationship of levels of self-regulation and external regulation to the concept of *flexible emotion regulation* (Gross, 2008, 2014, 2015a,b), with its recent important contributions (Kobyliñska and Kusev, 2019), and the coping strategies associated with each combination type. It would also be desirable to evaluate RT produced by university teachers as a function of their own emotions, given that some relationships have already been found (Frenzel et al., 2016, 2018). Another important aspect to be studied is the cross-cultural validity of these results, recognizing our limitation to a Spanish-speaking environment, and the need to expand this evidence to English-speaking samples, as well as other international groups, something to be addressed in future research. Special attention should also be given to gender differences, not analyzed in the present research study, but where important effects can be found, as shown by one recent study (Cabanach et al., 2009; Martínez et al., 2019).

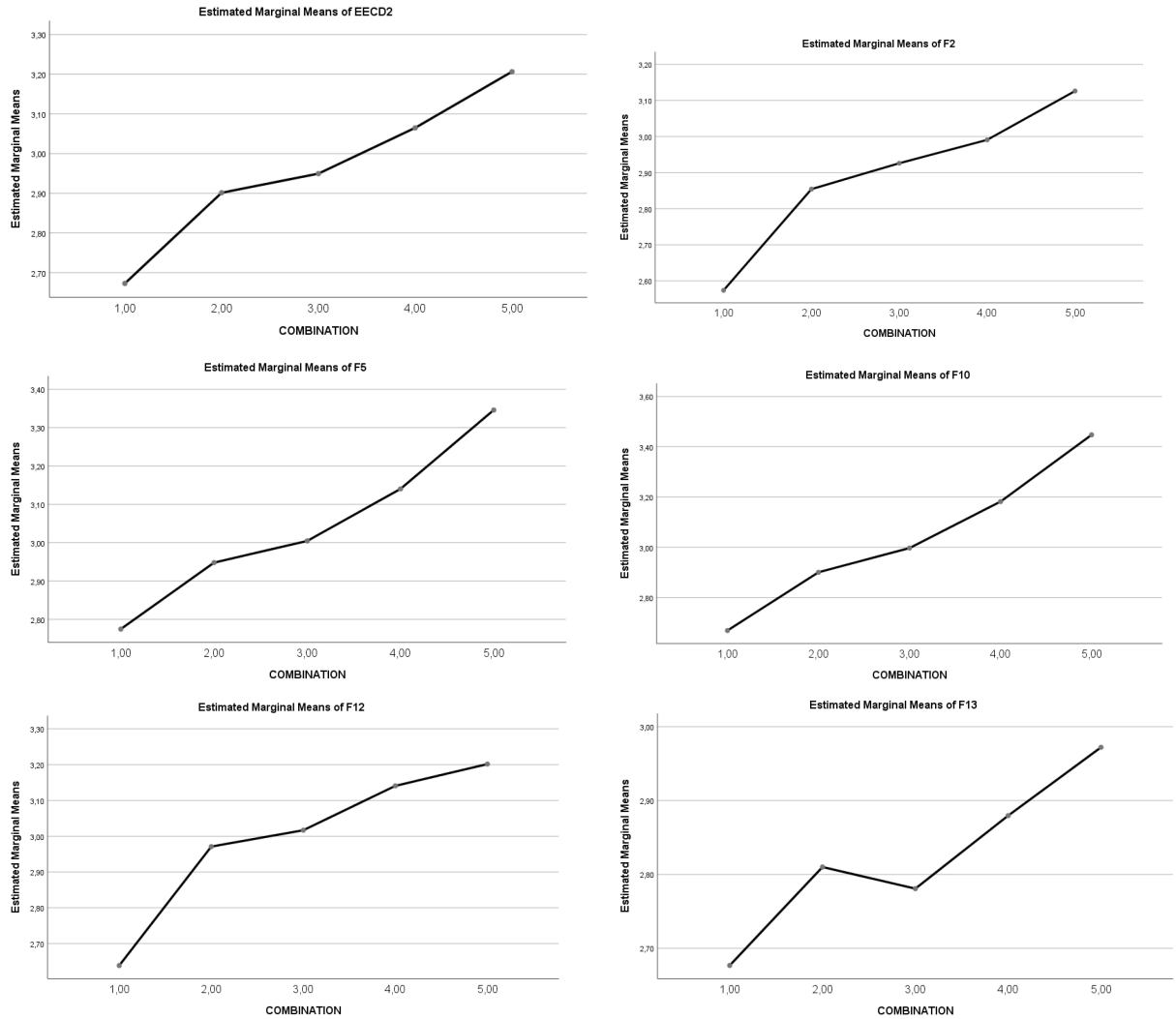


**FIGURE 4 |** Graphical representation of the effects of the combination types (levels 1–5) on *Problem-focused Coping Strategies.* EECD2 = Problem-focused strategies; F2 = Seeking help; F5 = Self-Instructions; F10 = Reappraisal; F12 = Comm. feelings and social support; F13 = Alternative reinforcement.

## Implications for the Practice of Educational Psychology at University

Applied implications from this research refer to two aspects. On one hand, students must be trained in the importance of self-regulating behavior when learning at university, not only in its *meta-cognitive* aspects (deep vs. surface learning approaches), but also in the relevance of *emotional factors* (achievement emotions), *meta-emotional factors* (emotion-focused vs. problem-focused coping strategies) and *meta-behavioral factors* (behavioral SR). On the other hand, it is essential that university teachers be trained to minimize stress factors through the design of their teaching process. The concept of *effective teaching* is associated with well-planned teaching, and with fostering in students a perception of control (Paris and Winograd, 2003; Putwain et al., 2019; Shannon et al., 2019). If students with a low level of SR perceive more stress factors and also experience more stress symptomology inherent to the teaching process, any innovative teaching design should take this personal factor into account.

When implementing innovations in the university teaching process, it is important to consider what type of context is being designed, within the framework of the *SRL vs. ERL Theory* (de la Fuente, 2017). If the context is non-regulating or dysregulating, it will probably not help students improve their learning process, especially if students have low SR. As seen in prior evidence, students with little SR require greater external regulation. Certain prior evidence has shown results consistent with this idea (Shaw et al., 2017; Bingen et al., 2019; Kassymova et al., 2019).

## DATA AVAILABILITY STATEMENT

The datasets analyzed in this manuscript are not publicly available. Requests to access the datasets should be directed to jdlfuente@unav.es.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Comité de Ética, Universidad de Navarra. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JF have made the general analysis and first version of the manuscript. MG-T has made the second review of the Self-regulation and Externally regulation sections of Coping Stress. JA and JG-T have performed a review of the data analysis. RA and SF have participated in the data collection.

## FUNDING

This work was supported by R&D Project PGC2018-094672-B-I00 (Ministry of Science and Education, Spain), UAL18 SEJ-DO31-A-FEDER (University of Almería, Spain), and the European Social Fund.

## REFERENCES

Aldrupa, K., Klusmanna, U., Lüdtkea, O., Göllnerc, R., and Trautweind, U. (2019). Student misbehavior and teacher well-being: testing the mediating role of the teacher-student relationship. *Learn. Instr.* 58, 126–136. doi: 10.1016/j.learninstruc.2018.05.006

Alonso-Tapia, J., Rodríguez-Rey, R., Garrido-Hernansaiz, H., Ruiz, M., and Nieto, C. (2018). Coping assessment from the perspective of the person-situation interaction: development and validation of the Situated Coping Questionnaire for Adults (SCQA). *Psicothema* 28, 479–486. doi: 10.7334/psicothema2016.19

Alson, J. (2019). Stress among public school teachers. *J. Res. Initiat.* 4:3.

Bhullar, N., Hine, D. W., and Phillips, W. J. (2014). Profiles of psychological well-being in a simple of Australian university students. *Int. J. Psychol.* 49, 288–294. doi: 10.1002/ijop.12022

Biggs, J. (2001). The reflective institution: assuring and enhancing the quality of teaching and learning. *High. Educ.* 41, 221–238.

Bingen, H. M., Steindal, S. A., Krumsvik, R., and Tveit, B. (2019). Nursing students studying physiology within a flipped classroom, self-regulation and off-campus activities. *Nurse Educ. Pract.* 35, 55–62. doi: 10.1016/j.nepr.2019.01.004

Browers, A., and Tomic, W. (2000). A longitudinal study of teacher burnout and perceived self-efficacy in classroom management. *Teach. Teach. Educ.* 16, 239–253. doi: 10.1016/s0742-051x(99)00057-8

Brown, J. M., Miller, W. R., and Lawendowski, L. A. (1999). "The self-regulation questionnaire," in *Innovations in Clinical Practice: a Source Book*, Vol. 17, eds L. Vandecreek, and T. L. Jackson (Sarasota, FL: Professional Resources Press), 281–293.

Cabanach, R. G., González, P., and Freire, C. (2009). El afrontamiento del estrés en estudiantes de ciencias de la salud. Diferencias entre hombres y mujeres [Coping with stress in health science students. Differences between men and women]. *Aula Abierta* 37, 3–10.

Cabanach, R. G., Rodríguez, S., Valle, A., Piñeiro, I., and Millán, P. G. (2007). Metas académicas y vulnerabilidad al estrés en contextos académicos [Academic goals and vulnerability to stress in academic contexts]. *Aula Abierta* 36, 3–16.

Carey, K. B., Neal, D. J., and Collins, S. E. (2004). A psychometric analysis of the self-regulation questionnaire. *Addict. Behav.* 29, 253–260. doi: 10.1016/j.addbeh.2003.08.001

Cassady, J. C., Pierson, E. E., and Starling, J. M. (2019). Predicting student depression with measures of general and academic anxieties. *Front. Educ.* 4:11. doi: 10.3389/feduc.2019.00011

Chartier, I. S., Gaudreau, P., and Fecteau, M. (2011). From dispositional affect to academic goal attainment: the mediating role of coping. *Anxiety Stress Coping* 24, 43–58. doi: 10.1080/10615801003725360

Chorot, P., and Sandín, B. (1987). *Escalas de Estrategias de Coping. [Scales of Coping Strategies]*. Madrid: UNED.

Collie, R. J., Granziera, H., and Martin, A. J. (2019). Teachers' motivational approach: links with students' basic psychological need frustration, maladaptive engagement, and academic outcomes. *Teach. Teach. Educ.* 86:102872. doi: 10.1016/j.tate.2019.07.002

de la Fuente, J. (2014). *Confirmatory Structural Equation Model of Coping Strategies Scale (EEC)*. Almería: University of Almería.

de la Fuente, J. (2017). Theory of self- vs. externally- regulated learning$^{TM}$: fundamentals, evidence, and applicability. *Front. Psychol.* 8:1675. doi: 10.3389/fpsyg.2017.01675

de la Fuente, J., Fernández-Cabezas, M., Cambil, M., Vera, M. M., González-Torres, M. C., and Artuch-Garde, R. (2017a). Linear relationship between resilience, learning approaches, and coping strategies to predict achievement in undergraduate students. *Front. Psychol.* 8:1039. doi: 10.3389/fpsyg.2017.01039

de la Fuente, J., García-Torrecillas, J. M., and Rodríguez-Vargas, S. (2015a). "The relationships between coping strategies, test anxiety and burnout-Engagement behaviour in university undergraduates," in *Coping Strategies and Health*, ed. M. Bachman (New York, NY: Nova Science Publisher), 27–41.

de la Fuente, J., González-Torres, M. C., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Sander, P., and Amate, J., (2020, in review). Effects of self-regulation and regulatory teaching on the factors and symptoms of academic stress in undergraduate students. *Assess. Eval. High. Educ.*

de la Fuente, J., López, M., Zapata, L., Sollinas, G., and Fadda, S. (2015b). "Improving mental health through an online self-assessment and self-help e-utility in university students," in *Progress in Education*, Vol. 33, ed. R. V. Nata (New York, NY: Nova Publisher), 63–74.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Garzón-Umerenkova, A., Vera, M. M., and Paoloni, P. (2019). Applying the SRL vs ERL theory to the knowledge of achievement emotions in undergraduate university students. *Front. Psychol.* 10:2070. doi: 10.3389/fpsyg.2019.02070

de la Fuente, J., Sander, P., Cardelle-Elawar, M., and Pignata, S. (2016). "Effects of level of regulatory teaching on achievement emotion in the learning process: anxiety and achievement emotions on higher education," in *Teaching and Learning*, ed. M. Vargas (New York, NY: Nova Science Publishers, Inc), 131–151.

de la Fuente, J., Sander, P., Martínez-Vicente, J. M., Vera, M. M., Garzón, A., and Fadda, S. (2017b). Combined effect of levels in personal self-regulation and regulatory teaching on meta-cognitive, on meta-motivational, and on academic achievement variables in undergraduate students. *Front. Psychol.* 8:232. doi: 10.3389/fpsyg.2017.00232

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Cardelle-Elawar, M., Sander, P., Justicia, F., et al. (2012). Regulatory teaching and self-regulated learning in college students: confirmatory validation study of the IATLP scales. *Electron. J. Res. Educ. Psychol.* 10, 839–866.

Dicke, T., Marsh, H. W., Parker, P. D., Pekrun, R., Guo, J., and Televantou, I. (2018). Effects of school-average achievement on individual self-concept and achievement: unmasking phantom effects masquerading as true compositional effects. *J. Educ. Psychol.* 110, 1112–1126. doi: 10.1037/edu0000259

D'Mello, S. (2013). A selective meta-analysis on the relative incidence of discrete affective states during learning with technology. *J. Educ. Psychol.* 105, 1082–1099. doi: 10.1037/a0032674

Duffy, M. C., Lajoie, S. P., Pekrun, R., and Lachapelle, K. (2018). Emotions in medical education: examining the validity of the Medical Emotion Scale (MES) across authentic medical learning environments. *Learn. Instr.* (in press). doi: 10.1016/j.learninstruc.2018.07.001

Fimian, M. J., Fastenau, P. A., Tashner, J. H., and Cross, A. H. (1989). The measure of classroom stress and burnout among gifted and talented students. *Psychol. Sch.* 26, 139–153. doi: 10.1002/1520-6807(198904)26:2<139::aid-pits2310260205>3.0.co;2-e

Folkman, S. (1997). Positive psychological states and coping with severe stress. *Soc. Sci. Med.* 45, 1207–1221. doi: 10.1016/s0277-9536(97)00040-3

Folkman, S. (2008). The case for positives emotions in the stress process. *Anxiety Stress Coping* 21, 3–14. doi: 10.1080/10615800701740457

Folkman, S. (2011). "Stress, health, and coping: synthesis, commentary, and future directions," in *The Oxford Handbook of Stress, Health, and Coping*, ed. S. Folkman (Oxford: Oxford University Press), 453–462.

Francis, B., Singh-Gill, J., Yit-Han, N., Petrus, C. F., Azhar, F. L., Ahmad-Sabki, Z., et al. (2018). Religious coping, religiosity, depression and anxiety among medical students in a multi-religious setting. *Int. J. Environ. Res. Public Health* 16:E259. doi: 10.3390/ijerph16020259

Freire, C., Ferradás, M. M., Núñez, J. C., Valle, A., and Vallejo, G. (2018). Eudaimonic well-being and coping with stress in university students: the mediating/moderating role of self-efficacy. *Int. J. Environ. Res. Public Health* 16:E48. doi: 10.3390/ijerph16010048

Freire, C., Ferradás, M. M., Valle, A., Núñez, J. C., and Vallejo, G. (2016). Profiles of psychological well-being and coping strategies among university students. *Front. Psychol.* 7:1554. doi: 10.3389/fpsyg.2016.01554

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., and Lüdtke, O. (2018). Emotion transmission in the classroom revisited: a reciprocal effects model of teacher and student enjoyment. *J. Educ. Psychol.* 110, 628–639. doi: 10.1037/edu0000228

Frenzel, A. C., Pekrun, R., Goetz, T., Daniels, L. M., Durksen, T. L., Becker-Kurz, B., et al. (2016). Measuring enjoyment, anger, and anxiety during teaching: the Teacher Emotions Scales (TES). *Contemp. Educ. Psychol.* 46, 148–163. doi: 10.1016/j.cedpsych.2016.05.003

Garzón-Umerenkova, A., de la Fuente, J., Amate, J., Paoloni, P. V., Fadda, S., and Fiz, J. F. (2018). A linear empirical model of self-regulation on flourishing, health, procrastination, and achievement, among university students. *Front. Psychol.* 9:536. doi: 10.3389/fpsyg.2018.00536

Gentsch, K., Loderer, K., Soriano, C., Fontaine, J. R., Eid, M., Pekrun, R., et al. (2018). Effects of achievement contexts on the meaning structure of emotion words. *Cogn. Emot.* 32, 379–388. doi: 10.1080/02699931.2017.1287668

Goetz, T., Frenzel, A. C., Hall, N. C., Nett, U. E., Pekrun, R., and Lipnevich, A. A. (2014). Types of boredom: an experience sampling approach. *Motiv. Emot.* 38, 401–419. doi: 10.1007/s11031-013-9385-y

González-Torres, M. C., and Artuch, R. (2014). Resilience and coping strategy profiles at university: contextual and demographic variables. *Electron. J. Res. Educ. Psychol.* 12, 621–648. doi: 10.14204/ejrep.34.14032

Gross, J. J. (ed.). (2008). *Handbook of Emotion Regulation*. New York, NY: Guilford.

Gross, J. J. (2014). *Handbook of Emotion Regulation*, 2nd Edn. New York, NY: Guilford.

Gross, J. J. (2015a). Emotion regulation: current status and future prospects. *Psychol. Inq.* 26, 1–26. doi: 10.1080/1047840X.2014.940781

Gross, J. J. (2015b). The extended process model of emotion regulation: elaborations, applications, and future directions. *Psychol. Inq.* 26, 130–137. doi: 10.1080/1047840X.2015.989751

Gustems-Carnicer, J., Calderon, C., Batalla-Flores, A., and Esteban-Bara, F. (2019). Role of coping responses in the relationship between perceived stress and psychological well-being in a sample of Spanish educational teacher students. *Psychol. Rep.* 122, 380–397. doi: 10.1177/0033294118758904

Harley, J. M., Pekrun, R., Taxer, J. L., and Gross, J. J. (2019). Emotion regulation in achievement situations: an integrated model. *Educ. Psychol.* 54, 106–126. doi: 10.1080/00461520.2019.1587297

Hederich-Martínez, C., and Camargo, U. A. (2019). Critical review of J. Vermunt's learning pattern model. *Rev. Colomb. Educ.* 77, 1–25. doi: 10.17227/rce.num77-9469

Hirvonena, R., Yli-Kivistöa, L., Putwain, D. W., Ahonena, T., and Kiuru, N. (2019). School-related stress among sixth-grade students – associations with academic buoyancy and temperament. *Learn. Individ. Differ.* 70, 100–108. doi: 10.1016/j.lindif.2019.01.012

Holinka, C. (2015). Stress, emotional intelligence, and life satisfaction in college students. *Coll. Stud. J.* 49, 300–311.

Kamijo, N., and Yukawa, S. (2018). The role of rumination and negative affect in meaning making following stressful experiences in a Japanese sample. *Front. Psychol.* 9:2404. doi: 10.3389/fpsyg.2018.02404

Kassymova, K. G., Tyumaseva, Z. I., Valeeva, G. V., Lavrinenko, S. V., Arpentieva, M. R., Kenzhaliyev, B. K., et al. (2019). Integrative model of student and teacher stress coping: the correction of relations in educational, profesional and personal interaction. *Bull. Natl. Acad. Sci. Repub. Kazagistan* 3, 169–179.

Kim, L. E., Jorg, V., and Klassen, R. M. (2019). A meta-analysis of the effects of teacher personality of teacher effectiveness and burnout. *Educ. Psychol. Rev.* 31, 163–195. doi: 10.1007/s10648-018-9458-2

Kobyliñska, D., and Kusev, P. (2019). Flexible emotion regulation: how situational demands and individual differences influence the effectiveness of regulatory strategies. *Front. Psychol.* 10:72. doi: 10.3389/fpsyg.2019.00072

Lazarus, R. S. (1999). *Stress & Emotion: A New Synthesis*. New York, NY: Free Association Books.

Lazarus, R. S., and Folkman, S. (1984/1986). *Estrés y Procesos Cognitivos*. Barcelona: Martínez Roca.

Lekwa, A. J., Reddy, L. A., and Shernoff, E. S. (2018). Measuring teacher practices and student academic engagement: a convergent validity study. *Sch. Psychol. Q.* 34, 109–118. doi: 10.1037/spq0000268

Linnenbrink-Garcia, L., and Pekrun, R. (2011). Students' emotions and academic engagement [Special issue]. *Contemp. Educ. Psychol.* 36, 1–3. doi: 10.1016/j.cedpsych.2010.11.004

Loderer, K., Pekrun, R., and Lester, J. C. (2018). Beyond cold technology: a meta-analytic review of research on emotions in technology-based learning environments. *Learn. Instr.* (in press). doi: 10.1016/j.learninstruc.2018.08.002

Lüftenegger, M., Klug, J., Harrer, K., Langer, M., Spiel, C., and Schober, B. (2016). Students' achievement goals, learning-related emotions and academic achievement. *Front. Psychol.* 7:603. doi: 10.3389/fpsyg.2016.00603

Mainhard, T., Oudman, S., Hornstra, L., Bosker, R. J., and Goetz, T. (2018). Student emotions in class: the relative importance of teachers and their interpersonal relations with students. *Learn. Instr.* 53, 109–119. doi: 10.1371/journal.pone.0201442

Martín, M. O., Trujillo, F. D., and Moreno, N. (2003). Estudio y evaluación del estrés académico en estudiantes de grado de ingenierías industriales en la universidad de Málaga [academic stress evaluation in industrial engineering in the university of Malaga]. *Rev. Educ. Hekademos* 13, 55–63.

Martínez, I. M., Meneghel, I., and Penalver, J. (2019). Does gender affect coping strategies leading to well-being and improved academic performance? *Rev. Psicodidáctica* 24, 111–119. doi: 10.1016/j.psicoe.2019.01.002

Miller, W. R., and Brown, J. M. (1991). "Self-regulation as a conceptual basis for the prevention and treatment of addictive behaviours," in *Self-Control and the Addictive Behaviours*, eds N. Heather, W. R. Miller, and J. Greeley (Sydney: Maxwell Macmillan Publishing Australia), 3–79.

Moffa, K., Dowdy, E., and Furlong, M. J. (2016). Exploring the contributions of school belonging to complete mental health screening. *Educ. Dev. Psychol.* 33, 16–32. doi: 10.1017/edp.2016.8

Murayama, K., Goetz, T., Malmberg, L.-E., Pekrun, R., Tanaka, A., and Martin, A. J. (2017). "Within-person analysis in educational psychology: importance and illustrations," in *British Journal of Educational Psychology Monograph Series II: Psychological Aspects of Education – Current Trends: The Role of Competence Beliefs in Teaching and Learning*, eds D. W. Putwain, and K. Smart (Oxford: Wiley).

Palmer, A., and Rodger, S. (2009). Mindfulness, stress and coping among university students. *Can. J. Couns.* 43, 198–212.

Paris, S., and Winograd, P. (2003). *The Role of Self-Regulated Learning in Contextual Teaching: Principals and Practices for Teacher Preparation*. Washington, DC: Office of Educational Research and Improvement.

Park, C. L., and Adler, N. E. (2003). Coping style as a predictor of health and well-being across the first year of medical school. *Health Psychol.* 22, 627–631. doi: 10.1037/0278-6133.22.6.627

Pichardo, M. C., Cano, F., Garzón-Umerenkova, A., de la Fuente, J., Peralta-Sánchez, F. J., and Amate-Romera, J. (2018). Self-regulation questionnaire (SRQ) in Spanish adolescents: factor structure and Rasch analysis. *Front. Psychol.* 9:1370. doi: 10.3389/fpsyg.2018.01370

Pichardo, M. C., Justicia, F., de la Fuente, J., Martínez-Vicente, J. M., and Berbén, A. B. (2014). Factor structure of the self-regulation questionnaire (SRQ) at Spanish universities. *Span. J. Psychol.* 17:E62. doi: 10.1080/02699931.2016.1204989

Pidgeon, A. M., and Pickett, L. (2017). Examining the differences between university students' levels of resilience on mindfulness, psychological distress and coping strategies. *Eur. Sci. J.* 13, 103–113.

Putwain, D. W. (2018). An examination of the self-referent executive processing model of test anxiety: control, emotional regulation, self-handicapping, and examination performance. *Eur. J. Psychol. Educ.* 34, 341–358. doi: 10.1007/s10212-018-0383-z

Putwain, D. W., Pekrun, R., Nicholson, L. J., Symes, W., Becker, S., and Marsh, H. W. (2019). Control-value appraisals, enjoyment, and boredom in mathematics: a longitudinal latent interaction analysis. *Am. Educ. Res. J.* 55, 1339–1368. doi: 10.3102/0002831218786689

Rapillard, S., Plexico, L. W., and Plumb, A. M. (2019). Influence of graduate speech language pathology student's learning style and coping strategies on training and development. *Teach. Learn. Commun. Sci. Disord.* 3, 2–24. doi: 10.30707/TLCSD3.1Rapillard

Rusk, R., Tamir, M., and Rothbaum, F. (2011). Performance and learning goals for emotional regulation. *Motiv. Emot.* 35, 444–460. doi: 10.1007/s11031-011-9229-6

Saklofske, D. H., Austin, E. J., Mastoras, S. M., Beaton, L., and Osborne, S. E. (2012). Relationships of personality, affect, emotional inteligence and coping with student stress and academic success: different patterns of association for stress and success. *Learn. Individ. Differ.* 22, 251–257. doi: 10.1016/j.lindif.2011.02.010

Scharp, K. M., and Dorrance, E. (2017). Examining the relationship between undergraduate student parent social support-seeking factors, stress, and somatic symptoms: a two-model comparison of direct and indirect effects. *Health Commun.* 34, 54–64. doi: 10.1080/10410236.2017.1384427

Shannon, M., Suldo, S. M., Storey, L. D., O'Brennan, L. M., Shaunessy-Dedrick, E., Ferron, J. M., et al. (2019). Identifying high school freshmen with signs of emotional or academic risk: screening methods appropriate for students in accelerated courses. *School Ment. Health* 11, 210–227. doi: 10.1007/s12310-018-9297-9

Shaw, M. P., Peart, D. J., and William, O. J. (2017). Perceived stress in university students studying in a further education college. *Res. Post Compulsory Educ.* 22, 442–452. doi: 10.1080/13596748.2017.1362534

Tada, A. (2017). The associations among psychological distress, coping style, and health habits in Japanese nursing students: a cross-sectional study. *Int. J. Environ. Res. Public Health* 14:E1434. doi: 10.3390/ijerph14111434

Vanthournout, G., Donche, V., Gijbels, D., and Van Petegem, P. (2014). "(Dis)similarities in research on learning approaches and learning patterns," in *Learning Patterns in Higher Education*, eds G. Gijbels, V. Donche, J. Richardson, and J. Vermunt (London: Routledge), 9–32.

Vermunt, J., Bronkhorst, L. H., and Martínez-Fernández, J. R. (2014). "The dimensionality of student learning patterns in different cultures," in *Learning Patterns in Higher Education*, eds G. Gijbels, V. Donche, J. Richardson, and J. Vermunt (London: Routledge), 33–55.

Vermunt, J. D. (1998). The regulation of constructive learning processes. *Br. J. Educ. Psychol.* 68, 149–171. doi: 10.1111/j.2044-8279.1998.tb01281.x

Vermunt, J. D. (2005). Relations between student learning patterns and personal and contextual factors and academic performance. *High. Educ.* 49, 205–225.

Vermunt, J. D. (2007). The power of teaching-learning environments to influence student learning. *Br. J. Educ. Psychol. Monogr. Ser.* 4, 73–90.

Vermunt, J. D., and Donche, V. (2017). A learning patterns perspective on student learning in higher education: state of the art and moving forward. *Educ. Psychol. Rev.* 29, 269–299. doi: 10.1007/s10648-017-9414-6

Vermunt, J. D., and Vermetten, Y. J. (2004). Patterns in student learning: relationships between learning strategies, conceptions of learning, and learning orientations. *Educ. Psychol. Rev.* 16, 359–384. doi: 10.1007/s10648-004-0005-y

Willcoxson, L., Cotter, J., and Joy, S. (2011). Beyond the first year experience: the impact on attrition of student experiences throughout undergraduate degree studies in six diverse universities. *Stud. High. Educ.* 36, 331–352. doi: 10.1080/03075070903581533

Zimmerman, B. J. (2001). "Theories of self-regulated learning and academic achievement: an overview and analysis," in *Self-Regulated Learning and Academic Achievement: Theoretical Perspectives*, 2nd Edn, eds B. J. Zimmerman, and D. H. Schunk (Mahwah, NJ: Erlbaum), 1–35.

Zimmerman, B. J. (2008). "Goal setting: a key proactive source of academic self-regulation," in *Motivation and Self-Regulated Learning*, eds D. H. Schunk, and B. J. Zimmerman (New York, NY: Erlbaum), 267–295.

Zimmerman, B. J., and Labuhn, A. S. (2012). "Self-regulation of learning: process approaches to personal development," in *APA Educational Psychology Handbook*, Vol. 1, eds K. R. Harris, S. Graham, and T. Urdam (Washington, DC: American Psychological Association), 339–425.

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 24 March 2020
doi: 10.3389/fpsyg.2020.00449

# The Role of Philosophical Inquiry in Helping Students Engage in Learning

*Lu Leng**

*College of Foreign Studies, Jinan University, Guangzhou, China*

Studies have characterized high school students as bored, alienated, and disconnected with their class and the learning process. In order to address this problem to improve student learning engagement, this study explores the impact of philosophical inquiry (PI) on the development of adolescents' academic engagement and adds to the scholarly research on Philosophy for Children (P4C). In determining an appropriate and holistic approach to investigating students' learning engagement and motivation from the perspective of psychology, this study involves multiple forms of data collection, specifically including surveys, student work, focus group interviews, classroom discussions, and reflective notes. Applying a qualitative method, this multiple case study developed a deeper understanding of the classroom contexts, conditions, discourses, tools, and practices that promote positive adolescent learning experiences. The study developed a conceptual framework of student academic engagement in a PI class and summarized reasons why the participants engaged in learning. First, students believed that maintaining a safe and positive classroom environment is a fundamental condition for learning. Second, they reported that asking questions, sharing ideas, listening attentively, thinking deeply, and making connections are the manifestations of an engaging classroom. Third, students reported that they transcended their learning experiences by living a new philosophy that was acquired in the process of the community of inquiry. The study found that PI enhanced social inclusion and active participation of the participant in the learning process.

**Keywords: learning engagement, Philosophy for Children Hawaii, adolescent academic achievement, philosophical inquiry, motivation**

OPEN ACCESS

***Edited by:***
*Meryem Yilmaz Soylu,*
*University of Nebraska-Lincoln,*
*United States*

***Reviewed by:***
*Chi-Ming Lam,*
*The Education University of Hong Kong, Hong Kong*
*Walter Omar Kohan,*
*Rio de Janeiro State University, Brazil*
*Enrico Postiglione,*
*University of Modena and Reggio Emilia, Italy*

***Correspondence:**
*Lu Leng*
*lusophialeng@hotmail.com*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *11 December 2019*
***Accepted:*** *26 February 2020*
***Published:*** *24 March 2020*

***Citation:***
*Leng L (2020) The Role of Philosophical Inquiry in Helping Students Engage in Learning. Front. Psychol. 11:449. doi: 10.3389/fpsyg.2020.00449*

## INTRODUCTION

Philosophical inquiry (PI), or the practice of "thinking together" and "thinking about thinking together," is an educational approach that originates from philosophical pragmatism. It upholds that knowing is not merely an acquisition of knowledge that is external to the knower, but arises from a community of inquiry that students engage with and construct together. This pedagogical approach involves logical questioning and broad discussions among students and their teachers. The teacher is the students' coparticipant. In the process of constructive dialog, students and their teacher clarify thinking, raise questions, record discussions, explore meanings, listen carefully, and respond to the ideas of others respectfully and non-judgmentally (Millett and Tapper, 2011). Considering the benefits of PI, the Hawai'i State Department of Education developed a standards-based social studies course called PI that helps students understand and gain knowledge in transforming

what they learn into daily practice and problem solving. In this PI course, students will build an intellectually safe place (Jackson, 2001) where students and teachers use dialog, gentle Socratic inquiry, responsible thinking, and empathy to examine questions and issues that arise from their genuine wonderings about the study of history, psychology, contemporary society, economics, political science, geography, and social interaction. During the inquiry, students learn tools for thinking philosophically, critically, and ethically across the wide range of interdisciplinary topics and issues introduced in each area of scholarship (Hawaii public schools course description catalog, 2019).

The PI course is grounded in the Philosophy for Children Hawaii (p4cHI) approach to education and helps students and teachers to create a more thoughtful, compassionate, and ethical educational experience. p4cHI is an outgrowth and unique expression of Matthew Lipman's (1988, 2003) original Philosophy for Children (P4C) movement. p4cHI is an innovative approach to education that transforms the schooling experience by engaging students in intellectually safe communities of inquiry where students and teachers continue to develop their ability to think for themselves in responsible ways (p4cHI website, 2020). p4cHI has now become the namesake of the educational movement associated with doing philosophy with K-12 and university students in the Hawaiian islands (Miller, 2013). The PI course was piloted in the Hawaii State Department of Education (HI DOE) at Kailua High School (KHS) in the fall of 2013. This research will examine the effects of the PI course on students' learning engagement.

## RESEARCH PURPOSE

The purpose of this qualitative research is to explore how a PI course that utilizes p4cHI educational approach featuring a community of inquiry, philosophical thinking, and reflection contributes to adolescents' engagement to learning. It is hoped that the theoretical and academic engagement frameworks developed from this project will be able to assist educators to develop curriculum and pedagogy, and classroom practices and learning environments that foster increased academic engagement and intrinsic motivation in a social studies classroom and beyond.

## SIGNIFICANCE OF THE STUDY

Academic engagement decreases significantly from the early grades of elementary to high school. One reason for disengagement is that adolescents do not fully appreciate the value of academic achievement and successful schooling experiences (Eccles et al., 1998; Marks, 2000). Many high school students abandon their sense of wonder when they step into their history, psychology, civics, or philosophy classrooms. They often stop asking questions, make fewer connections with their prior learning and personal experiences, and fail to find meaning. Although teachers work extraordinarily hard to provide their students with the practical uses and meaningfulness of their lessons, and use various teaching strategies to motivate and engage their students to participate in class activities, young students still tune out and disengage from their studies (Toshalis and Nakkula, 2012). Figuring out what motivates and engages high school students is a critical question that needs to be addressed.

Although there has been a growing awareness of the significance of adolescents' engagement in education, there has been little scholarship documenting p4cHI or PI's effects on student learning engagement and motivation. To fill the void, this research examines how the PI course and p4cHI approach to education promote involvement of economically disadvantaged youth in academic engagement.

Adolescence is a critical psychological stage between childhood and adulthood that deserves particular attention. The onset of adolescence is a time of rapid physical growth, sexual maturation, and social and emotional changes, and it also implies a wide range of behavioral and emotional health problems. Pubertal development and brain maturation shape adolescent development and presumably later behavior (Erikson, 1963; Board of Children Youth and Families, 2004; Forbes and Dahl, 2010). This work will extend adolescent research to students' academic engagement in the association of PI. The investigation and description of various factors that contribute to adolescents' academic engagement in the PI course from the perspective of students themselves will provide educators, researchers, and policy makers with important insights into the practicalities of PI course design, revision, and implementation, especially in regard of the complex educational and psychological development of adolescents.

## RESEARCH QUESTIONS

The major research question driving this study is: In what ways does the PI course influence high school students' learning engagement? Do students feel more engaged in their learning during and after taking the PI course? If so, what reasons for this do they report?

## THEORETICAL FRAMEWORK

Vygotskian and Deweyan educational theories are used to support this study. It informs the research questions, methodology, and data analysis of this study. Over the last 30 years, research on p4cHI has been viewed through a variety of theoretical perspectives: multicultural educational theory, social constructivism learning theories, learner-centered ideology, identity exploration theories (Makaiau, 2010, 2013), constructive grounded theory (Miller, 2013), social cognitive theory, community of inquiry theory (Jones, 2012), and Deweyan and Vygotskyian theories (Bleazby, 2007; Makaiau and Lukey, 2013). Those previous studies provide the rationale for the selection of Dewey's theory of education and Vygotsky's social constructivism theory for this study.

Graham et al. (2007) argued, "the idea that students must be actively engaged in the learning process in order for it to be

effective is not new. The roots for active learning reach back in the literature to John Dewey" (p. 233). In the 1930s, Dewey proposed the radical transformation of schools that contributed to the creation of career and technical education courses in order to promote student engagement (Fletcher, 2020). According to Dewey, first, academic achievement is positively influenced by the amount of active and collaborative *participation* in the learning process (Dewey, 1997; Coates, 2007). Second, authentic interest can be best achieved when teachers are able to find the students *preferences, needs, and skills* in the subject matter. The planning and teaching, studies, and topics included in the course of study should enrich students' *lives* and consider their *direct interest*. Third, one way to reinvigorate schooling is to make more use of students' *out-of-school experiences*, as they are more likely to encourage reflection. Engagement occurs when students engage in activities related to their interests and competence (Lam, 2013).

In the context of the KHS PI social studies curriculum, students actively engage in their discussion and take the major responsibility for their learning. Learning by doing, or the incorporation of activity and experience in the classrooms, is at the heart of PI class. PI students can "grow in their own natural self-actualizing ways" rather than get trained by imposed knowledge and skills (Schiro, 2008, p. 98). The goals of the PI class are to integrate students' experiences, consider their interests, support active participation, deepen their thinking, and encourage multiple opinions, which are closely connected with Dewey's educational philosophy.

Vygotsky's (1962) sociocultural theory also develops a construct of academic engagement in classrooms. First, academic engagement requires *intellectual* and *affective involvement*. Students' cognitive development occurs with social, emotional, and motivational investment during activities. Second, a social constructivist classroom is a highly *literate place* where students and teachers can exchange ideas effectively. Third, the activities designed in the classrooms, no matter if it is reading or writing, are *shared socially* (Palincsar, 1998). When students participate in challenging activities, the more capable peers and teachers will guide and support the learners' learning and thinking. *Social interaction* thus plays a fundamental and inseparable role in the process of cognitive development (Oakes and Lipton, 1999). Fourth, since *environmental factors* affect students' learning experiences, it is necessary to create a safe and supportive environment in the classroom.

The main Vygotskian theory at work in the PI classroom is the idea that a student's cultural development appears in two levels. First, they raise their own questions in the individual level. Then, they vote and discuss the questions on the social level. Lastly, they internalize the new knowledge and reconstruct their understandings from *interpsychological* to *intrapsychological* level (Cam, 2006). As Philip Cam (2006) writes, "it would be a natural extension of Vygotskian psychology to suggest that children come to think for themselves through the internalization of social practices" (p. 45). In conclusion, Dewey and Vygotsky's theories provide scholars and practitioners with a common language and a frame of references for understanding this research.

# LITERATURE REVIEW

Over 30 years of U.S. and international research, including recent studies done in Hawaii, indicate that the use of PI with a group of students who are supported by trusted facilitators and peers to interact respectfully and critically as they explore intellectually challenging questions, known as an intellectually safe community of inquiry, sharpens students' abilities to "think for themselves" (Lipman et al., 1980, p.53). This activity also positively affects students' cognitive and social–affective abilities, engagement, moral dispositions, and self-confidence (Lukey, 2004; Jones, 2012; Toyoda, 2012; Yos, 2012; Makaiau, 2013). Even so, there has been very little written about the intersection between students' academic engagement and p4cHI in the education of adolescents at a Hawaii public high school. The following section will introduce the meaning of engagement and demonstrate p4cHI researches on adolescents' academic engagement.

## Academic Engagement

Engagement is "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote." Students show engagement by seeking out activities and displaying their curiosity, a desire to learn, and positive emotional responses to the process of learning (Newmann, 1992). Authentic, meaningful engagement, though observable, is an internal action. Zyngier (2008) reviews the psychological definition of engagement as a combination of student behaviors, emotions, and cognitive abilities: Psychological definitions are commonly a mix of (i) *behavioral* aspects of the student as doing the work, following the rules, persisting, and participating, while (ii) the *emotional* aspects center interest, value, and feelings (negative and positive) toward the school, the class, and the teacher, and (iii) *cognitive* engagement (psychological investment) includes motivation, effort, and strategy use of students. These views see student engagement as something students *do* and that teachers can *organize* for them (p. 1769).

This means that in addition to being interested in the academic needs of the students, teachers are deeply concerned with the social, emotional, cognitive, behavioral, and physical state of learners. Teachers are acutely aware of the emotional aspects of learning (Goleman, 1995) and design classroom practices that cultivate the making of meaningful relationships. Learner-centered teachers view building relationships of care and trust as a prerequisite to academic engagement (Bluestein, 2001), including higher levels of cognitive thinking (Noddings, 1992, 2002). However, it is often believed that schools tend to be impersonal spaces that fail to individually and personally engage students (Kohn, 2004). Often, they become "institutions of isolation" (Delpit, 2006, p. 179) that discourage individual development.

The National Research Council published a comprehensive study concerning the lack of engagement in today's public high schools. Many of the students who are retained at schools attend irregularly, exert modest effort on schoolwork, and learn little. This situation can be changed if schools "help the young make sense of life, of experience, and of an unknowable future" (Brady, 2006, p.47). Students are more likely to show both short- and

long-term commitment to learning if the class activities are consistently personally relevant, enjoyable, and appropriately challenging (Csikszentmihalyi et al., 1993; Csikszentmihalyi and Schneider, 2000). When students learn subjects that they are interested in and have autonomy in making choices, they tend to perform better (Pintrick and Schunk, 2002; Stipek, 2002). If students pursue an activity out of genuine interest, their commitment will be both more persistent and more successful than those who do not (Armes, 1992). Research has shown that the more educators give their students choice, control, challenge, and opportunities for collaboration, the more their motivation and engagement are likely to rise (Toshalis and Nakkula, 2012).

Three empirical studies on adolescents' learning, motivation, and reaction to the p4cHI were conducted in the past 10 years. Miller's (2013) research showed that an overwhelming majority of KHS students thought school had no meaningful connection to their lives outside of school. They believed that school was boring and disconnected, but it is necessary to go to college and "make a lot of money." While Miller integrated p4cHI in his English curriculum, students started to personally construct meaning through the practice and improvement of their thinking and reasoning. They were able to discuss and weigh ideas about philosophical issues and contents beyond the English texts. More significantly, the students not only recognized their intellectual growth but also took ownership of their learning process. Jones' (2012) study found that the implementation of a student-centered curriculum that utilizes the p4cHI approach improved student cognitive, social, and emotional engagement, especially student's perception of self as a learner. The findings of this study revealed that there is a strong connection between the level of student personal engagement and student academic and personal success. From 2005 to 2007, Makaiau (2010) worked together with the Asian/Pacific Islander Youth Violence Prevention Center at the University of Hawaii at Manoa to conduct a large−scale qualitative study that involved 89 KHS ethnic studies students. The study found that applying PI in the course, students not only appeared to grow academically but also personally and interpersonally. Academically, the students developed their abilities to construct philosophical questions, gather relevant information for an inquiry from a variety of sources, analyze data, construct a well−reasoned thesis, write, reflect, and participate in a philosophical community of inquiry.

## Philosophy for Children Hawaii (p4cHI)

Since the PI course is grounded in the theory and practice of P4C, it is important to introduce the conception of P4C in this part.

Philosophy for Children began around 1969 when Matthew Lipman (1993, 2003), a Columbia University philosophy professor, became disenchanted with the educational system. He observed that children did not think as well as they could or should in a democratic society. He observed and was concerned that schools encouraged children to have a negative view of their own intellectual abilities. To address these issues, Lipman created a curriculum that incorporated the skills of logic and reasoning found in the practice of philosophy to improve students' thinking in the K–12 setting. In an effort to extend Lipman's original curriculum and vision to a variety of geocultural contexts, a number of P4C Centers have been established worldwide. The Uehiro Academy for Philosophy and Ethics in Education is one of them, which was located at the University of Hawaii at Manoa and was established by the initiator of p4cHI movement, Dr. Thomas Jackson (2012, 2013). Jackson and his colleagues are cultivating a K–12 philosophical schooling experience that encourages students to think collaboratively about meaningful topics and questions that arise from their interests, experiences, and learning contexts.

Jackson's p4cHI has been adapted and expanded Lipman's original P4C to serve the various populations in Hawaiian Islands. It provided a more flexible approach than Lipman's P4C, whose P4C emphasized to incorporate the skills of logic and reasoning found in the practice of philosophy to improve students' thinking (Miller, 2013). Jackson (2017) branched his viewpoints of bringing the primal wonderment of philosophy from opportunities to move away from Lipman's novel and teacher manuals to put more emphasis on the building of *an intellectually safe community* influenced by the Aloha culture, the *"little p" philosophy*, the activity of coinquiry between the teacher and students, the *context and content sensitive* (Makaiau, 2010) learning experiences, and *self-corrective reflection*. In Jackson's (2017) words, his p4c Hawaii views

> philosophical activity as grounded in inquiry, not argument, and to view our content as arising from the interests of the community, highly sensitive to the culture and norms of that community, as well as, in some classroom contexts, discipline specific content such as science, math, language, arts, and social studies. (p. 33)

### An Intellectually Safe Community

The concept of *intellectual safety* is the most important feature of p4cHI approach to education. Jackson (2001) states:

> In an intellectually safe place there are no put-downs and no comments intended to belittle, negate, devalue, or ridicule. Within this place, the groups accept virtually any question or comment, so long as it is respectful of the other members of the circle. What develops is a growing trust among the participants and with it the courage to present one's own thoughts, however tentative initially, on complex and difficult issues. (p. 460)

The p4cHI way of building up a community includes an application of the Hawaiian spirit of *aloha*. Aloha in the Hawaiian language means affection, love, peace, compassion, mercy, goodbye, and hello, among other sentiments of a similar nature. It is this spirit that students can mediate multicultural tensions and build a sense of community between diverse groups of people in the islands (Makaiau, 2017). It is also this sense of intellectual safety that makes participants' interests, cultures, languages, histories, socioeconomic backgrounds, and other aspects of their identities are included and validated during the community development and serves as a basic foundation for PI (Makaiau et al., 2017).

### "little p" Philosophy and p4c Inquiry

Agreeing with Plato and Aristotle, Jackson (2004) believed that philosophy begins in wonder. However, he also argued that in the classroom, philosophical thinking associated with wonder

did not need to be based solely on the Western academic perspective of philosophy, which he called "Big P" philosophy, such as metaphysics, epistemology, ethics, and practice, that is grounded in the Western model of argument such as reasons, premises, and conclusions. There was also what Jackson (2017) called *"little p"* philosophy that stems from the wonder, questions, and thinking of the students with which we all begin our life. Thus, the two important particular features of p4cHI inquiry are *the inquiry arises out of the interests of the students and begins where students are in their understanding*. Because of the "little p," the P4C Hawaii is abbreviated as p4cHI. It enables the students to "properly, rightly, compassionately participate in our diverse worlds with the rich varieties of sounds and actions of those around us" (p. 35).

### Content- and Context-Sensitive p4c Hawaii

Although, in the beginning, the Hawaiian P4C practitioners used Lipman's theories and concepts, soon, they found that Lipman's model of using specific novels and his version of P4C made teachers very difficult to teach content-specific classes in regular classroom practice. It was not easy for teachers to move from the text to "Leading Ideas" to the use of "Exercises" and "Discussion Plans" provided in the manuals. Thus, they adopted a more concretely designed and flexibly implemented p4cHI approach, responding to Lipman's insightful analysis of critical thinking, the "context sensitivity." This approach takes the stance that philosophy is an instructive element of classroom pedagogy and a way of responding to "content" that begins with the questions of the students while it is sensitive to the content being taught and the cultural context of the learning environment (Makaiau and Miller, 2012).

### The Good Thinker's Tool Kit

A p4cHI approach to education encourages teachers and students to brainstorm, implement, and reflect on new ways of incorporating *community, inquiry, philosophy,* and *reflection* into a wide array of subject areas and diverse community contexts. It is based on a set of teaching strategies that can guide teachers to translate those theoretical foundations into classroom practices (Jackson, 2012, p. 6). The entire process of the Plain Vanilla[1], the posing of questions using the Good Thinker's Toolkit, the use of the Community Ball, a sharing of different perspectives including that of the instructor as a coinquirer, and reflecting and evaluating at the end, provides a concrete procedure to transform philosophy and thinking into real classroom practice. The Good Thinker's Tool Kit consists of seven indicators for critical thinking, which is an essential component of the Kailua students' p4cHI practice.

> W—What do you mean by that?
> R—What are the reasons?
> A—What is being assumed? Or what can I assume?
> I—Can I infer ___ from ___? Or where are there inferences made?
> T—Is what is being said true and what does it imply if it is true?
> E—Are there any examples to prove what is being said?
> C—Are there any counter-examples to disprove what is being said?

A considerable number of empirical studies into the effects of P4C have been conducted (Sutcliffe, 2003; Trickey and Topping, 2004, 2006, 2007; Garcia-Moriyon et al., 2005; Topping and Trickey, 2007), and they have produced strong support for the practice of P4C or philosophical community of inquiry, in terms of cognitive, social, and emotional benefits. Yet many of the studies have been more focused on reading, critical thinking, and mathematical abilities than on academic engagement, social, and affective benefits. Additional rigorous studies are needed to examine the psychological benefits of using p4cHI in the classroom.

## MATERIALS AND METHODS

This case study is "interested in uncovering the meaning of a phenomenon" for the PI participants (Merriam, 2009, p. 5). The phenomenon in question is participants' learning engagement in the PI classroom. Do students report feeling more engaged in their learning through p4cHI, and if so, what are the reasons they attribute to this?

### Setting: Kailua High School

Kailua High School was founded in 1955 and was moved to its present location in 1962. With its beautiful views of the Koʻolau mountain range, KHS is one of four public high schools that serve the Windward (eastern side) District on Oahu. The rural communities of Kailua and Waimanalo each provide about 50% of the population of just under 1000 students at KHS (2014 total enrollment = 750), among those just under 60% of the students are native Hawaiian. As more than 40% of the student population comes from low-income families, KHS receives Title I funding. Many students are faced with domestic violence, discrimination, and substance abuse (Makaiau, 2010). The school utilizes programs such as p4cHI and Habits of Mind to prepare mindful, philosophical thinkers who will pursue their life goals and create positive changes in the world (Kailua High School, 2013).

### Participants

Students were recruited from the PI course at KHS in Fall, 2014. Pseudonyms are used to protect the identities of the four girls and two boys. Their ages range from 15 to 17. Five of them are mixed race, and one is Japanese ethnicity.

[1]Plain Vanilla is a strategy for organizing classroom discussion, dialog, and inquiry. It follows five steps: (1) *READ:* Students read or are exposed to some sort of stimulus, such as text, art, music, or video. (2) *QUESTION*: Each student creates a compelling question that was stimulated by the stimulus. (3) *VOTE*: Students vote on a question they want to discuss. (4) *DIALOG, INQUIRY, and DELIBERATION*: During this time, participants are able to provide insights, examples, and counterexamples, and ask questions in order to inquire deeply into the topic behind the question. It is *not* an argument or debate, but considering and exploring multiple perspectives. (5) *REFLECT and EVALUATE*: Closure is created at the end of the inquiry by having each student write or orally share her or his responses to a set of reflective questions.

## Data Sources

This multiple case study uses multiple sources of evidence. The following documents help "uncover meaning, develop understanding, and discover insights relevant to the research problem" (Merriam, 2009, p. 163).

### Class Discussion

The PI class ran for 8 weeks. Five classes were held each week, for 65 min each in the late mornings, except on Wednesdays when class was only 45 min for a total of 35 classes. Students engaged in philosophical inquiries using the Good Thinker's Toolkit and Plain Vanilla (Jackson, 2013) on topics such as racial politics (i.e., race and ethnicity in Hawai'i; what if there were no governments), and gender and society (i.e., Bel Hooks—feminism is for everyone; what is it like to be somebody else). Twenty student class discussions (CDs) out of 35 classes were recorded. The full length of the video-recordings is about 21 h.

### Student Work

Besides CD, additional student work was collected throughout the semester including student handwritten responses in class to a set of open-ended questions or sheets provided to them in the workbook named The Daily Record, PI Student Resources, and Workspace (Makaiau et al., 2014). The following section will describe student work in detail.

#### *Philosophical inquiry daily reflection*

Students used the PI daily reflection (DR) in every class. In the DR, they reflected on the prompt of the day (POD), which was a quote, a short video, a song, a poem, or movie related to the class. They needed to "use textual evidence and/or self-knowledge/experiences to support" their responses (p. 63).

#### *Philosophical insight paper*

Students used philosophical insight paper (PIP) to continue thinking about the topic they philosophized about after each unit (e.g., what is the meaning of life? Am I the same person that I used to be?). The PIP was organized into five sections: (a) Evaluation of the Community of Inquiry; (b) Lenses of PI; (c) Constructed Response using Claims, Assumptions, Supporting Evidence, and Counter-example; (d) Personal Reflection and Action; and (e) References (p. 225). At the end of the semester, each participant submitted two PIPs.

#### *Inquiry memos*

During each Plain Vanilla discussion, students used inquiry memos to record their questions and thoughts, as well as those of their peers. The inquiry memo data were collected after each Plain Vanilla discussion.

#### *Final take-home reflection paper*

In the final take-home reflection paper (FRP), students reflected on their experiences in the PI course at the end of the semester.

### Focus Group Interview

A follow-up focus group regarding student academic engagement with four PI participants (originally there were six participants, but two of them did not continue in the class after mid-term) using a semistructured interview approach (Merriam, 2009) was conducted by the end of the semester.

## Data Analysis

Data from student written work, classroom discussions, and field notes were analyzed, as they were collected. While organizing and analyzing data, NVivo software, Mac trial version, was used.

Analysis of qualitative data occurred in three phases. In phase 1, all qualitative data were entered into the NVivo software, and initial open codes were developed to highlight major themes occurring in each individual case study. The analysis made use of all of the relevant evidences, considered major rival interpretations, and addressed the most significant aspects of each case study. Salient themes that appeared in each individual case study are reported in the format of concept maps and narratives based on the occurrence frequency that was shown in the NVivo software.

In phase 2, using the method of constant comparison (Strauss and Corbin, 1998; Merriam, 2009), similarities, differences, and complementarities across and within participants were examined in a cross-case study analysis. The six cases were studied collectively in order to inquire into similarities and differences in students' learning engagement (Denzin and Lincoln, 1998). A categorical analysis strategy was utilized to break down the narrative data and rearrange those data to produce bigger categories that facilitated comparisons. In order to provide intuitive data analysis results, flow charts were created to tabulate frequency of themes. Concept maps were used to categorize and recombine data.

During phase 3, three types of qualitative data, the CD, daily written reflections, and observation notes; focus group interview; and PIP and final reflection paper were triangulated in order to increase the trustworthiness of the study. The final themes were refined and reread with critical friends.

# RESULTS

This multiple case study consists of six individual case studies of students in the PI class (see **Table 1**). Each student has an individual perspective about an engaging PI classroom that is anchored in his or her life context, but there were several common themes emerged in the cross-case analysis. Based on the frequency count in the NVivo software, the reasons that six participants felt engaged in learning in the PI course are (a) the PI class created an intellectually safe environment that fostered students' learning and development; (b) participants inquired together into the topics and questions that they are really interested; and (c) participating in communities of philosophical inquiries broadened their understandings of themselves and others. Besides that, listening attentively and carefully to their peers and teacher's ideas benefited both themselves and others. Building up a strong community helped them engage in their learning as well. Each participant has their own understanding of an engaged PI classroom. Kalani appreciated how an intellectually safe environment promoted his learning experiences.

**TABLE 1 |** PI participant demographics.

| Participants | Gender | Age | Grade | Ethnicity |
|---|---|---|---|---|
| Kalani | Male | 17 | 12th | Hawaiian, Portuguese, Chinese, Japanese |
| Nahele | Male | 17 | 12th | Caucasian, Japanese |
| Peleke | Male | 16 | 11th | Chinese, Caucasian, Part-Hawaiian |
| Liko | Female | 16 | 11th | Japanese |
| Makali | Male | 15 | 10th | Caucasian, Japanese, German |
| Kanani | Female | 17 | 12th | Hawaiian, Chinese |

> Not being scared or worried that others will judge you. You can express your thoughts or feelings with others who will support you and listen to you. It's a feeling like being with someone you trust or like being with your family who listen to you and hold you up. I see this class as a family and I know I can express myself freely. (CD, 10/16/2014)

Nahele shared in the focus group that he was more engaged in learning in the PI course. The most important reason is that the PI course was interesting, and he could be able to say how they feel about the subjects they learned. For instance, he expressed that:

> I think we are more engaged [without doubt]. Because in other social studies classes, you are not allowed to say how you feel about certain things, you just learn it, you are supposed to read about it, and just accept what you read. While in this class. . .you get to make connections to your life, you get to listen to other people's saying. (FG, 12/18)

Nahele commented after the PI course, he still wondered about the topics discussed in the classroom. He was motivated to come back to the classroom to talk about it again. Peleke believed that communications made learning engaging. Liko thought she was more motivated to learn in the PI course: "I think this class motivates me by like I am never challenged to think outside my own thinking, so yeah [I like this class]." She felt that History was boring, but in the PI course, she could "get to reflect how we feel about it [subjects]" (DR, 12/18). Makali liked the PI course, "because there are actual community" (DR, 10/30). He used a counterexample to describe a class he disliked: "In ethnic studies, last year I didn't know anyone and I hated that class" (DR, 10/20). Kanani's data indicate that peer acknowledgment and support had a strong positive impact on her academic engagement. She appreciated that the PI course inspired to her to think outside of the box.

Based on the cross-case analysis, a conceptual framework of student perceptions of academic engagement in the PI class is presented in **Figure 1**. This was created based on each student's salient themes counted in the NVivo software. In general, the six participants' perceptions of an engaging PI classroom can be categorized into three main themes, which correspond to the three parts of this conceptual framework of a house.

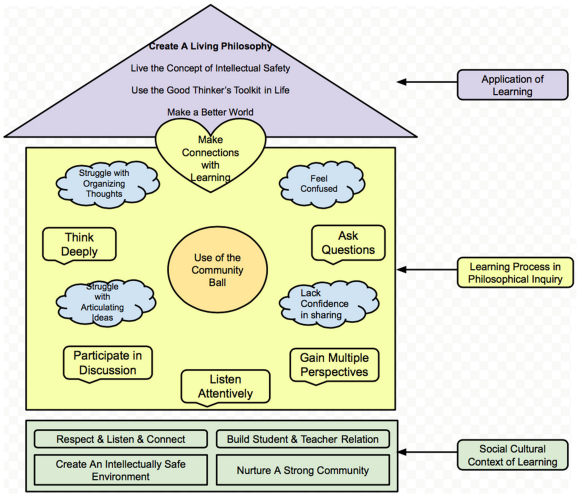


**FIGURE 1 |** The philosophical inquiry student academic engagement framework.

## Social Cultural Context of Learning

Maintaining a safe and positive classroom environment is a fundamental condition for learning. In the conceptual framework, this part is colored in green, representing that a positive classroom culture creates a nurturing foundation for learning. The intellectually safe environment developed a constructive, creative, and methodological culture of thinking and communication. For example, Kalani shared in the classroom that it was his own responsibility to maintain an intellectual safe environment. The intellectual safety set a foundation for a supportive and collaborative learning environment. Kalani explained that in the PI course, "No one was really putted down or felt unsafe, everyone gets along while in the discussion" (CD, 11/6). Peleke realized that even though he had a disagreement or argument against an idea or one person, he could still examine its benefits. He learned to be open-minded and think critically.

In the PI course, the students and teacher cocreated a social–cultural learning context that ensured a deep PI could occur. Prior to the PI class, the students and teacher coconstructed a definition of intellectual safety and made a community ball to facilitate their turn taking. While making the community ball, they began to know each other personally. Participants considered the community ball as a tool that helped them to manage the classroom and engage in coinquiry with their teacher. According to Nahele, the uniqueness of the community ball was that students became respectful and attentive while sharing thoughts. "Because of this, not only does it represent our community, but it also represents the power to speak so that during inquiry, each person who receives the ball is allowed to express their opinion hopefully without interruption" (DR, 10/20).

While engaging in a number of reflective activities and readings that reiterated the importance of intellectual safety and community building, the students began to build up a strong community and a good relationship with their teacher. For instance, the biggest takeaway for Kalani was "just making a bond, and making a strong community" (FG, 12/18). Like Kalani, Nahele appreciated that the class participants built up a strong

community that encouraged the gifts and strengths of every participant and promoted a sense of belonging and purpose. He suggested that his peers "strengthen the community further. . .. we can keep it up. So it's not boring" (CD, 10/21).

Living the concept of intellectual safety, students transformed their learning into an art of democracy. They respected each other's ideas, interests, and needs. They listened attentively to what others had to say, and shared their thoughts genuinely. They were continuously working on cultivating and nurturing a sense of belongingness and connectedness in and out of the class. This social context of learning sets a psychological foundation for students' further learning in the PI.

## Learning Process in Philosophical Inquiry

The learning process in the concept model is colored in yellow, representing the "aha" and mind "sparkling" moments that students experienced. Because the community ball is a symbol of empowerment, it is painted an orange color. The challenges take the shape of a cloud, which means that although the students experienced confusion and struggles, these could nurture new realizations. These activities are in the living area of the house model, representing the daily work of learning and realizing.

The PI class worked to create a learning environment that maximized each learner's ability to interact with each other, especially with the teacher. Kalani expressed his gratitude to his teacher and described that, "I feel good [studying in this classroom]. I love her [the teacher]" (CD, 12/19). Nahele reported that he built a better social relationship with his teacher, and described,

> I guess I feel afraid my teachers in a social level. Because you just walk in the class, you tell them, they just tell you this this, and then you go home, you don't talk them. Miss Shiroma is like, I don't know, you kind of like on a social level, because we know how she thinks and feels about certain topics. And I think it really helps with the whole community building thing. (12/18)

Students were seated in a circle and engaged in PI through social interaction and communication. The class puts a premium on students' inner interests and needs, so students were able to raise questions that they genuinely wondered about. Although there was not always a definitive answer to each question, students were eager to explore the solutions and think alongside each other, appreciating peers who were more able to articulate ideas and explain thoughts. Taking Nahele as a typical example, he explained, "It's good to ask questions and strive to ask more, but even better if everyone make an attempt to answer them" (CD, 11/6). He enjoyed using Good Thinker's Tool Kit to ask questions and used it beyond the classroom. He commented, "Within our community of inquiry, we get more by giving to expand on our discussion" (DR, 10/29). As a fortuitous byproduct of this newfound expanded perception, Nahele was more engaged in his thinking. He demonstrated new connections with his learning as he questioned: "Why does racism exist? Where did racism originate from?" (DR, 12/10). He showed insight into his own thinking when he said, "I'm taking away that maybe everything we do is subconsciously selfish, even if to the smallest degree. Is it purely for other people? Does altruism really exist?" (DR, 10/24) On another day, he explored ideas around morality. "We teach children certain rules of morality growing up. At what point do they become irrelevant in our lives? What are the reasons we disregard them in life?" (DR, 12/18). These internal dialogs indicated that the student had internalized good reasoning skills and were learning to think for themselves.

Using the community ball to issue the invitation, students were empowered to share their personal stories, challenges, raw thoughts, and not clearly formulated ideas. Students enjoyed the academic freedom to explore meaningful and controversial issues that arose from their life and context. Peleke thought he actually was rewarded with more knowledge and more strength. He positively commented that, "From that it actually helps yourself and other people, you are not being one sided, relying that one information" (CD, 10/30). Their discussions were connected with their prior experiences, thoughts, feelings, and ideas, and learned through these experiences in the classroom. Because of this encouraging and safe community of learners, Liko was able to overcome her experiences of insults in other classes.

The PI participants were sometimes confused by their own questions and by those of others during their discussions. They experienced challenges in organizing their thoughts and articulating their ideas. Peleke shared,

> I am walking away with that I need to try to understand more terms. I need to make people understand what I am saying. I just want to have clarification, examples, probably I have to look up some new words to understand and to figure out. (CD, 11/6)

Some students initially lacked confidence in sharing their thoughts. For instance, Kanani exhibited low self-efficacy in her thinking. "I wrote it, but. . .because I. . .I wrote it, I don't think it's a good reflection. I don't understand" (CD, 10/16). She felt it was a risk to share her ideas in the classroom. She explained,

> "I said we need to take certain risk in order for us to move forward. When I didn't wanna share, I think this is the first day in our class, I didn't wanna share, but then I also feel I have to take the risk in sharing in order for our task to move on. (CD, 11/17)

Kanani had a unique challenge that other participants did not share in the PI course, which was that she had to work almost 10 h each day instead of focusing on studies. She appreciated that the PI course inspired to her to think outside of the box. Yet she also experienced many challenges she could not handle during the course, such as articulating her ideas and thinking deeply. All these challenges may result in Kanani's absence from school.

By the end of the semester, students all learned certain reasoning skills (i.e., to raise questions, to make assumptions, to use evidences, to apply the Good Thinker's Tool Kit), as well as to make decisions and solve problems. Students expressed that they appreciated the multiple perspectives gained from their peers, teachers, and guests because they developed an understanding of ideas from a range of areas and obtained the skills, knowledge, and attitude to interpret these ideas and to live their lives better.

### Application of Learning

When engaging in discussions, participants were exposed to multiple perspectives, which inspired them to reflect on their own thinking, examine personal beliefs, and then make changes in their lives. The class awakened students' inner selves and helped them realize their own unique potentials. Peleke increased his confidence in expressing personal beliefs. For example, he wrote,

> I am starting a personal change from taking this course due to the interaction and participation in what p4c feels on a daily basis and also I have become less anxious due to me participating within in the community and sharing my opinions and ideas on the work we are given and at times on my own personal life. (12/18)

They began to think about the purpose and meaning of their lives. Each student actively chose his or her own way to construct the meaning of his or her particular life. They created a living philosophy and applied new learning in how they made decisions and lived their lives. For example, they engaged in PI with friends, and brought the concept of intellectual safety to their family and community. For instance, Makali was involved in p4cHI activities outside of the classroom.

> I would say that this was the fun of this class in order to be able to take this outside.. . . my friend. . .started to really use all the terms, like what are the reasons, can I assume. . .. We ended up having this kind of discussions after lunch after school. It's really interesting. . ..That makes me think deeply about anything. (CD, 11/6)

The PI participants not only took into account their own inclinations and options for a meaningful life but also took into consideration the need for a more humane and democratic society. They started to build a more holistic and integral understanding of themselves and the society. They learned to put their engaging and dynamic reflections into practice. For instance, after learning ethical egoism and altruism, Liko asked, "What I realized is that talking about benefiting ourselves. We talked about having good or bad intentions. I thought, what makes you have these good or bad intentions, and why you act upon them?" (CD, 10/17) Liko began to question human nature and her self-knowledge; she asked, "When I heard everyone, I have more values. What I think is right? What makes me happier? What would I think human nature is?" (CD, 10/28) She also thought about "What is morally right and wrong?" (DR, 12/5) She related her learning to the world problems, and questioned, "Is there really a way to get rid of racism? WATRs [What are the reasons] why we can't get rid of racism?" (DR, 12/10) She showed her care to the environment, and asked "WATRs [What are the reasons] people are so cruel to the environment?" (DR, 12/16)

They were interested in personal happiness and wanted to lead balanced and peaceful lives. They were inspired to strive for ideals of social justice, democracy, and multiculturalism, and to contribute to the public good. In class, they interrogated the social, political, economical, and moral imperatives of society, which helped them through the developmental transition period of adolescence. They discovered the hidden voices of women, children, minorities, nature, and of those who are marginalized. Many of them continued to think about the questions posed in class when they went back home and looked forward to coming back to this class again. These characteristics are placed just under the roof of the house, the highest place. The roof is shaped like a triangle, similar to Maslow's (1968) hierarchy of needs. These skills and purposes will hopefully help students to develop increased self-esteem and self-actualization. This is also one goal of education, making students use the new knowledge and resources around them, and helping them transcend their thinking and living. The color is purple, commemorating royalty, or the best in each of us.

## DISCUSSION

Applying qualitative methods, this study developed a deeper understanding of what classroom contexts, conditions, discourses, tools, and practices promote adolescent learning experience. Referring to the PI Student Academic Engagement Framework (**Figure 1**), the six participants' perceptions of an engaging PI classroom can be categorized into three main themes: First, maintaining a safe and positive classroom environment is a fundamental condition for learning. Second, asking questions, sharing ideas, listening attentively, thinking deeply, and making connections are the manifestations of an engaging classroom in the PI process. Third, students transcend their learning experiences by living a new philosophy.

In the student qualitative data, the most important reason for students to engage in learning, or the most salient theme that appeared, was that the PI class created an intellectually safe environment that fostered students' learning and development. Echoing Vygotsky (1935/1994)'s theory, the context of a social–historical environment can significantly influence students' learning. Maintaining a positive classroom environment is a fundamental condition for students to thrive in learning. Each individual is a socially grounded self, and is "in the ongoing process of living in a social environment" (Campbell, 1995, p. 40). It is necessary for students and teachers to create an intellectually safe environment in the classroom. This understanding gives way to a respect for opposing viewpoints and claims that often arise out of an inquiry. Rather than having differences divert the direction of the inquiry into an argument or popularity contest, an intellectually safe class will recognize, examine, and celebrate them. This awareness is necessary to create a less intimidating classroom environment, allowing for all students to be active contributors to the community of inquiry process.

Participants indicated that the circular seating format and smaller class size helped establish an environment that could free them from some social and emotional stresses. The intellectually safe community provided them with ongoing opportunities to build up connections and relationships among each other. The removal of judgment and fear created a space where, despite their different ethnic backgrounds, beliefs, and worldviews, they could openly share their personal experiences and explore controversial issues with their peers (Makaiau, 2010; Miller, 2013). In the PI classroom, Nahele and Makali often raised their voices and frequently volunteered to contribute. Kalani and

Peleke were more reflective learners who typically developed ideas and questions in their minds before speaking. Liko was a shy student who felt uncomfortable speaking in front of groups, at least initially in the first week of the class. Kanani was not confident in sharing her ideas. These differences may be due to learning preferences as well as personalities. However, a strong community enabled Liko and Kanani and other students with different learning styles and personalities to contribute. Active participants such as Nahele and Makali were able to use the community ball to invite Liko and Kanani to share.

Research showed that "persons with significant difficulties relating to others interpersonally often have related academic struggles in the classroom particularly as they get older" (Winner, 2011, p. 4). Freire (1970) wrote, "Education must begin with the solution of the teacher–student contradiction, by reconciling the poles of the contradiction so that both are simultaneously teachers and students" (p. 72). The teacher added an important dimension to students' social relationships. Teachers were often the more capable peers (Vygotsky, 1978) in the classroom, especially in the beginning that pushed students to think deeper and broader. Teachers are not only facilitators through asking questions such as, "What do you mean by. . ." or "Could you use a specific example to explain. . .," but also participants by contributing their own thinking and ideas to the inquiry. As a coparticipant, teachers become "real" with their students, so an atmosphere of trust is built (Purkey and Novak, 1996, p. 50). As the community matures, the role between teachers and students began to blur, as students' opinions increasingly influenced their teacher or changed their teacher's thinking. Through social interaction, participants, teachers, and students actively created, interpreted, reorganized, and reconstructed knowledge in individual and meaningful ways. The fundamental norms and culture of a classroom were transformed because the PI classroom has achieved a new pattern of teacher-and-student relationship and interaction, making students and teachers more connected.

Described in the foundation part of the house model, when students' basic psychological needs of safety, belongingness, and esteem are satisfied in the classroom, they developed better socially and cognitively in the PI class (Maslow, 1968, 1987). In the p4cHI PI process, participants thought and inquired alongside their peers and their teacher into the topics and questions that they genuinely wondered about. Participants criticized other social studies classes, like history, where they had to memorize facts and events. Knowing students' concerns and motives, the PI course was designed to include, but not limit, and to integrate students' experiences and prior knowledge, consider their interests and needs, support active participation and discussion, deepen their thinking and inquiry, and encourage multiple perspectives. The class created opportunities for students to wonder, discover, explore, and imagine and allowed students to experience what that feels like. They simply found their chosen topics and learning interesting.

Student academic achievement is positively influenced by the amount of active and collaborative participation in the learning process (Coates, 2007). The level of engagement and collaboration, and the excitement among the PI participants while engaging in Plain Vanilla activities reshaped their learning into an esthetic experience because it was full of life and its own form of beauty and spontaneity. They transformed from passive participants to active agents of thought and change in their class and life.

## CONCLUSION

One current crisis in education is that students lack real interpersonal connections. Although contemporary formal education helps students gain tremendous external knowledge, accumulate skills and wealth to become good citizens, and become members of the working force, emphasis on the basics of human life and existence such as health, happiness, and human values is too often overlooked or entirely missing throughout the worldwide educational systems (Ozmon and Craver, 2007). While education and schooling increasingly strive to integrate technology into teaching and learning, high-speed Internet and social communication tools do not seem to strengthen the internal and physical connections among students and communities (Xu, 2013). Younger generations experience this lack of intimacy to a much greater extent. Many adolescents are out of touch with themselves, with others, with nature, with the environment, and with the time they live (Roberts et al., 2009).

Many teachers now cannot fully satisfy students' psychological and social needs in the class. That's one reason that students do not feel engaged in their schooling, or cannot even construct meaning that guides and motivates their future development. Deci and Ryan's (1991, 2008) research summarized that autonomy, competence, and relatedness are the conditions that nurture intrinsic motivation. In the traditional idea of the school, the student's *personhood* is often ignored; their interests, questions, thoughts, personal experiences, beliefs, and curiosity have been disregarded in the process. Yet in the PI environment, students awakened their spirit to wonder, to question, to explore, and to experiment. In addition to being interested in the academic needs of their students, p4cHI teachers are also deeply concerned with the social, emotional, behavioral, and psychological state of learners. The class moved from the notion that their answers, thoughts, and questions were only "right" if students aligned with those of their teacher or textbook, and that only authority figures had correct answers and would explain "what is text about" and "how to answer this question" once they had finished reading (Miller, 2013). As the students were able to overcome these assumptions and realize that their personal experiences, genuine thoughts, once supported by solid evidences and reason and taken seriously by the teacher and the community, they began to intrinsically engage with their learning.

Imagining a world, wouldn't it be nice if educators could make classroom environments grounded in our human curiosity for exploration, own enthusiastic desire to construct our own

self-defined meaning? The p4cHI community of inquiry creates the space and the opportunity for students to make fundamental connections within their individual selves and with other people. It assists students in making connections in their own thinking, between their emotions and their thinking, and other aspects of their self. It fosters better student-and-teacher connections as they participate in cooperative learning. The students were able to use the thinking tools practiced in the community of inquiry as a way to examine their own lives and frozen thoughts, and challenge their beliefs, which allowed them to create personal significance to the academic content.

The study proved that education would cultivate a better self if we provide students with a time and space to reflect and reconnect within themselves, and with others and the world. Such insights may provide suggestions and implications for teachers to implement more effective P4C education in and beyond the Hawaiian Islands.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Hawaii at Manoa. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## AUTHOR CONTRIBUTIONS

LL conducted the research and wrote this manuscript.

## FUNDING

This work was supported by the National Social Science Foundation of China under Grant No. 19CZX049.

## ACKNOWLEDGMENTS

The author thanks Amber Makaiau, Thomas Jackson, Di Xu, Katherine Ratcliffe, and Cheriesse Shiroma-Ming for help with the research and the reviewers for their constructive and insightful comments and suggestions on earlier drafts.

## REFERENCES

Armes, C. (1992). "Achievement goals and the classroom motivational climate," in *Student Perceptions in the Classroom*, eds D. H. Schunk and J. Meece (Hillsdale, NJ: Erlbaum), 327–348.

Bleazby, J. (2007). *Social Construction Learning: Using Philosophy for Children and John Dewey to Overcome Problematic Dualisms in Education and Philosophy*. Doctoral. dissertation, University of New South Wales, Sydney, NSW.

Bluestein, J. (2001). *Creating Emotionally Safe Schools: A Guide for Educators and Parents*. Deerfield Beach, FL: Health Communications, Inc.

Board of Children Youth and Families (2004). *Engaging Schools: Fostering High School Students' Motivation to Learn*. Washington, DC: National Academic Press.

Brady, M. (2006). Why thinking 'outside the box' is not so easy. *Educ. Week* 26, 47–49.

Cam, P. (2006). Philosophy and the school curriculum: some general remarks. Critical and creative thinking. *Aust. J. Philos. Educ.* 14, 35–51.

Campbell, J. (1995). *Understanding John Dewey: Nature and Cooperative Intelligence*. Chicago, IL: Open Court Publishing Company.

Coates, H. (2007). A model of online and general campus-based student engagement. *Assess. Eval. High. Educ.* 32, 121–141. doi: 10.1080/02602930600801878

Csikszentmihalyi, M., Rathunde, K., and Whalen, S. (1993). *Talented Teenagers: The Roots of Success and Failure*. New York, NY: Cambridge University Press.

Csikszentmihalyi, M., and Schneider, B. (2000). *Becoming Adult: How Teenagers Prepare for the World of Work*. New York, NY: Basic Books.

Deci, E., and Ryan, R. (1991). "A motivational approach to self: integration in personality," in *Nebraska Symposium on Motivation, 1990: Perspectives on Motivation*, ed. R. Dienstbier (Lincoln, NE: University Nebraska Press), 237–288.

Deci, E. L., and Ryan, R. M. (2008). Self-determination theory: a macro theory of human motivation, development, and health. *Can. Psychol.* 49, 182–185. doi: 10.1037/a0012801

Delpit, L. (2006). *Other People's Children*. New York, NY: Norton & Company, Inc.

Denzin, N. K., and Lincoln, Y. S. (1998). *Strategies of Qualitative Research*. Thousand Oaks, CA: Sage Publications.

Dewey, J. (1997). *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*. Mineola, NY: Dover Publications.

Eccles, J. S., Wigfield, A., and Shiefele, U. (1998). "Motivation to succeed," in *Social, Emotional, and Personality Development Handbook of Child Psychology*, Vol. 3, ed. N. Eisenberg (New York, NY: Wiley), 1017–1096.

Erikson, E. H. (1963). *Childhood and Society*. New York, NY: Norton.

Fletcher, A. F. C. (2020). *Defining Student Engagement: A Literature Review [Web Log Post]*. Available online at: https://soundout.org/defining-student-engagement-a-literature-review/ (accessed March 12, 2020).

Forbes, E. E., and Dahl, R. E. (2010). Pubertal development and behavior: hormonal activation of social and motivational tendencies. *Brain Cogn.* 72, 66–72. doi: 10.1016/j.bandc.2009.10.007

Freire, P. (1970). *Pedagogy of the Oppressed*. New York, NY: Continuum.

Garcia-Moriyon, F., Robello, I., and Colom, R. (2005). Evaluating philosophy for children: a meta-analysis. *Think. J. Philos. Children* 17, 14–22. doi: 10.5840/thinking20051743

Goleman, D. (1995). *Emotional Intelligence*. New York, NY: Bantum.

Graham, C. R., Tripp, T. R., Seawright, L., and Joeckel, G. L. (2007). Empowering or compelling reluctant participators using audience response systems. *Active Learn. High. Educ.* 8, 233–258. doi: 10.1177/1469787407081885

Hawaii public schools course description catalog (2019). Available online at: https://www.hawaiipublicschools.org/DOE%20Forms/ACCNCourseGuide.pdf (accessed March 12, 2020).

Jackson, T. (2001). "The art and craft of "gently Socratic" inquiry," in *Developing. Minds: A resource Book for Teaching Thinking*, 3rd Edn, ed. A. Costa (Alexandria, VA: Association for Supervision and Curriculum Development).

Jackson, T. E. (2004). Philosophy for children Hawaiian style—"On not being in a rush…". *Think. J. Philos. Children* 17, 4–8. doi: 10.5840/thinking2004171/211

Jackson, T. (2012). Home grown. *Educ. Perspect.* 44, 3–7.

Jackson, T. (2013). "Philosophical rules of engagement," in *Philosophy in Schools: An Introduction for Philosophers and Teachers*, eds S. Goering, N. Shudak, and T. Wartenberg (New York, NY: Routledge), 99–109.

Jackson, T. (2017). Primal wonder. *Polylog* 37, 17–36.

Jones, T. (2012). *Community in the Classroom: An Approach to Curriculum and Instruction as a Means for the Development of Student Cognitive, Social and*

*Emotional Engagement in a High School*. Doctoral. dissertation, University of Hawai'i, Manoa.

Kailua High School (2013). *Habits of Mind [Web log post]*. Available online at: http://kailuahs.k12.hi.us/webmaster/pages/KAILUAHS_HOME.html (accessed December 16, 2013).

Kohn, A. (2004). *What Does it Mean to be Well Educated?* Boston, MA: Beacon Press.

Lam, C. M. (2013). "Education for open society as an educational ideal," in *Childhood, Philosophy and Open Society. Education in the Asia-Pacific Region: Issues, Concerns and Prospects*, Vol. 22 (Singapore: Springer), 41–65.

Lipman, M. (1988). *Philosophy Goes to School*. Philadelphia, PA: Temple University Press.

Lipman, M. (1993). "Philosophy for children," in *Thinking Children and Education*, ed. M. Lipman (Dubuque, IA: Kendall/Hunt Publishing Company), 373–384.

Lipman, M. (2003). *Thinking in Education*. Cambridge: Cambridge University Press.

Lipman, M., Sharp, A., and Oscanyan, F. (1980). *Philosophy in the Classroom*. Philadelphia, PA: Temple University Press.

Lukey, B. (2004). Rethinking dialogue: reflections on P4C with autistic children. *Think. J. Philos. Children* 17, 24–29. doi: 10.5840/thinking2004171/214

Makaiau, A. S. (2010). *Adolescent Identity Exploration in a Multicultural Community Context: An Educator's Approach to Rethinking Identity Interventions*. Doctoral. dissertation, University of Hawai'i, Mānoa.

Makaiau, A. S. (2013). Incorporating the activity of philosophy into social studies: a seven-part philosophical inquiry process. *Quest. Philos. Young People* 13, 15–17. doi: 10.5840/questions20131318

Makaiau, A. S. (2014). *Philosophical Inquiry Curriculum Guide*. Honolulu, HI: The Uehiro Academy for Philosophy and Ethics in Education.

Makaiau, A. S. (2017). "Philosophy for children Hawai'i: a culturally responsive pedagogy for social justice education," in *Inclusion, Diversity and Intercultural Dialogue in Young People's Philosophical Inquiry*, eds C. C. Lin, and L. Sequeira (Rotterdam: Sense Publishers), 99–110.

Makaiau, A. S., and Lukey, B. (2013). A philosopher's pedagogy: a three-part model for school betterment. *J. Acad. Perspect.* 3, 1–18.

Makaiau, A. S., and Miller, C. (2012). The philosopher's pedagogy. *Educ. Perspect.* 44, 8–19.

Makaiau, A. S., Wang, Q. S., Ragoonaden, K., and Leng, L. (2017). "Empowering global P4C research and practice through self-study: The philosophy for children Hawaii International journaling and self-study project," in *The Routledge International Handbook of Philosophy for Children*, eds M. Gregory, J. Haynes, and K. Murris (London: Routledge), 227–235.

Makaiau, A. S., Shiroma, S., Miller, C., and Fukuda, R. (2014). *The Daily Record: Philosophical Inquiry Student Resources and Workspace*. Honolulu, HI: The Uehiro Academy for Philosophy and Ethics in Education.

Marks, H. M. (2000). Student engagement in instructional activity: patterns in the elementary, middle, and high school years. *Am. Educ. Res. J.* 37, 153–184. doi: 10.3102/00028312037001153

Maslow, A. H. (1968). *Toward a Psychology of Being*. Princeton, NJ: Van Nostrand.

Maslow, A. H. (1987). *Motivation and Personality*. New York, NY: Harper & Row.

Merriam, S. B. (2009). *Qualitative Research and Case Study Applications in Education*. San Francisco, CA: Jossey-Bass.

Miller, C. (2013). *Philosophy Goes to High School: An Inquiry into the Philosopher's Pedagogy*. Doctoral. dissertation, University of Hawai'i, Mānoa.

Millett, S., and Tapper, A. (2011). Benefits of collaborative philosophical inquiry in schools. *Educ. Philos. Theory* 44, 546–567. doi: 10.1111/j.1469-5812.2010.00727.x

Newmann, F. M. (1992). *Student Engagement and Achievement in American Secondary Schools*. New York, NY: Teachers College Press Columbia University.

Noddings, N. (1992). *The Challenge to Care in Schools: An Alternative Approach to Education*. New York, NY: Teachers College Press.

Noddings, N. (2002). *Educating Moral People: A Caring Alternative to Character Education*. New York, NY: Teachers College Press.

Oakes, J., and Lipton, M. (1999). *Teaching to Change the World*. Boston, MA: McGraw-Hill.

Ozmon, H., and Craver, S. M. (2007). *Philosophical Foundations of Education*. Upper Saddle River, NJ: Prentice Hall.

p4cHI website (2020). *What's p4cHI [Web Log Post]*. Available online at: http://p4chawaii.org/ (accessed March 12, 2020).

Palincsar, A. S. (1998). Social constructivist perspectives on teaching and learning. *Annu. Rev. Psychol.* 49, 345–375. doi: 10.1146/annurev.psych.49.1.345

Pintrick, P. R., and Schunk, D. (2002). *Motivation in Education, Theory Research, and Applications*. New York, NY: Pearson Education.

Purkey, W. W., and Novak, J. M. (1996). *Inviting School Success: A Self-Concept Approach to Teaching, Learning, and Democratic Practice*. Belmont, CA: Wadsworth, Inc.

Roberts, D. F., Henriksen, L., and Foehr, U. G. (2009). "Adolescence, adolescents, and media," in *Handbook of Adolescent Psychology: Contextual Influences on Adolescent Development*, eds R. M. Lerner and L. Steinberg (Hoboken, NJ: John Wiley & Sons Inc), 314–344.

Schiro, M. S. (2008). *Curriculum Theory: Conflicting Visions and Enduring Concerns*. Thousand Oaks, CA: Sage.

Stipek, D. (2002). *Motivation to Learn: Integrating Theory and Practice*. Englewood Cliffs, NJ: Prentice Hall.

Strauss, A., and Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, CA: Sage Publications.

Sutcliffe, R. (2003). Is teaching philosophy a high road to cognitive enhancement? *Educ. Child Psychol.* 20, 65–79.

Topping, K. J., and Trickey, S. (2007). Collaborative philosophical inquiry for school children: cognitive gains at two-year follow-up. *Br. J. Educ. Psychol.* 77, 787–796. doi: 10.1348/000709907x193032

Toshalis, E., and Nakkula, M. J. (2012). Motivation, engagement, and student voice. *Educ. Dig.* 78, 29–35.

Toyoda, M. (2012). Practicing philosophy for children in the search for a better society. *Educ. Perspect.* 44, 20–21. doi: 10.17730/praa.5.1.k387l37040g1233g

Trickey, S., and Topping, K. J. (2004). Philosophy for children: a systematic review. *Res. Pap. Educ.* 19, 365–380. doi: 10.1080/0267152042000248016

Trickey, S., and Topping, K. J. (2006). Collaborative philosophical enquiry for school children: socio-emotional effects at 10–12 Years. *Sch. Psychol. Int.* 27, 599–614. doi: 10.1177/0143034306073417

Trickey, S., and Topping, K. J. (2007). Collaborative philosophical enquiry for school children: participant evaluation at 11–12 years. *Think. J. Philos. Children* 18, 23–34.

Vygotsky, L. S. (1962). *Thought and Language*. Cambridge, MA: MIT Press.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1935/1994). "The problem of the environment," in *The Vygotsky Reader*, eds R. Van der Veer and J. Valsiner (Oxford: Blackwell), 338–354.

Winner, M. G. (2011). *Social Thinking*. Madison, WI: Department of Educational Services, Metroplitan School District.

Xu, D. (2013). Spiritual heritage and education today. *Int. J. Hum. Soc. Sci.* 3, 42–51.

Yos, T. B. (2012). Raising the bar: love, the community of inquiry, and the flourishing life. *Educ. Perspect.* 44, 52–57.

Zyngier, D. (2008). (Re)conceptualising student engagement: doing education not doing time. *Teach. Teach. Educ.* 24, 1765–1776. doi: 10.1016/j.tate.2007.09.004

**Conflict of Interest:** The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 30 April 2020
doi: 10.3389/fpsyg.2020.00647

# The Role of Active Coping in the Relationship Between Learning Burnout and Sleep Quality Among College Students in China

*Yi Wang[1], Huiwen Xiao[2], Xiaotian Zhang[1] and Li Wang[3]**

[1] Faculty of Education, University of Macau, Macau, China, [2] School of Psychology, Fujian Normal University, Fuzhou, China, [3] School of Psychology, Beijing Sport University, Beijing, China

Learning burnout negatively influences students' learning and well-being. Sleep quality is directly related to students' health and learning outcomes. Research indicates that sleep quality and coping style may be associated with learning burnout. However, the interrelationship among learning burnout, sleep quality, and coping style has not yet been fully studied. This study aimed to explore the relationship between sleep quality and learning burnout and examine whether coping mediates this relationship in Chinese university students. A total of 228 undergraduate students were recruited to participate in this research. The Simplified Coping Style Questionnaire (SCSQ), Learning Burnout Questionnaire (LBQ), and Pittsburgh Sleep Quality Index-Chinese (PSQI-C) were employed to collect data. The results showed the following: (1) poor sleep quality had a positive association with learning burnout, and (2) active coping style mediated the effects of poor sleep quality on learning burnout and the dimensions of learning burnout (depression and low sense of achievement). The findings of the current study contribute to knowledge of learning burnout and provide theoretical evidence for further educational interventions.

**Keywords: sleep quality, coping, learning burnout, college student, well-being**

OPEN ACCESS

***Edited by:***
*Meryem Yilmaz Soylu, University of Nebraska–Lincoln, United States*

***Reviewed by:***
*Carlos Freire, University of A Coruña, Spain*
*Nora Suleiman Martos, University of Granada, Spain*

****Correspondence:***
*Li Wang*
*wangli@bsu.edu.cn*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *22 January 2020*
***Accepted:*** *18 March 2020*
***Published:*** *30 April 2020*

***Citation:***
*Wang Y, Xiao H, Zhang X and Wang L (2020) The Role of Active Coping in the Relationship Between Learning Burnout and Sleep Quality Among College Students in China. Front. Psychol. 11:647. doi: 10.3389/fpsyg.2020.00647*

## INTRODUCTION

University life is rewarding yet challenging, and students may experience many difficult periods and mixed emotions. Especially in regard to academic challenges, researchers have repeatedly found that learning burnout has become a common problem among university students during their educational experience (Lin and Huang, 2012; Chunming et al., 2017; Xu, 2017). Learning burnout can be regarded as an extension of burnout and refers to negative learning mindset, attitudes, and behaviors toward study due to pressure or a lack of learning motivation, which makes people tired (Schaufeli et al., 2002; Zhang et al., 2007). Similar to the concept of burnout, the meaning of learning burnout, which refers more specifically to burnout in academics, has been considered to include emotional exhaustion, cynicism, and low efficacy (Maslach and Jackson, 1981; Lin and Huang, 2014; Ling et al., 2014). Usually, learning burnout varies by gender, with women being more prone to

learning burnout (Castellanos, 2019; Templeton et al., 2019). Higher learning burnout in students has been found to have stronger effects on school achievement and even lead to drop out (Fiorilli et al., 2017). Therefore, it is important to determine the potential variables relating to students' learning burnout in universities and identify means of improving this situation.

The experience of learning burnout has been found to be pervasive among university students across cultures (Ling et al., 2014; Stoliker and Lafreniere, 2015; Vahabi et al., 2018; Zhang, 2019), with negative psychological and behavioral consequences such as depression, anxiety and stress (Koutsimani et al., 2019; Mufarrih et al., 2019); low self-concept and engagement in learning (Widlund et al., 2018); and low academic achievement (Fiorilli et al., 2017). In particular, several studies conducted with Chinese samples have indicated the alarming prevalence of learning burnout in the college student population. For example, Yan et al. (2013), who conducted a survey of universities in Nanjing, China, found that 90.3% of students felt tired of learning. A range of factors that can cause learning burnout, including perceived academic stress, loneliness, and poor sleep quality, have been identified in the literature (Gibbons, 2010; Harvey et al., 2014; Lin and Huang, 2014; Stoliker and Lafreniere, 2015). To better understand the influential factors of learning burnout, a large amount of research has also been conducted to investigate the correlates of this syndrome, such as parenting style and negative perfectionism (Ding et al., 2019), education achievement attribution and academic self-efficacy (Song and Luo, 2018), with intrinsic motivation and teacher affective support (Karimi and Fallah, 2019), and sleep quality and coping style (Gibbons, 2010; Azizollah et al., 2015). Among these correlations, the positive relationships between learning burnout, stress, and loneliness have been extensively discussed (e.g., Lin and Huang, 2012; Fares et al., 2016; Worly et al., 2019). To our knowledge, however, no study has been conducted to assess the relationship between learning burnout, coping style, and sleep quality among Chinese university students. Thus, it is worth surveying how the aforementioned factors affect learning burnout in China.

Sleep is a periodic resting condition of the body and the nervous system that is crucial for university students' learning, performance, and health (Suen et al., 2008; Simon et al., 2020). In particular, poor sleep quality, which is a recurring feature of student life that may affect not only cognitive processes but also recovery from stress and the elimination of fatigue, has been found to be associated with many psychological factors (Lin and Huang, 2012). A previous study also showed that sleepiness increased the possibility of poor school performance (Dewald-Kaufmann et al., 2010; Lin and Huang, 2014), which may cause learning burnout. A few attempts have been made to investigate the relationship between sleep quality and learning burnout. For example, Pagnin et al. (2014) found that learning burnout and sleep disorders showed relevant bidirectional effects in medical students in the early phase of medical school (Pagnin et al., 2014). Furthermore, some studies have shown that the poorer sleep quality people have, the more they experience performance failure and learning burnout (Azizollah et al., 2015). This study explored the relationship between sleep quality and learning burnout among students in universities and the mediating mechanism in this relationship.

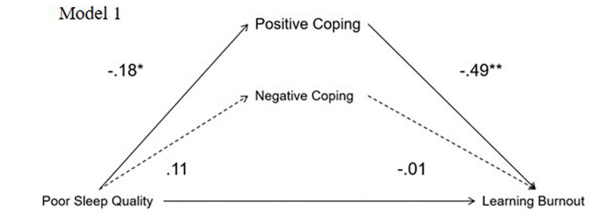


**FIGURE 1 |** Model 1 with learning burnout as dependent variable.
**Correlation is significant at the 0.01 level (2-tailed).

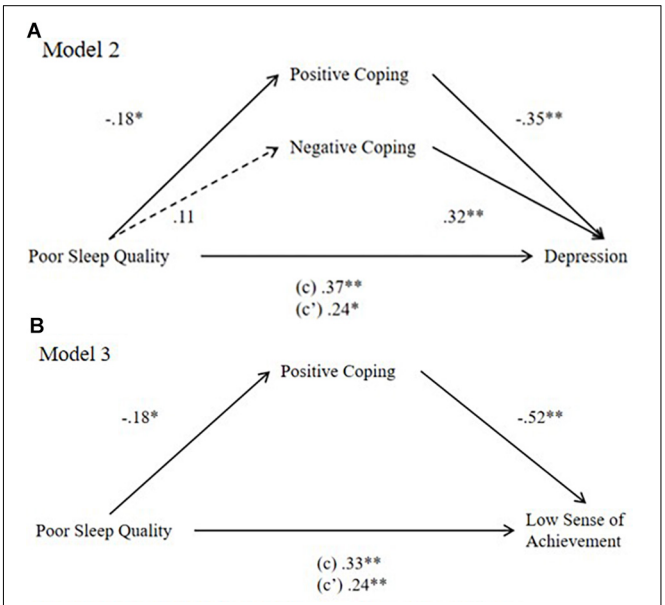


**FIGURE 2 | (A,B)** Models with depression and low sense of achievement as dependent variables. * Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

As the influencing factor of learning burnout and sleep quality, coping style refers to individuals' behavioral and cognitive attempts to overcome or tolerate external and internal challenges or stressors (Skinner et al., 2003) and has been roughly divided into two categories: active coping and passive coping (Li et al., 2014). According to Carver (1997), when dealing with stressors, individuals adopting active coping strategies (1) consider ways to overcome stress and make plans for subsequent efforts, (2) accept the existence of stressful events, and (3) take full advantage of the situation by learning lessons from it or looking at the bright side of the situation. In contrast, individuals applying passive coping strategies (1) refuse to acknowledge the existence of stressful events, (2) give up on making efforts to pursue the goals set under stressful situations, (3) strengthen stressful feelings, and (4) make fun of the stressor. Nonetheless, as coping is highly situational (Carver and Scheier, 1994), empirical evidence indicated that active coping is not always adaptive for stressor. A meta-analysis

by Clarke (2006) revealed that active coping is maladaptive when the stressor is not controllable based on one's ability and available resources (e.g., parental discord, one's best friend moving away). In most cases, therefore, people's coping behaviors can be part of the explanation why exposure to the same stressors may cause burnout in some subjects but not others. For instance, Luo et al. (2016) conducted a survey of 1,112 middle school students and reported that when they encountered difficulties, students who set high standards for their performance and who highly valued self-esteem tended to adopt active coping strategies rather than attempt to escape; they subsequently experienced less learning burnout than those who exhibited the adverse way. Consistent findings have also been found in prior studies that active and effective coping could reduce burnout levels experienced by individuals (Kilfedder et al., 2001; Doolittle, 2007). In a similar vein, Gibbons's (2010) investigation of the relationship between sources of stress and learning burnout among university students revealed that passive coping was a strong predictor of learning burnout. Limited work has been done to characterize coping strategies related to sleep quality. Hofstetter et al. (2005) examined the effects of sleep quality on the coping style and quality of life of patients with schizophrenia, and the results showed that poor sleep quality could impair coping in patients and sustain poor quality of life. Hoyt et al. (2009), on the other hand, tested the impact of coping style on sleep quality; their findings also revealed that frequent use of passive coping strategies led to severe sleep-related disturbance.

Previous research has found limited effects of the educational environment on students' learning burnout. Instead, it has been suggested that sleep quality has a significant influence on university students' learning burnout (Mazurkiewicz et al., 2012; Pagnin et al., 2014; Azizollah et al., 2015). Moreover, a large number of studies have suggested the potential impact of coping style on students' learning burnout, demonstrating a close association between sleep quality and coping style as well as between coping style and learning burnout for students in universities. Thence, through deductive reasoning, the present study investigated the mediation effect of coping style on the relationship between sleep quality and learning burnout. The study hypothesized that (1) Sleep quality could negatively predict college students' learning burnout. (2) Coping style mediated the relationship between sleep quality and learning burnout.

# MATERIALS AND METHODS

## Participants

The study participants were 228 Chinese college students. The participants were sampled with an online self-report survey. In total, 300 responses to the online survey were received. In the primary analysis, after the incomplete questionnaires and outliers were removed, 228 responses remained, for a valid rate of 76%. Among the students, 81 were male (35.5%), and 147 were female (64.5%). Their ages ranged from 18 to 30 years old ($M$ = 22.18). This study adhered to the ethical principles of human subjects and was approved by the Ethics Board of the School of Psychology, Beijing Sport University.

## Instruments

### Simplified Coping Style Questionnaire (SCSQ)

Coping style was measured with the Simplified Coping Style Questionnaire (SCSQ) (Xie, 1998). This questionnaire is a four-point Likert self-report questionnaire that includes 20 items divided into two dimensions: active and passive coping styles. Participants are asked to evaluate their frequency of engagement in certain behaviors as "Never," "Occasionally," "Sometimes," or "Often." The active coping dimension is composed of items 1 to 12, which mainly reflect active coping strategies an individual use when encountering stress, such as "trying to see things in as good of a way as possible" and "identifying several different ways to solve problems." The passive coping dimension consists of items 13–20, which mainly reflect passive coping strategies that an individual use when encountering stress, such as "relieving troubles through smoking and drinking" and "fantasizing that some miracle may happen to change the *status quo*." The SCSQ was shown to be valid and reliable in the original study, and the Cronbach's α of the subscales ranged from 0.73 to 0.80 in the present study. The SCSQ score reflects participants' coping style preferences, with a higher score indicating a higher possibility that the participant would adopt the relevant coping style.

### Learning Burnout Questionnaire (LBQ)

The Learning Burnout Questionnaire (LBQ) developed by Lian et al. (2005) was used to measure the learning burnout of college students. This scale employs a five-point Likert response scale with 20 items across three factors: a low sense of achievement (eight items), take example as "It's not easy for me to master the professional knowledge only when I take the exam," misconduct (six items), like "I only study when I have an exam," and depression (six items), such as "I feel exhausted after studying all day." Participants are asked to subjectively evaluate items in accordance with their experience using the following response options: 1—"Strongly disagree," 2—"Disagree," 3—"Neutral," 4—"Agree," and 5—"Strongly Agree." All factor scores are summed to calculate the total score, and higher scores indicate higher levels of learning burnout, which is categorized as follows: low ($<$33), average (33–66), and high ($>$66). Regarding the overall internal consistency, the Cronbach's α was 0.93, and for the individual dimensions, the Cronbach's α values were 0.88 for depression, 0.79 for misconduct, and 0.81 for low sense of achievement, which proves that the scale has acceptable internal consistency reliability.

### Pittsburgh Sleep Quality Index-Chinese (PSQI-C)

The Pittsburgh Sleep Quality Index (PSQI) was used to assess an individuals' quality of sleep in the last 30 days. Liu et al. (1996) translated the original PSQI developed by Buysse et al. (1989) into the Chinese version of the PSQI, which includes the following seven components and uses a specific calculation formula: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, and daytime dysfunction. Each component scale has a score of 0–3, with a higher total score indicating worse sleep quality. The component scale scores are summed to determine the total score, which is categorized as follows: good (0–5), fairly good (6–10), normal (11–15), and bad

(16–21). The PSQI was validated by Buysse et al. (1989) and showed good reliability, with a Cronbach's α of 0.83. The Chinese version of the PSQI was tested and found to be a valid clinical instrument with good reliability. The Cronbach's α was 0.84 in the previous study (Buysse et al., 1989) and 0.75 in the current study.

## Procedure

The study was conducted via the Internet, and participation was voluntary. All the participants were informed about the general aim of the research and the anonymity of their data. After providing informed consent and demographic information, the participants completed the SCSQ and LBQ and then the PSQI-C. Two control questions assessing the seriousness of participation were included in this survey. The estimated completion time was approximately 15 min.

## Data Analyses

Data analyses were performed using SPSS 19.0 and AMOS 23.0. The statistical results are displayed as the mean, standard deviation, and percentage. Gender differences were analyzed using a t-test. Correlation and regression analyses were conducted to analyze the relationships between variables. The model fit of the structural equation models and the mediating effects of coping style were tested by using AMOS 23.0. To investigate whether active coping style mediated the relationship between learning burnout and poor sleep quality, a bootstrapping procedure was performed in which the 95% *CIs* and 2,000 bootstrapping samples were used. With this method, multiple samples are taken from a set of data to approach the true sampling distribution. If the *CIs* computed for the effects do not include 0, then the effects are significant (Hayes and Scharkow, 2013). First, we explored coping style as a mediator between learning burnout and poor sleep quality. Three mediation models were investigated. Poor sleep quality was the independent variable, and coping style (active or passive coping style) was the mediator. In the first model, the learning burnout total score was the dependent variable; in the remaining two models, depression and low sense of achievement were the dependent variables.

# RESULTS

## Gender Differences in Learning Burnout, Coping, and Sleep Quality

Overall, a moderate level of learning burnout ($M$ = 49.50, $SD$ = 9.49) was found in Chinese college students. Regarding the dimensions of learning burnout, the depression score was moderate ($M$ = 2.55, $SD$ = 0.830), and the misconduct ($M$ = 2.59, $SD$ = 0.44) and low sense of achievement ($M$ = 2.26, $SD$ = 0.60) scores were not high. Gender differences in the low sense of achievement dimension of learning burnout were significant, $t = 2.074$, $p < 0.05$. Females ($M$ = 2.15, $SD$ = 0.50) presented lower achievement than males ($M$ = 2.31, $SD$ = 0.64). There were no significant gender differences in depression, $t$ = 1.31, $p > 0.05$, and misconduct, $t$ = 1.58, $p > 0.05$. Based on a comparison of the average coping style scores, college students tended to use active coping ($M$ = 3.02, $SD$ = 0.42) rather than passive coping ($M$ = 2.45, $SD$ = 0.49), $t$ = 13.317, $p < 0.001$. There were no significant gender differences in coping in the current study (active coping, $t$ = 0.408, $p > 0.05$; passive coping, $t$ = 1.935, $p > 0.05$). Overall, sleep quality was fairly good ($M$ = 6.99, $SD$ = 2.92). Gender differences were not found in sleep quality, $t$ = 0.935, $p > 0.05$. **Table 1** shows the correlations between learning burnout, sleep quality, and coping style. Preliminary analysis of the correlations among variables indicated that there was a moderate positive correlation between learning burnout and sleep quality ($r = 0.213$, $p < 0.01$), with high learning burnout associated with a high level of poor sleep quality.

In addition, there was a moderate positive relationship between learning burnout and passive coping style ($r$ = 0.327, $p < 0.01$), with high learning burnout associated with high levels of passive coping style. Furthermore, the results suggested a moderate negative correlation between learning burnout and active coping style ($r = -0.226$, $p < 0.01$).

## Sleep Quality and Coping Style as Direct Predictors of Learning Burnout

One predictor, namely, poor sleep quality, was entered into linear regressions that were conducted to explain the relationships among learning burnout, coping, and the dimensions of learning burnout and coping (see **Table 2**). A stepwise regression model was proposed to explain the variation in learning burnout. The changes in the regression models are shown in **Table 3**. Coping style ($x_2$ and $x_3$) was entered into the regressions after poor sleep quality ($x_1$). The equation of the regression models is as follows:

$$Y_1 = \beta_0 + \beta_1 (x_1) + \beta_2 (x_2) + \beta_3 (x_3) + e_1$$
$$Y_2 = \beta_0 + \beta_1 (x_1) + \beta_2 (x_2) + \beta_3 (x_3) + e_2$$
$$Y_3 = \beta_0 + \beta_1 (x_1) + \beta_2 (x_2) + \beta_3 (x_3) + e_3$$
$$Y_4 = \beta_0 + \beta_1 (x_1) + \beta_2 (x_2) + \beta_3 (x_3) + e_4$$

Notes: $Y_1$, learning burnout; $Y_2$, depression; $Y_3$, misconduct; $Y_4$, low sense of achievement, $b_0$, constant; $\beta_1$, $\beta_2$, $\beta_3$, regression coefficients; $x_1$, poor sleep quality; $x_2$, active coping; $x_3$, passive coping; e, error.

The results showed that poor sleep quality and coping style explained 24.1% of the variance in learning burnout, $F_{(3,\ 224)} = 23.75$, $p < 0.001$. Poor sleep quality ($\beta_1 = 0.228$, $t = 3.824$, $p < 0.001$), active coping style ($\beta_2 = -0.252$, $t = 4.181$, $p < 0.001$), and passive coping style ($\beta_3 = 0.353$, $t = 5.917$, $p < 0.001$) were associated with learning burnout. Poor sleep quality and coping style explained 19.5% of the variance in the depression dimension of learning burnout, $F_{(3,224)} = 18.06$, $p < 0.001$. Poor sleep quality ($\beta_1 = 0.188$, $t = 3.067$, $p < 0.01$), active coping style ($\beta_2 = -0.300$, $t = 4.831$, $p < 0.001$), and passive coping style ($\beta_3 = 0.265$, $t = 4.316$, $p < 0.001$) were associated with depression. Poor sleep quality and coping style explained 68.6% of the variance in the misconduct dimension of learning burnout, $F_{(3,224)} = 163.452$, $p < 0.001$. Active coping style ($\beta_2 = 0.420$, $t = 10.823$, $p < 0.001$) and passive coping style ($\beta_3 = 0.641$, $t = 16.718$, $p < 0.001$) were associated with misconduct, while poor sleep quality was not a significant predictor of misconduct ($\beta_1 = -0.002$, $t = 0.039$, $p = 0.969$).

**TABLE 1 |** The correlations among learning burnout, sleep quality, and coping styles.

| Factors | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AC | – | | | | | | | | | | | | |
| 2 | PC | 0.184** | – | | | | | | | | | | | |
| 3 | PQSI | −0.088 | 0.276** | – | | | | | | | | | | |
| 4 | SSQ | −0.170 | 0.090 | 0.508** | – | | | | | | | | | |
| 5 | LS | −0.092 | 0.125 | 0.661** | 0.481** | – | | | | | | | | |
| 6 | SP | 0.067 | 0.166* | 0.486** | 0.139* | 0.159* | – | | | | | | | |
| 7 | SE | 0.005 | 0.038 | 0.404** | −0.158* | −0.010 | 0.019 | – | | | | | | |
| 8 | SD | −0.083 | 0.206** | 0.619** | 0.214** | 0.257** | 0.354** | 0.068 | – | | | | | |
| 9 | DD | −0.113 | 0.200** | 0.580** | 0.353** | 0.366** | 0.121 | −0.040 | 0.406** | – | | | | |
| 10 | LB | −0.226** | 0.327** | 0.213** | 0.302** | 0.141* | 0.120 | −0.137* | 0.214** | 0.354** | – | | | |
| 11 | DP | −0.283** | 0.227** | 0.164* | 0.263** | 0.112 | 0.066 | −0.140* | 0.208** | 0.333** | 0.946** | – | | |
| 12 | MC | 0.538** | 0.718** | 0.244** | −0.015 | 0.092 | 0.226** | 0.050 | 0.164* | 0.123 | 0.186** | 0.014 | – | |
| 13 | LA | −0.465** | −0.082 | 0.080 | 0.322** | 0.097 | 0.028 | −0.140* | 0.060 | 0.227** | 0.753** | 0.639** | −0.266** | – |
| | Skewness | −0.335 | −0.105 | 0.854 | 0.396 | 0.264 | 0.824 | 0.017 | 0.748 | 0.081 | 0.058 | 0.190 | 0.087 | 0.360 |
| | Kurtosis | −0.136 | −0.228 | 1.023 | 0.727 | −0.710 | 0.177 | −1.442 | 0.953 | −0.616 | −0.608 | −0.778 | 0.278 | −0.322 |
| | *M* | 3.020 | 2.453 | 6.991 | 1.013 | 1.377 | 0.693 | 1.482 | 1.232 | 0.917 | 2.467 | 2.552 | 2.593 | 2.255 |
| | *SD* | 0.418 | 0.487 | 2.916 | 0.640 | 0.914 | 0.741 | 1.155 | 0.525 | 0.648 | 0.441 | 0.830 | 0.438 | 0.600 |

*$^*p < 0.05$, $^{**}p < 0.01$. PC, passive coping; AC, active coping; LB, learning burnout; DP, depression; MC, misconduct; LA, low sense of achievement; SSQ, subjective sleep quality; LS, Latent sleep; SP, sleep persistence; SE, sleep efficiency; SD, sleep disorder; DD, daytime dis-function; PQSI, the pittsburgh sleep quality index.*

**TABLE 2 |** The prediction of poor sleep quality on variables.

| Predictor | Dependent variables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Active coping | | Passive coping | | Learning burnout | | Depression | | Misconduct | | Low sense of achievement | |
| | *B* | *SE* | *B* | *SE* | *B* | *SE* | *B* | *SE* | *B* | *SE* | *B* | *SE* |
| Constant | 37.585 | 0.616 | 19.07 | 0.483 | 14.988 | 0.375 | 17.651 | 0.798 | 15.619 | 0.327 | 11.695 | 0.424 |
| PSQ | −0.170* | 0.514 | 0.09 | 0.404 | 0.302*** | 0.313 | 0.263*** | 0.666 | −0.015 | 0.273 | 0.322*** | 0.354 |
| $R^2$ | 0.029 | | 0.008 | | 0.091 | | 0.069 | | 0.000 | | 0.104 | |
| *Adjusted* $R^2$ | 0.025 | | 0.004 | | 0.087 | | 0.065 | | −0.004 | | 0.100 | |
| *F* | 6.703* | | 1.856 | | 22.727*** | | 16.791*** | | 0.050 | | 26.160 | |

*$^*p < 0.05$, $^{***}p < 0.001$.*

**TABLE 3 |** The changes of models after enter coping styles into regression analysis.

| Model | Y1 | | Y2 | | Y3 | | Y4 | |
|---|---|---|---|---|---|---|---|---|
| | *B* | *SE* | *B* | *SE* | *B* | *SE* | *B* | *SE* |
| Constant | 15.500 | 1.573 | 23.966 | 3.405 | −0.898 | 0.841 | 23.431 | 1.747 |
| PSQ | 0.228*** | 0.294 | 0.188** | 0.637 | −0.002 | 0.157 | 0.254*** | 0.327 |
| PC | 0.353*** | 0.048 | 0.265*** | 0.105 | 0.641*** | 0.026 | −0.028 | 0.054 |
| AC | −0.252*** | 0.038 | −0.300*** | 0.082 | 0.420*** | 0.020 | −0.478*** | 0.042 |
| $R^2$ | | 0.241 | | 0.195 | | 0.686 | | 0.278 |
| *Adjusted* $R^2$ | | 0.231 | | 0.184 | | 0.682 | | 0.268 |
| *F* | | 23.752** | | 18.060*** | | 163.452*** | | 28.767*** |
| $\Delta R^2$ | | 0.050 | | 0.034 | | 0.686 | | 0.174 |
| $\Delta F$ | | 14.624** | | 9.408** | | 245.099*** | | 27.054*** |

*$^{**}p < 0.01$, $^{***}p < 0.001$. Y1, learning burnout; Y2, depression; Y3, misconduct; Y4, low sense of achievement; PSQ, poor sleep quality; PC, passive coping; AC, active coping.*

Poor sleep quality and coping style explained 27.8% of the variance in the low sense of achievement dimension of learning burnout, $F_{(3,224)} = 28.767$, $p < 0.001$. Active coping style ($\beta_2 = -0.417$, $t = 7.091$, $p < 0.001$) and poor sleep quality ($\beta_1 = 0.254$, $t = 4.371$, $p < 0.001$) were associated with low sense of achievement, and passive coping style did not

**TABLE 4 |** Indicates for three models.

| Model | $\chi^2$ | $\chi^2$/df | *CFI* | *GFI* | *AGFI* | *NNFI* | *RMSEA* |
|---|---|---|---|---|---|---|---|
| Model 1 | 102.732 | 5.707 | 0.837 | 0.907 | 0.814 | 0.814 | 0.144 |
| Model 2 | 140.916 | 1.409 | 0.965 | 0.926 | 0.900 | 0.958 | 0.042 |
| Model 3 | 45.539 | 1.084 | 0.995 | 0.965 | 0.945 | 0.993 | 0.019 |

significantly predict low sense of achievement ($\beta_3 = -0.028$, $t = 0.478$, $p = 0.633$).

## Active Coping Mediates the Relationship Between Sleep Quality and Learning Burnout

The indices of model fit were $\chi^2$, $\chi^2$/df, CFI, GFI, AGFI, NNFI, and RMSEA, which are common SEM fit indices. $\chi^2$ more easily reaches significance when the sample size (n) is more than 200 due to its sample size sensitivity. It is best if the SEM statistic $\chi^2$/df is less than 5, which indicates a good model fit. A CFI of more than 0.9 was used as an indicator of the acceptability of the model (Li, 2006). The GFI evaluates the closeness between a model and the observed covariance matrix. GFI, AGFI, and NNFI values greater than 0.9 are considered acceptable (Bentler and Bonett, 1980; Bentler, 1983). The RMSEA indicates how well the model fits the data, and a value below 0.8 indicates a fair fit (McDonald and Ho, 2002). The fit indices for models 1–3 are listed in **Table 4**.

Model 1 in **Figure 1**, with learning burnout as the dependent variable, showed indirect effects. Poor sleep quality had a positive total effect on learning burnout (β = 0.33, $p < 0.01$, 95% CI = 0.20, 0.47). Poor sleep quality had a negative effect on active coping (β = −0.18, $p < 0.05$, 95% CI = −0.20, −0.01). Active coping had a negative effect on learning burnout (β = −0.49, $p < 0.01$, 95% CI = −8.48, −2.68). Poor sleep quality had a significant direct effect on learning burnout (β = 0.09, $p < 0.01$, 95% CI = 0.01, 0.38) and a positive indirect effect on learning burnout (β = 0.61, $p < 0.05$, 95% CI = 0.01, 0.18). Passive coping had no significant mediating effect between poor sleep and learning burnout.

Model 2 in **Figure 2**, with depression as an outcome, showed indirect effects. The model fit was better than that of model 1. Poor sleep quality had a positive total effect on depression (β = 0.27, $p < 0.01$, 95% CI = 0.17, 0.56) and a negative effect on active coping (β = −0.18, $p < 0.05$, 95% CI = −0.20, −0.01). Active coping had a negative effect on depression (β = −0.35, $p < 0.01$, 95% CI = −1.20, −0.48). Poor sleep quality had a significant direct effect (β = 0.24, $p < 0.05$, 95% CI = 0.04, 0.33) and a positive indirect effect (β = 0.13, $p < 0.01$, 95% CI = 0.04, 0.24) on depression.

Model 3 in **Figure 2**, with a low sense of achievement of learning burnout as an independent variable, showed indirect effects. The model had a good fit. Poor sleep quality had a positive total effect on low sense of achievement (β = 0.33, $p < 0.01$, 95% CI = 0.21, 0.47) and a negative effect on active coping (β = −0.18, $p < 0.05$, 95% CI = −0.20, −0.01). Active coping had a negative effect on low sense of achievement (β = −0.53, $p < 0.01$, 95% CI = −1.19, −0.56). Poor sleep quality had a significant direct effect (β = 0.24, $p < 0.01$, 95% CI = 0.11, 0.38) and a positive indirect effect (β = 0.18, $p < 0.05$, 95% CI = 0.01, 0.19) on low sense of achievement.

As mentioned before, gender differences in low sense of achievement were observed. Therefore, a multigroup invariance analysis was conducted to test the stability of model 3 to ensure that it was suitable for both males and females. The indicators shown in **Table 5** illustrate that there were no gender differences in model 3.

# DISCUSSION

In general, our study confirmed the significant relationship between burnout and negative psychological states, which has been repeatedly identified in quite a few prior studies across diverse disciplines, as reported in a recent systematic review conducted by Koutsimani et al. (2019). The previous robust evidence that paved the way for this study focused on learning burnout to explore its association with university students' sleep quality and coping styles. This study first examined the relationship between learning burnout, sleep quality, and coping in female and male college students. The results indicated that compared to women, men scored significantly higher on low sense of achievement, one of the subscales of the LBQ. Men experienced significantly greater learning stress than women, which might have been related to their personality traits, such as high conscientiousness, while low extraversion might be associated with girls' academic achievement (Janošević and Petrović, 2019). In this study, the hypothesis that sleep quality would negatively affect students' learning burnout was supported. It was found that poor sleep quality was a predictor of learning burnout. Additionally, poor sleep quality was a predictor of depression and a low sense of achievement. In addition, the hypothesis that coping style would mediate the relationship between sleep quality and learning burnout was supported. Active coping style played a mediating role in the relationship between poor sleep quality and depression and in the relationship between poor sleep quality and low sense of achievement among students. Passive coping style did not have significant mediating effects on the relationship between poor sleep quality and learning burnout.

The findings from the current study echo previous studies on the topic of learning burnout. We found a weak positive correlation between poor sleep quality and learning burnout in Chinese college students. Similar findings of negative correlations between learning burnout and sleep quality were described in a previous study (Yan et al., 2018). Yan et al. (2018) found that adolescent academic stress was indirectly associated with sleep quality through the mediating effect of school burnout

**TABLE 5 |** Gender invariance testing.

| Model | $\chi$ 2 | df | CFI | GFI | AGFI | NNFI | SRMR | RMSEA | $\Delta\chi$ 2 | $\Delta$ df |
|---|---|---|---|---|---|---|---|---|---|---|
| Unconstrained | 91.212 | 84 | 0.989 | 0.934 | 0.897 | 0.985 | 0.067 | 0.019 | – | – |
| Fully constrained | 104.105 | 95 | 0.986 | 0.926 | 0.897 | 0.984 | 0.084 | 0.021 | 12.893 | 11 |

and depression. Previous studies have suggested that sleepiness increases poor academic performance (Pagnin et al., 2014), which leads to psychological distress and negative emotions, possibly causing learning burnout (Dewald-Kaufmann et al., 2010; Lin and Huang, 2014; Wolf and Rosenstock, 2017). However, it was found in the present study that there was no significant association between poor sleep quality and misconduct. Beebe (2011) observed that inadequate sleep could cause problems with cognition, behavior, or other functions in Western children (Beebe, 2011). Willis and Gregory (2015) also reported that poor subjective sleep quality was associated with children's behavioral problems (Willis and Gregory, 2015). Participants in the present study were college students, who are not as sensitive as children (Park et al., 2001), and their average sleep quality was good and was not characterized as pathological. Furthermore, although misconduct is generally considered a part of burnout, research has shown that misconduct is not applicable to all situations or to all individuals (Garden, 1987). This study found that poor sleep quality could predict learning burnout, depression, and low sense of achievement but could not predict misconduct. Garden (1987) also observed that misconduct is a type-specific concept that is not applicable to the prediction of learning burnout based on sleep quality.

This study found that an active coping style may help students mediate the effects of poor sleep quality on learning burnout. Models 1–3 were consistent with the hypothesis that coping style mediates the effects of sleep quality on depression and a low sense of achievement in college students. This finding is similar to those of previous studies that revealed that sleep quality and coping style were both independent predictors of learning burnout (Pagnin et al., 2014; Vizoso et al., 2019). Sleep quality, as an important factor in students' health, has a crucial impact on mental well-being and emotions. Poor sleep quality directly affects learning burnout and its two dimensions. A possible interpretation is that an unstable sleep schedule and sleep deprivation can lead to serious psychological and health consequences, while an optimized sleep mode can improve students' neurocognition and academic performance (Curcio et al., 2006; Dewald-Kaufmann et al., 2010; Lin and Huang, 2014). Moreover, sleep indirectly affects learning burnout through coping: sleep influences coping style, and coping affects academic stress and improves learning burnout. Hofstetter et al. (2005) reported that poor quality sleep was negatively correlated with active coping. This study further confirmed the causal relationship between the two variables, which may be due to poor sleep quality, weakening one's ability to find positive ways to handle stress and desire to achieve personal growth. Active coping can alleviate academic pressure and the negative effects of learning burnout among college students (Azizollah et al., 2015). Therefore, sleep can indirectly affect learning burnout through coping. Therefore, our study revealed that an active coping style played a mediating role between sleep quality and learning burnout and its dimensions, while a passive coping style did not. As in previous studies, passive coping significantly predicted depression (Guerrero, 2003; Ramírez et al., 2018; García-Arroyo and Segovia, 2019). However, no significant relationship between passive coping and sleep quality, or even a mediating effect of passive coping, was found. A previous study reported that people with poor sleep quality had more difficulty regulating their negative emotions and that passive coping could alleviate sleep disorders (Sandru and Voinescu, 2014). Unlike previous studies, this study showed that students tended to use active coping. According to Andreotti et al. (2013), active coping allows students to engage in consistent reassessments, thus, reducing the occurrence of negative results.

This study primarily examined the mediating role of active coping style between sleep quality and learning burnout and the dimensions of learning burnout in Chinese college students. The findings from this study contribute to knowledge about learning burnout and how to improve and prevent it among university populations. Foremost, the findings extend previous educational research on the association between poor sleep quality and learning burnout, which showed that these factors not only were related but also negatively affected students' academic performance (Curcio et al., 2006). Moreover, previous scholars have focused on the relationship between the two variables, and a few have focused on the mediating effects of factors such as coping style. The present study found that coping style is a potential mediating factor of learning burnout, particularly in the relationship between sleep quality and learning burnout. Accordingly, an active coping style may be suggested as a target factor for interventions related to the influence of poor sleep quality on students' learning burnout.

However, the present study had some limitations. One limitation was that we do not know whether the findings might have been affected by other confounding factors, such as effort control, self-efficacy, and social support (Dahlin et al., 2007; Johnson et al., 2008; Diaz et al., 2016). In addition, although the sample size of 228 was sufficient for the path analyses (which required a sample size of more than 200), it may have been a limitation within this study. Finally, the data were obtained from self-assessments that showed inaccuracies due to memory bias. As learning burnout constantly changes during a semester, a longitudinal tracking study may be needed for further exploration. Further research should be done on more than one factor. Preferably, social support should be considered a

confounding factor in the relationship between learning burnout and sleep quality that may influence the levels of learning burnout. Moreover, future studies should recruit a larger sample of participants to measure group invariance by gender. Likewise, larger samples include more diversity, which could increase the generalizability of the results. Finally, future research should focus on the development and evaluation of interventions and prevention programs to accurately manage college students' coping styles, which could reduce learning burnout.

## CONCLUSION

The present study demonstrated that sleep quality has a negative effect on learning burnout and the dimensions of learning burnout in Chinese college students. An active coping style mediates the effects of sleep quality on learning burnout. Therefore, promoting an active coping style and high sleep quality may effectively contribute to the improvement of learning burnout.

## DATA AVAILABILITY STATEMENT

Requests to access the datasets should be directed to the first author YW (mb84822@um.edu.mo).

## ETHICS STATEMENT

This study was consistent with the ethical principles of human subjects and had been approved by The Ethics Board of the School of Psychology, Beijing Sport University.

## AUTHOR CONTRIBUTIONS

YW, HX, XZ, and LW contributed to the conception and structure of the manuscript and wrote the manuscript. YW carried out the data collection and conducted the data analysis.

## REFERENCES


Andreotti, C., Thigpen, J. E., Dunn, M. J., Watson, K., Potts, J., Reising, M. M., et al. (2013). Cognitive reappraisal and secondary control coping: associations with working memory, positive and negative affect, and symptoms of anxiety/depression. *Anxiety Stress Coping* 26, 20–35. doi: 10.1080/10615806.2011.631526

Azizollah, A., Hashemi, S. M., Sharif, M. R., and Alizadeh, K. H. (2015). The relationship between sleep quality and social intimacy, and academic burn-out in students of medical sciences. *Glob. J. Health Sci.* 8, 231–238.

Beebe, D. W. (2011). Cognitive, behavioral, and functional consequences of inadequate sleep in children and adolescents. *Pediatr. Clin.* 58, 649–665. doi: 10.1016/j.pcl.2011.03.002

Bentler, P. M. (1983). Confirmatory factor analysis via noniterative estimation: a fast, inexpensive method. *J. Mark. Res.* 19, 417–424. doi: 10.1177/002224378201900403

Bentler, P. M., and Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychol. Bull.* 88, 588–606. doi: 10.1037/0033-2909.88.3.588

Buysse, D. J., Reynolds, C. F. III, Monk, T. H., Berman, S. R., and Kupfer, D. J. (1989). The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 28, 193–213. doi: 10.1016/0165-1781(89)90047-4

Carver, C. S. (1997). You want to measure coping but your protocol's too long: consider the brief cope. *Int. J. Behav. Med.* 4, 92–100. doi: 10.1207/s15327558ijbm0401_6

Carver, C. S., and Scheier, M. F. (1994). Situational coping and coping dispositions in a stressful transaction. *J. Pers. Soc. Psychol.* 66, 184–195. doi: 10.1037/0022-3514.66.1.184

Castellanos, J. (2019). "Gender differences within academic burnout," in *Proceedings of 42nd Annual Conference of Adult Higher Education Alliance*, Orlando, FL, 27–30.

Chunming, W. M., Harrison, R., MacIntyre, R., Travaglia, J., and Balasooriya, C. (2017). Burnout in medical students: a systematic review of experiences in Chinese medical schools. *BMC Med. Educ.* 17:217. doi: 10.1186/s12909-017-1064-3

Clarke, A. T. (2006). Coping with interpersonal stress and psychosocial health among children and adolescents: a meta-analysis. *J. Youth Adolesc.* 35, 10–23. doi: 10.1007/s109640059001-x

Curcio, G., Ferrara, M., and Gennaro, L. D. (2006). Sleep loss, learning capacity and academic performance. *Sleep Med. Rev.* 10, 323–337. doi: 10.1016/j.smrv.2005.11.001

Dahlin, M., Joneborg, N., and Runeson, B. (2007). Performance-based self-esteem and burnout in a cross-sectional study of medical students. *Med. Teach.* 29, 43–48. doi: 10.1080/01421590601175309

Dewald-Kaufmann, J., Meijer, A. M., Oort, F. J., and Kerkhof, G. A. (2010). The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: a meta-analytic review. *Sleep Med. Rev.* 14, 179–189. doi: 10.1016/j.smrv.2009.10.004

Diaz, A., Berger, R. H., Valiente, C., and Eisenberg, N. (2016). Children's sleep and academic achievement: the moderating role of effortful control. *Int. J. Behav. Dev.* 41, 275–284. doi: 10.1177/0165025416635284

Ding, X., Zhibing, Z., and Ge, G. (2019). "The study on the relationship among parenting style, negative perfectionism and academic burnout of college students," in *Proceedings of the International Conference on Information Technology in Medicine and Education (ITME)*, Fuzhou, 237–240. doi: 10.1109/itme.2019.00061

Doolittle, R. B. (2007). Burnout and coping among parish-based clergy. *Ment. Health Relig. Cult.* 10, 31–38. doi: 10.1080/13674670600857591

Fares, J., Tabosh, H. A., Saadeddin, Z., and Mouhayyar, C. E. (2016). Stress, burnout and coping strategies in preclinical medical students. *N. Am. J. Med. Sci.* 8, 75–81. doi: 10.4103/1947-2714.177299

Fiorilli, C., De Stasio, S., Di Chiacchio, C., Pepe, A., and Salmela-Aro, K. (2017). School burnout, depressive symptoms and engagement: their combined effect on student achievement. *Int. J. Educ. Res.* 84, 1–12. doi: 10.1016/j.ijer.2017.04.001

García-Arroyo, J. A., and Segovia, A. O. (2019). Work overload and emotional exhaustion in university teachers: moderating effects of coping styles. *Univ. Psychol.* 18, 1–12. doi: 10.11144/javeriana.upsy18-2.woee

Garden, A. M. (1987). Depersonalization: a valid dimension of burnout? *Hum. Relat.* 40, 545–559. doi: 10.1177/001872678704000901

Gibbons, C. (2010). Stress, coping and burn-out in nursing students. *Int. J. Nurs. Stud.* 47, 1299–1309. doi: 10.1016/j.ijnurstu.2010.02.015

Guerrero, E. (2003). Análisis pormenorizado de los grados de burnout y técnicas de afrontamiento del estrés docente en profesorado universitario. *An. Psicol.* 19, 145–158.

Harvey, C. J., Gehrman, P., and Espie, C. A. (2014). Who is predisposed to insomnia: a review of familial aggregation, stress-reactivity, personality and coping style. *Sleep Med. Rev.* 18, 237–247. doi: 10.1016/j.smrv.2013.11.004

Hayes, A. F., and Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: does method really matter? *Psychol. Sci.* 24, 1918–1927. doi: 10.1177/0956797613480187

Hofstetter, J. R., Lysaker, P. H., and Mayeda, A. R. (2005). Quality of sleep in patients with schizophrenia is associated with quality of life and coping. *BMC Psychiatry* 5:13. doi: 10.1186/1471-244X-5-13

Hoyt, M. A., Thomas, K. S., Epstein, D. R., and Dirksen, S. R. (2009). Coping style and sleep quality in men with cancer. *Ann. Behav. Med.* 37, 88–93. doi: 10.1007/s12160-009-9079-6

Janošević, M., and Petrović, B. (2019). Effects of personality traits and social status on academic achievement: Gender differences. *Psychol. Sch.* 56, 497–509. doi: 10.1002/pits.22215

Johnson, B., Batia, A. S., and Haun, J. (2008). Perceived stress among graduate students: roles, responsibilities, & social support. *Vahperd J.* 29, 31–36.

Karimi, M. N., and Fallah, N. (2019). Academic burnout, shame, intrinsic motivation and teacher affective support among Iranian EFL learners: a structural equation modeling approach. *Curr. Psychol.* 159, 57–63. doi: 10.1007/s12144-019-0138-2

Kilfedder, C. J., Power, K. G., and Wells, T. J. (2001). Burnout in psychiatric nursing. *J. Adv. Nurs.* 34, 383–396. doi: 10.1046/j.1365-2648.2001.01769.x

Koutsimani, P., Montgomery, A., and Georganta, K. (2019). The relationship between burnout, depression, and anxiety: a systematic review and meta-analysis. *Front. Psychol.* 10:284. doi: 10.3389/fpsyg.2019.00284

Li, M. N. (2006). *An Introduction to Amos and its Uses in Scale Development: Graphics & Basic*. Taipai: Psychological Publishing.

Li, X., Guan, L., Chang, H., and Zhang, B. (2014). Core self-evaluation and burnout among nurses: the mediating role of coping styles. *PLoS One* 9:e115799. doi: 10.1371/journal.pone.0115799

Lian, R., Yang, L., and Wu, L. (2005). Relationship between professional commitment and learning burnout of undergraduates and scales developing. *Chin. J. Psychol.* 37, 632–636.

Lin, S. H., and Huang, Y. C. (2012). Investigating the relationships between loneliness and learning burnout. *Active Learn. High. Educ.* 13, 231–243. doi: 10.1177/1469787412452983

Lin, S. H., and Huang, Y. C. (2014). Life stress and academic burnout. *Active Learn. High. Educ.* 15, 77–90. doi: 10.1177/1469787413514651

Ling, L., Qin, S., and Shen, L. (2014). An investigation about learning burnout in medical college students and its influencing factors. *Int. J. Nurs. Sci.* 1, 117–120. doi: 10.1016/j.ijnss.2014.02.005

Liu, X. C., Tang, M. Q., Hu, L., Wang, A. Z., Wu, H. X., Zhao, G. F., et al. (1996). Reliability and validity of the Pittsburgh sleep quality index. *Chin. J. Psychiatry* 29, 103–107.

Luo, Y., Wang, Z., Zhang, H., and Chen, A. (2016). The effect of perfectionism on school burnout among adolescence: the mediator of self-esteem and coping style. *Pers. Individ. Dif.* 88, 202–208. doi: 10.1016/j.paid.2015.08.056

Maslach, C., and Jackson, S. (1981). The measurement of experienced burnout. *J. Occup. Behav.* 2, 99–113. doi: 10.1002/job.4030020205

Mazurkiewicz, R., Korenstein, D., Fallar, R., and Ripp, J. (2012). The prevalence and correlations of medical student burnout in the pre-clinical years: a cross-sectional study. *Psychol. Health Med.* 17, 188–195. doi: 10.1080/13548506.2011.597770

McDonald, R. P., and Ho, M. R. (2002). Principles and practice in reporting structural equation analysis. *Psychol. Methods* 7, 64–82. doi: 10.1037//1082-989X.7.1.64

Mufarrih, S. H., Naseer, A., Qureshi, N. Q., Anwar, Z., Zahid, N., Lakdawala, R. H., et al. (2019). Burnout, job dissatisfaction, and mental health outcomes among medical students and health care professionals at a tertiary care hospital in Pakistan: protocol for a multi-center cross-sectional study. *Front. Psychol.* 10:2552. doi: 10.3389/fpsyg.2019.02552

Pagnin, D., de Queiroz, V., Carvalho, Y. T. M. S., Dutra, A. S. S., Amaral, M. B., and Queiroz, T. T. (2014). The relation between burnout and sleep disorders in medical students. *Acad. Psychiatry* 38, 438–444. doi: 10.1007/s40596-014-0093-z

Park, Y. M., Matsumoto, K., Shinkoda, H., and Nagashima, H. (2001). Age and gender difference in habitual sleep-wake rhythm. *Psychiatry Clin. Neurosci.* 55, 201–202. doi: 10.1046/j.1440-1819.2001.00825.x

Ramírez, M. R., Otero, P., Blanco, V., Ontaneda, M. P., Díaz, O., and Vázquez, F. L. (2018). Prevalence and correlates of burnout in health professionals in Ecuador. *Compr. Psychiatry* 82, 73–83. doi: 10.1016/j.comppsych.2017.11.011

Sandru, C., and Voinescu, B. I. (2014). The relationship between emotion regulation, dysfunctional beliefs about sleep and sleep quality-an exploratory study. *J. Evid. Based. Psychother.* 14, 249–257.

Schaufeli, W. B., Martinez, I. M., Pinto, A. M., Salanova, M., and Bakker, A. B. (2002). Burnout and engagement in university students: a cross-national study. *J. Cross Cult. Psychol.* 33, 464–481. doi: 10.1177/0022022102033005003

Simon, E. B., Rossi, A., Harvey, A. G., and Walker, M. P. (2020). Overanxious and underslept. *Nat. Hum. Behav.* 4, 100–110. doi: 10.1038/s41562-019-0754-8

Skinner, E. A., Edge, K., Altman, J., and Sherwood, H. (2003). Searching for the structure of coping: a review and critique of category systems for classifying ways of coping. *Psychol. Bull.* 129, 216–269. doi: 10.1037/0033-2909.129.2.216

Song, Y., and Luo, Z. (2018). The relationship between learning burnout and education achievement attribution, academic self-efficacy of college students. *China J. Health Psychol.* 1, 124–127.

Stoliker, B., and Lafreniere, K. (2015). The influence of perceived stress, loneliness, and learning burnout on university students' educational experience. *Coll. Stud. J.* 49, 146–159.

Suen, L. K. P., Ellis Hon, K. L., and Tam, W. W. S. (2008). Association between sleep behavior and sleep-related factors among university students in Hong Kong. *Chronobiol. Int.* 25, 760–775. doi: 10.1080/07420520802397186

Templeton, K., Bernstein, C. A., Sukhera, J., Nora, L. M., Newman, C., Burstin, H., et al. (2019). *Gender-Based Differences in Burnout: Issues Faced by Women Physicians. NAM Perspectives*. Washington, DC: National Academy of Medicine. doi: 10.31478/201905a

Vahabi, A., Vahabi, A., Sayyad, S., Kashefi, H., and Vahabi, B. (2018). The relationship between the student stressor factors and academic burnout among the students in Kurdistan University of Medical Sciences, Iran, in year 2016. *Chronic Dis. J.* 6, 45–52. doi: 10.1109/ITME.2019.00061

Vizoso, C., Arias-Gundín, O., and Rodríguez, C. (2019). Exploring coping and optimism as predictors of academic burnout and performance among university students. *Educ. Psychol.* 39, 768–783. doi: 10.1080/01443410.2018.1545996

Widlund, A., Tuominen, H., and Korhonen, J. (2018). Academic well-being, Mathematics performance, and educational aspirations in lower secondary education: changes within a school year. *Front. Psychol.* 9:297. doi: 10.3389/fpsyg.2018.00297

Willis, T. A., and Gregory, A. M. (2015). Anxiety disorders and sleep in children and adolescents. *Sleep Med. Clin.* 10, 125–131. doi: 10.1016/j.jsmc.2015.02.002

Wolf, M. R., and Rosenstock, J. B. (2017). Inadequate sleep and exercise associated with burnout and depression among medical students. *Acad. Psychiatry* 41, 174–179. doi: 10.1007/s40596-016-0526-y

Worly, B., Verbeck, N., Walker, C., and Clinchot, D. M. (2019). Burnout, perceived stress, and empathic concern: differences in female and male Millennial medical students. *Psychol. Health Med.* 24, 429–438. doi: 10.1080/13548506.2018.1529329

Xie, Y. (1998). Reliability and validity of the simplified coping style questionnaire. *Chin. J. Clin. Psychol.* 6, 114–116. doi: 10.1177/0961203318815595

Xu, L. (2017). Looking into burnout levels of freshmen in English majors of Normal university. *World J. Educ.* 7, 33–37. doi: 10.1016/j.paid.2007.04.010

Yan, X., Li, A. T., Xing, P., Liu, Z., Gong, J., Xiong, F., et al. (2013). A positivist study on factors for college students' academic weariness. *J. Nanjing Agric. Univ.* 13, 104–110.

Yan, Y. W., Lin, R. M., Su, Y. K., and Liu, M. Y. (2018). The relationship between adolescent academic stress and sleep quality: a multiple mediation model. *Soc. Behav. Pers. Int. J.* 46, 63–77. doi: 10.2224/sbp.6530

Zhang, Y. (2019). A survey on the causes of non-English majors college English learning burnout in a local university in china–A case study of Anhui University of Science and Technology. *J. Lang. Teach. Res.* 10, 872–878. doi: 10.17507/jltr.1004.27

Zhang, Y., Gan, Y., and Cham, H. (2007). Perfectionism, academic burnout and engagement among Chinese college students: a structural equation modeling analysis. *Pers. Individ. Dif.* 43, 1529–1540. doi: 10.1016/j.paid.2007.04.010

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 19 May 2020
doi: 10.3389/fpsyg.2020.00841

# Coping Strategies and Self-Efficacy in University Students: A Person-Centered Approach

*Carlos Freire[1], María del Mar Ferradás[1]*, Bibiana Regueiro[2], Susana Rodríguez[1], Antonio Valle[1] and José Carlos Núñez[3]*

*[1] Department of Psychology, University of A Coruña, A Coruña, Spain, [2] Department of Pedagogy and Didactics, University of Santiago de Compostela, Santiago de Compostela, Spain, [3] Faculty of Psychology, University of Oviedo, Oviedo, Spain*

In daily academic life, students are exposed to a wide range of potentially stressful situations which could negatively affect their academic achievement and their health. Among the factors that could be weakened by academic stress, attention has been paid to expectations of self-efficacy, which are considered one of the most important determinants for student engagement, persistence, and academic success. From a proactive perspective, research on academic stress has emphasized the importance of coping strategies in preventing harmful consequences. In recent years, there has been a growing interest in discovering the extent to which individuals are able to combine different coping strategies and the adaptive consequences this flexibility entails. However, studies using this person-centered approach are still scarce in the academic context. On that basis, this current study had two objectives: (a) to examine the existence of different profiles of university students based on how they combined different approach coping strategies (positive reappraisal, support seeking, and planning) and (b) to determine the existence of differences in general expectations of self-efficacy between those coping profiles. A total of 1,072 university students participated in the study. The coping profiles were determined by latent profile analysis (LPA). The differences in the self-efficacy variable were determined using ANCOVA, with gender, university year, and degree type as covariates. Four approach coping profiles were identified: (a) low generalized use of approach coping strategies; (b) predominance of social approach coping approaches; (c) predominance of cognitive approach coping approaches; and (d) high generalized use of approach coping strategies. The profile showed that a greater combination of the three strategies was related to higher general self-efficacy expectations and vice versa. These results suggest that encouraging flexibility in coping strategies would help to improve university students' self-efficacy.

**Keywords: coping strategies, coping flexibility, stress, self-efficacy, university students**

OPEN ACCESS

***Edited by:***
*Jesus de la Fuente, University of Navarra, Spain*

***Reviewed by:***
*Ana Miranda, University of Valencia, Spain*
*Jesús-Nicasio García-Sánchez, Universidad de León, Spain*

****Correspondence:***
*María del Mar Ferradás*
*mar.ferradasc@udc.es*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *29 January 2020*
***Accepted:*** *06 April 2020*
***Published:*** *19 May 2020*

***Citation:***
*Freire C, Ferradás MdM, Regueiro B, Rodríguez S, Valle A and Núñez JC (2020) Coping Strategies and Self-Efficacy in University Students: A Person-Centered Approach. Front. Psychol. 11:841. doi: 10.3389/fpsyg.2020.00841*

## INTRODUCTION

The mental health of university students has been a growing concern in recent years (Milojevich and Lukowski, 2016). Various studies have demonstrated the high frequency of psychological symptoms associated with this stage of education (Blanco et al., 2008; Kim et al., 2015), with stress being one of the psychosocial problems that have become prevalent (Deasy et al., 2014; American College Health Association, 2018; Gustems-Carnicer et al., 2019). In their daily lives, university

students have to face a wide variety of demands, both academic and non-academic, that could affect their well-being. Academic demands include adaptation to a new context, overwork, insufficient time to do their academic tasks, preparation for and doing of exams, and the pressure to perform (Beiter et al., 2015; Vizoso and Arias, 2016; Erschens et al., 2018; Webber et al., 2019). Non-academic demands include change of where they live; the need to create new social relationships; conflicts with partners, family, or friends; money worries; and concerns about future work (Howard et al., 2006; Galatzer-Levy et al., 2012; DeRosier et al., 2013; Beiter et al., 2015). Stress can bring with it significant harm to the student's academic performance (e.g., reduced ability to pay attention or to memorize, less dedication to study, and more absences from class) (Chou et al., 2011; Turner et al., 2015), as well as to the student's physical and psychological health (e.g., substance abuse, insomnia, anxiety, and physical and emotional exhaustion) (Waqas et al., 2015; Schönfeld et al., 2016). These harmful effects have triggered interest in the identification of individual psychological resources that could be protective factors against the inherent stressors of the university context (Tavolacci et al., 2013). These resources would modulate the relationship between the potential threats and the stress response, encouraging better psychological adjustment (Leiva-Bianchi et al., 2012). Two of the most widely studied resources are coping strategies and self-efficacy.

## Coping Strategies

Lazarus and Folkman (1984) thought of stress as an interactive process between the person and their surroundings, in which the influence of stressful events on physical and psychological well-being is determined by coping. From this widely accepted transactional approach, coping would come to be defined by cognitive and behavioral efforts employed in response to external or internal demands that the individual deems to be threats to their well-being.

Despite the documentation of more than 400 coping strategies (Skinner et al., 2003), they are generally categorized into two broad types (for a complete categorization, see Zimmer-Gembeck and Skinner, 2016): approach (also called active) strategies and evasive (or disengagement) strategies. Approach strategies involve cognitive and behavioral mechanisms aimed at making an active response to the stressor, directly changing the problem (primary control) or the negative emotions associated with it (secondary control). This category includes strategies such as planning, taking specific action, seeking support (instrumental and emotional), positive reappraisal of the situation, or acceptance. Evasive strategies are those which involve cognitive and behavioral mechanisms used to evade the stressful situation, such as distraction, denial, and wishful thinking. Based on this classification, there is a broad consensus that approach strategies are related to good academic, physical, and psychological adjustment (Clarke, 2006; Syed and Seiffge-Krenke, 2015; Gustems-Carnicer et al., 2019), whereas evasive strategies usually mean maladaptive consequences for the students (Tavolacci et al., 2013; Deasy et al., 2014; Skinner et al., 2016; Tran and Lumley, 2019).

## Self-Efficacy

Expectations of self-efficacy are a central element of the social cognitive theory proposed by Bandura (1997). This construct is about a person's beliefs about their ability to mobilize courses of action needed to achieve desired personal goals. It is, therefore, a fundamental psychological resource for exercising control over events in one's life (Wood and Bandura, 1989). In fact, self-efficacy is considered a powerful motivational, cognitive, and affective determinant of student behavior, with significant influence on their involvement, effort, persistence, self-regulation, and achievement (Schunk and Pajares, 2010; Honicke and Broadbent, 2016; Ritchie, 2016; Zumbrunn et al., 2019). These characteristics make self-efficacy an important variable in controlling stress (Bandura et al., 2003; Sahin and Çetin, 2017; Lanin et al., 2019), and it is a protection factor against the impact of day-to-day stressors at university (Freire et al., 2019; Schönfeld et al., 2019).

Although self-efficacy has commonly been characterized as an expectation that is strongly linked to a specific task or situation, various studies have demonstrated the existence of a more generalized belief—that is, general self-efficacy—around perceived competence in the face of a broad range of demands (Scholz et al., 2002; Feldman et al., 2015; Volz et al., 2019).

## Current Study

The literature reviewed reiterated the importance of considering both coping strategies and expectations of self-efficacy in protection against stress. However, far from being independent resources, some studies have suggested that coping strategies and self-efficacy are related. They postulate that coping behaviors would influence an individual's expectations of control (Lazarus and Folkman, 1984), such that self-efficacy would be a mediator between coping strategies and the stress response (Zimmer-Gembeck and Skinner, 2016).

Given that, our study aimed to examine the possible influence of coping strategies on the expectations of self-efficacy in a population that is particularly vulnerable to stress, university students. Some studies have shown a positive, significant influence of approach coping strategies on self-efficacy in infant samples (Sandler et al., 2000) and in adults with rheumatoid arthritis (Keefe et al., 1997). However, as far as we are aware, there have been none in the university context.

The main contribution of this study lies in the analysis of student coping strategies using a person-centered focus. Traditionally, research on coping strategies has attempted to determine the suitability of a given strategy, evaluating the benefit or harm that it produces for the individual. This variable-centered approach assumes that certain coping mechanisms are universally adaptive or maladaptive, an argument that has been called the "fallacy of uniform efficacy" (Bonanno and Burton, 2013).

The very characterization of coping strategies as responses to a specific challenge demonstrates their situational specificity. This has led in recent years to the adoption of an approach based on the flexibility of coping, under the supposition that a single individual can combine different strategies, using one

or the other depending on the specific situation they are facing (Eisenbarth, 2012; Kobylińska and Kusev, 2019). In this vein, the benefits provided by approach coping strategies are maximized if the individual employs problem-focused coping strategies (e.g., planning and seeking instrumental support) or emotion-centered strategies (e.g., positive reappraisal and seeking emotional support) based on the perceived controllability of the stressor facing them (Cheng, 2001; Siltanen et al., 2019). In contrast, people who are less flexible in their coping have a smaller repertoire of strategies, which are less effective adjusting to the specific demands of the situation (Cheng and Cheung, 2005).

Studying individuals' profiles in light of the flexibility of their coping is therefore adopting a person-centered focus (Laursen and Hoff, 2006), making it possible to identify subgroups of students characterized by high internal similarity in their repertoire of coping strategies, who differ from the way that other students combine their strategies. An additional advantage over the traditional, variable-focused approaches is that studying profiles of flexibility of coping makes it possible to identify specific groups of individuals who can be prioritized in the design of interventions (Kaluza, 2000).

Considering a perspective based on coping flexibility, the research question we posed in this study was whether the different student profiles—in the way they combine their coping strategies—would be related to significantly different levels of general self-efficacy. In the university context, various studies have demonstrated that, in comparison to those with less flexible profiles, students who are more flexible in their coping demonstrate lower vulnerability to stress (Cheng, 2001; Kato, 2012; Doron et al., 2014; González Cabanach et al., 2018) and to depressive symptomatology (Gabrys et al., 2018; Hasselle et al., 2019), as well as greater psychological well-being (Freire et al., 2018). Based on that research, our hypothesis is that students who exhibit a more flexible profile of strategies will demonstrate significantly higher levels of self-efficacy than less flexible students.

Assuming that in the young population the use of approach coping strategies is more typical (Cheng et al., 2014), in our study, we examined coping profiles based on the combination of three approach strategies that are very common in educational contexts (Skinner et al., 2016): a primary control (planning), a secondary control (positive reappraisal), and a mixed type (seeking instrumental and emotional support). Similarly, given the extensive and varied range of demands faced by students in their daily lives (both academic and non-academic), we examined their level of general self-efficacy. Finally, in this study, we also tried to control for the effects of the variables gender, university year, and degree type. It would seem that men report higher levels of self-efficacy than women, with this difference emerging at the end of adolescence (Huang, 2013). It may also be the case that students in their first year of university, because of their inexperience, may have lower levels of self-efficacy than students with more academic experience (Honicke and Broadbent, 2016). As for the type of course, scientific disciplines have been related to lower levels of self-efficacy (Findley-Van Nostrand and Pollenz, 2017).

# MATERIALS AND METHODS

## Participants

The study used a sample of 1,085 undergraduate students from the University of A Coruña (Spain). The inclusion criteria were for subjects to be undergraduate students at the time of the study. Exclusion criteria included failing to respond to more than 20% of the items. We excluded 13 cases because they failed to respond to enough items. There were a smaller number of missing values in 28 other cases, which were dealt with using full information maximum likelihood (FIML) via Mplus 7.11 (Muthén and Muthén, 1998–2012). This means that the definitive sample was made up of 1,072 students aged between 18 and 48 years ($M$ = 21.09; $SD$ = 3.16). Just over two thirds ($n$ = 729; 68%) were women, and 343 (32%) were men. The distribution by degree course was as follows: 383 (37.5%) were studying educational sciences (infant education, primary education, social education, physical education, language and hearing, speech therapy, and educational psychology); 203 (19%) were studying health sciences (physiotherapy, nursing, and sports science); 207 (19.3%) were studying legal and social sciences (law and sociology); and 279 (26%) were studying technical sciences (architecture, technical architecture, and civil engineering). The distribution of students in terms of their university year was 304 (28.4%) in their first year, 307 (28.6%) in their second year, 302 (28.2%) in their third year, 91 (8.5%) in their fourth year, and 68 (6.3%) in their fifth year.

## Instruments

### Coping Strategies

We used the coping scale from the Academic Stress Questionnaire to measure coping strategies (Cabanach et al., 2010). This instrument has 23 items evaluating three approach strategies for coping: positive reappraisal, support seeking, and planning. Positive reappraisal is a secondary control strategy in which the student seeks to reassign the stressful event, highlighting the positive (e.g., "When I am faced with a problematic situation, I forget unpleasant aspects and highlight the positive ones"). The psychometric properties were acceptable, in terms of both reliability ($\alpha$ = 0.860; $\omega$ = 0.864; construct reliability = 0.857; composite reliability = 0.857) and validity (convergent validity = 0.483; construct validity: $\chi^2$ = 119.87; $df$ = 30; $p > 0.05$; $GFI$ = 0.98; $AGFI$ = 0.96; $TLI$ = 0.96; $CFI$ = 0.98; $RMR$ = 0.03; $RMSEA$ = 0.05). Support seeking is a mixed coping strategy, as the student can do that with the aim of seeking information and advice from others to resolve the issue at hand (e.g., "When I am faced with a problematic situation, I ask for advice from a family member or a close friend") or they can seek consolation and emotional relief (e.g., "When I am faced with a problematic situation, I manifest my feelings and opinions to others"). The psychometric properties of this subscale were good, in reliability ($\alpha$ = 0.902; $\omega$ = 0.903; construct reliability = 0.900; composite reliability = 0.900) and validity (convergent validity = 0.566; construct validity: $\chi^2$ = 35.43; $df$ = 12; $p > 0.05$; $GFI$ = 0.99; $AGFI$ = 0.98; $TLI$ = 0.99; $CFI$ = 0.99; $RMR$ = 0.02; $RMSEA$ = 0.04). Planning is a primary control strategy, characterized by analysis and the design of a plan

of action aimed at resolving the problematic situation ("When I am faced with a problematic situation, I draw up an action plan and follow it"). The psychometric properties were acceptable, in terms of both reliability (α = 0.81; ω = 0.81; construct reliability = 0.85; composite reliability = 0.82) and validity (convergent validity = 0.504; construct validity: $\chi^2$ = 33.52; *df* = 8; $p > 0.05$; *GFI* = 0.99; *AGFI* = 0.97; *TLI* = 0.97; *CFI* = 0.98; *RMR* = 0.03; *RMSEA* = 0.05). The participants' responses are recorded on a five-point Likert scale (1 = never to 5 = always).

### Self-Efficacy

We used the Spanish validation of the General Self-efficacy Scale from Baessler and Schwarzer (1996). The scale has 10 items (e.g., "I can solve difficult problems if I try hard enough") that the participants respond to on a Likert scale from 1 (never) to 5 (always). In this study, the psychometric properties were good, in reliability (α = 0.91; ω = 0.91; construct reliability = 0.909; composite reliability = 0.909) and validity (convergent validity = 0.514; construct validity: $\chi^2$ = 121.36; *df* = 30; $p > 0.05$; *GFI* = 0.98; *AGFI* = 0.96; *TLI* = 0.98; *CFI* = 0.98; *RMR* = 0.02; *RMSEA* = 0.05).

## Procedure

The study protocol was designed and executed in compliance with the code of ethics set out by the university in which the research was done, with the informed consent of all participants, as required by the Helsinki Declaration. Data collection was carried out at the beginning of the academic year in order to avoid periods of high academic demands (e.g., work overload and preparation for exams) that could favor greater emotional activation in students and, therefore, influence their responses to the questionnaires. Before beginning the study, the participants were informed of the objectives and were asked to participate; they were assured of anonymity and the confidentiality of their responses. Likewise, the instructor explained that students who did not wish to participate in the study could leave the classroom until the end of the tests, without any repercussions or negative consequences. The questionnaires were administered in the classrooms where the students had their usual classes, during normal class hours, and in a single session without a time limit.

## Data Analysis

To identify the student profiles according to the flexibility of their coping, we performed a latent profile analysis (LPA) (Lanza et al., 2003) using the statistical program Mplus 7.11 (Muthén and Muthén, 1998–2012). LPA allows the identification of latent categorical variables to group the subjects into classes (profiles), establishing what fits best from a finite set of models. The following were used as reference parameters to determine the optimum model: the Akaike Information Criterion (AIC), the Schwarz Bayesian information criterion (BIC), the BIC adjusted for sample size (SSA-BIC), the formal adjusted maximum likelihood ratio test from Lo et al. (2001) (LMRT), the parametric bootstrap likelihood ratio test (PBLRT), and the sample size for each subgroup. The AIC, BIC, and SSA-BIC indices are descriptive, the lowest values indicating the best fit of the model, whereas LMRT and PBLRT are the indices that allow the final decision to be made. The values of *p* associated with LMRT and PBLRT indicate whether the solution with more ($p < 0.05$) or fewer classes ($p > 0.05$) is the one with the best fit to the data. Another of the exclusion criteria was the existence of spurious classes ($n \leq 5\%$ of the sample), which would indicate excessive extraction of profiles (Hipp and Bauer, 2006).

Once the optimal model was selected based on the above criteria, we moved on to determining its classifying accuracy using the entropy statistic and calculation of *a posteriori* probabilities as references. Another criterion for evaluating the validity of the model was a MANOVA analyzing the differences between classes in the three criterion variables (positive reappraisal, support seeking, and planning). Statistically significant differences between the three variables would indicate that the latent classes suggested by the model were distinct. Finally, the differences in self-efficacy between the different coping profiles were established using an ANCOVA, with gender, year, and degree type as covariables. The effect size of the differences between the groups was determined using partial eta squared and Cohen's (1988) *d*: null, $\eta_p^2 < 0.01$ ($d < 0.09$); small, $\eta_p^2 = 0.01$ to $\eta_p^2 = 0.058$ ($d = 0.10$ to $d = 0.49$); medium, $\eta_p^2 = 0.059$ to $\eta_p^2 = 0.137$ ($d = 0.50$ to $d = 0.79$); and large, $\eta_p^2 \geq 0.138$ ($d \geq 0.80$). These analyses were performed using SPSS 26.0 (IBM Corp, 2019).

# RESULTS

## Preliminary Analysis

Descriptive statistics and the values of (Pearson) correlations between the variables are given in **Table 1**. The asymmetry and kurtosis data indicate that the variables followed a normal distribution (all values between −1 and 1). Similarly, all of the correlations were statistically significant ($p < 0.001$). Statistically speaking, the results of the Bartlett sphericity test indicate that the variables were sufficiently intercorrelated [$\chi^2(6) = 1{,}066.75$; $p < 0.001$)], an important requirement for subsequent multivariate analysis.

**TABLE 1 |** Means, standard deviations, and correlations for the three strategies for coping with stress and general self-efficacy (*N* = 1072).

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. General self-efficacy | | | | |
| 2. Positive reappraisal | 0.63 | | | |
| 3. Support seeking | 0.21 | 0.22 | | |
| 4. Planning | 0.45 | 0.55 | 0.30 | |
| M | 3.34 | 3.01 | 3.44 | 3.05 |
| SD | 0.68 | 0.71 | 0.87 | 0.74 |
| Skewness | −0.03 | 0.05 | −0.15 | 0.07 |
| Kurtosis | −0.44 | −0.45 | −0.79 | −0.44 |

*All Pearson r correlation coefficients are significant at p < 0.001. General self-efficacy scale and coping strategies scale: 1 = never, 2 = sometimes, 3 = several times, 4 = many times, and 5 = always. Higher scores reflect greater levels of general self-efficacy and a higher use of coping strategies.*

## Identification of Coping Profiles

The fit of various latent profile models was examined (models from two to five classes). In the model fit, it was assumed that variances could differ between indicators within each group, with the restriction specifying that they be equal between the groups. Similarly, a restriction was set on the independence between indicators, both within and between groups.

**Table 2** gives the results of the model fit. The analysis of fit was stopped at the five-class model for various reasons: (a) the values of BIC and SSA-BIC were higher in the five-class model than in the four-class model, and the AIC was almost the same in the two models; (b) the values of LMRT and PBLRT for the five-class model were not statistically significant ($p > 0.05$, in both cases), which indicated that the fit of this model was not better than that of the four-class model; (c) the five-class model included a group made up of fewer than 5% of the total sample, which indicated excessive extraction of profiles. In contrast, in the four-class model, all of the groups made up more than 5% of the total sample. Similarly, all of the data summarized in **Table 2** indicated that the four-class model demonstrated better fit than the two- and three-class models, leading to the selection of the four-class model as the optimum.

**Table 3** gives the classifying accuracy of the four-class model, as well as the number of participants (overall sample and by gender) making up each class in that model, both in absolute terms ($n$) and as a percentage (%). The means associated with the groups the participants were assigned to are given in the main diagonal in the table in bold. The first group demonstrated a classification coefficient of 85%, whereas the other three groups had coefficients a little below 80%. Overall, these data indicate that the four-class model demonstrates adequate classification accuracy. Similarly, the value of the entropy statistic of this model (0.639) (**Table 2**), although modest, is acceptable (Nylund et al., 2007).

As an additional criterion for assessing the suitability of the four-class model, the results of the MANOVA showed statistically significant differences between the four classes in the three criterion variables: positive reappraisal [$F(3, 1068) = 391.49$; $p < 0.001$; $\eta_p^2 = 0.524$], support seeking [$F(3, 1068) = 770.37$; $p < 0.001$; $\eta_p^2 = 0.684$], and planning [$F(3, 1068) = 463.61$; $p < 0.001$; $\eta_p^2 = 0.566$]. The effect size was large in all cases.

**TABLE 2 |** Statistics for the identification of fit of latent class models and classifying accuracy.

| | Models of coping profiles | | | |
|---|---|---|---|---|
| | **Two classes** | **Three classes** | **Four classes** | **Five classes** |
| AIC | 7, 045.953 | 6, 979.629 | 6, 947.676 | 6, 945.556 |
| BIC | 7, 095.726 | 7, 049.311 | 7, 037.267 | 7, 055.056 |
| SSA-BIC | 7, 063.964 | 7, 004.844 | 6, 980.096 | 6, 985.180 |
| Entropy | 0.638 | 0.607 | 0.639 | 0.705 |
| Number of groups with $n \leq 5\%$ | 0 | 0 | 0 | 1 |
| LMRT | 397.586** | 71.753* | 38.571* | 9.770 |
| PBLRT | 411.832** | 74.324** | 39.953** | 10.120 |

*The models were adjusted assuming that the variances could differ between the indicators within each group, but it was specified as a restriction that they be equal between groups. Likewise, independence between the indicators was imposed as a restriction, both within each group and between groups. AIC = Akaike information criterion; BIC = Schwarz Bayesian information criterion; SSA-BIC = BIC adjusted for the sample size; LMRT = adjusted Lo–Mendell–Rubin maximum likelihood ratio test; PBLRT = parametric bootstrap likelihood ratio test; *p < 0.01; **p < 0.001.*

## Description of Coping Profiles

The mean scores (direct and standardized) of the members of each of the latent classes (coping profiles) in the selected model are given in **Table 4**. The same profiles are shown graphically in **Figure 1**.

The first group ($n$ = 296; 27.61%) was made up of students with low scores in the three approach coping strategies (profile of low approach coping strategies, LACS), who demonstrated

**TABLE 3 |** Characterization of the latent profiles and classifying accuracy of the individuals in each profile.

| | **Latent profiles** | | | | ***n* (%)** | ***n*$_{gender}$ (%)** | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | | **Female** | **Male** |
| 1. LACS | **0.848** | 0.002 | 0.089 | 0.061 | 296 (27.61) | 195 (65.9) | 101 (34.1) |
| 2. HACS | 0.001 | **0.796** | 0.135 | 0.068 | 290 (27.05) | 194 (66.9) | 96 (33.1) |
| 3. SAC | 0.084 | 0.111 | **0.770** | 0.035 | 355 (33.12) | 286 (80.6) | 69 (19.4) |
| 4. CAC | 0.089 | 0.094 | 0.049 | **0.768** | 131 (12.22) | 54 (41.2) | 77 (58.8) |

*LACS, profile of low approach coping strategies; HACS, profile of high approach coping strategies; SAC, profile with a prevalence of social approach coping strategies; CAC, profile with a prevalence of cognitive approach coping strategies. The coefficients associated with the groups to which the participants have been assigned are shown in bold.*

**TABLE 4 |** Description of latent profiles (means, standard errors, and confidence intervals).

| | | | **Confidence intervals** | |
|---|---|---|---|---|
| | ***M*** | ***SE*** | **Lower 5%** | **Upper 5%** |
| *LACS (n = 296)* | | | | |
| Positive reappraisal | 2.45 (−0.82) | 0.06 | 2.35 | 2.55 |
| Support seeking | 2.61 (−1.02) | 0.05 | 2.53 | 2.69 |
| Planning | 2.42 (−0.88) | 0.06 | 2.33 | 2.52 |
| *HACS (n = 290)* | | | | |
| Positive reappraisal | 3.61 (0.89) | 0.07 | 3.49 | 3.73 |
| Support seeking | 4.07 (0.75) | 0.05 | 3.99 | 4.16 |
| Planning | 3.72 (1.01) | 0.06 | 3.62 | 3.83 |
| *SAC (n = 355)* | | | | |
| Positive reappraisal | 2.79 (−0.35) | 0.06 | 2.69 | 2.88 |
| Support seeking | 3.95 (0.60) | 0.06 | 3.86 | 4.04 |
| Planning | 2.85 (−0.31) | 0.07 | 2.73 | 2.97 |
| *CAC (n = 131)* | | | | |
| Positive reappraisal | 3.52 (0.83) | 0.10 | 3.35 | 3.69 |
| Support seeking | 2.71 (−1.00) | 0.08 | 2.58 | 2.84 |
| Planning | 3.43 (0.59) | 0.11 | 3.24 | 3.61 |

*LACS, profile of low approach coping strategies; HACS, profile of high approach coping strategies; SAC, profile with a prevalence of social approach coping strategies; CAC, profile with a prevalence of cognitive approach coping strategies. All measurement scales ranged from 1 to 5, where the highest scores reflect a higher level of approach coping strategies. Normalized mean scores are given in brackets (z).*

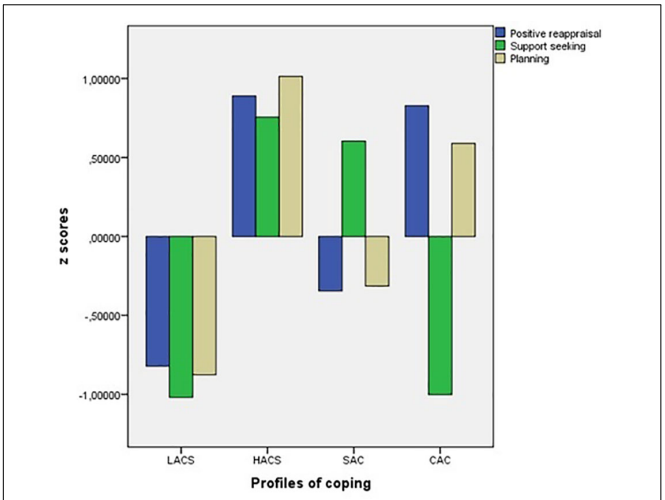


**FIGURE 1 |** Graphical representation of coping profiles (standardized scores). LACS: profile of low approach coping strategies; HACS: profile of high approach coping strategies; SAC: profile with a prevalence of social approach coping strategies; CAC: profile with a prevalence of cognitive approach coping strategies.

low flexibility in the use of these strategies. The second group ($n$ = 290; 27.05%) demonstrated the opposite, scoring highly in the three coping strategies (profile of high approach coping strategies, HACS). Compared to the other profiles, these were the students who demonstrated the most flexibility in deploying approach coping strategies. The third group was the largest ($n$ = 355; 33.12%) and was made up of students with high scores in support seeking and low scores in positive reappraisal and planning. Given the overwhelmingly social nature of support seeking, we called this the social approach coping (SAC) profile. Finally, the smallest group in quantitative terms ($n$ = 131; 12.22%) was made up of students demonstrating the opposite pattern to SAC, high scores in positive reappraisal and planning and low scores in support seeking. We called this the cognitive approach coping (CAC) profile as these students seemed to prefer more cognitive approach strategies, rather than social strategies.

## Relationship Between Coping Profiles and Self-Efficacy

Once the effects of gender, year, and degree course had been controlled for, the results of the ANCOVA demonstrated statistically significant differences between the coping profiles in the variable self-efficacy [$F(3, 1065) = 140.638$, $p < 0.001$, $\eta_p^2 = 0.284$), with a large effect size. The *a posteriori* tests (Scheffé) showed that the HACS profile scored highest in self efficacy, with statistically significant differences between it and the SAC and LACS profiles, the effect size being large in both cases ($d = 0.98$ and $d = 1.55$, respectively). The CAC profile also had significantly higher scores in self-efficacy than the SAC and LACS profiles, with large effect sizes ($d = 0.88$ and $d = 1.46$, respectively). The self-efficacy scores from the SAC profile were significantly higher than those from the LACS profile, with a medium effect size ($d = 0.58$). These data indicate that the LACS profile scored significantly lower in self-efficacy than the other coping profiles identified in this study. **Table 5** gives the descriptive statistics for the four coping profiles with respect to the self-efficacy variable. When we looked at the covariables, there was no statistically significant effect found with the year variable, but there was with the degree type [$F(1065) = 5.163$, $p < 0.05$, $\eta_p^2 = 0.005$] and gender [$F(1065) = 50.405$, $p < 0.001$, $\eta_p^2 = 0.045$], although the effect size was null for the degree type and small for gender. Having noted the small effect of gender on self-efficacy, we looked more deeply at this interaction in each of the coping profiles. In the LACS [$t(294) = 6.56$, $p < 0.001$, $d = 0.45$], HACS [$t(288) = 4.17$, $p < 0.001$, $d = 0.27$], and SAC profiles [$t(353) = 3.43$, $p < 0.01$, $d = 0.26$], men scored significantly higher in self-efficacy than women, whereas the effect of gender on self-efficacy was not significant in the CAC profile.

**TABLE 5 |** Descriptive statistics (means and standard deviations) corresponding to coping profiles in general self-efficacy.

| | | Coping profiles | | | |
|---|---|---|---|---|---|
| | | **LACS** ***M* (*SD*)** | **HACS** ***M* (*SD*)** | **SAC** ***M* (*SD*)** | **CAC** ***M* (*SD*)** |
| General self-efficacy | Women | 2.73 (0.61) | 3.69 (0.55) | 3.16 (0.59) | 3.62 (0.49) |
| | Men | 3.18 (0.53) | 3.96 (0.51) | 3.43 (0.49) | 3.79 (0.63) |
| | Total | 2.88 (0.60) | 3.78 (0.54) | 3.22 (0.58) | 3.72 (0.58) |

*LACS, profile of low approach coping strategies; HACS, profile of high approach coping strategies; SAC, profile with a prevalence of social approach coping strategies; CAC, profile with a prevalence of cognitive approach coping strategies. All measurement scales were from 1 to 5, where the highest scores reflect the highest level of approach coping strategies and general self-efficacy.*

# DISCUSSION

Although previous research has demonstrated the importance of coping strategies and self-efficacy in the prevention of stress, the relationship between these two psychological resources has not been the focus of attention previously in the university context. The main contribution of this study is in the analysis of the relationship between coping strategies and general self-efficacy in university students in light of coping flexibility.

From this person-centered focus, it is assumed that coping strategies are not mutually exclusive categories but instead operate together (Eisenbarth, 2012; Kobylińska and Kusev, 2019), such that their functionality depends on the individuals having a repertoire of strategies available that would allow them to respond specifically to the challenge they have to deal with (Cheng et al., 2014; Siltanen et al., 2019). The results of our study are consistent with this approach, we have identified four profiles of university students which differ in the extent of their flexibility in approach coping with stress. One of the profiles we identified (HACS) has a coping repertoire which combines high levels of positive reappraisal, support seeking, and planning. This is a group of highly flexible students when it comes to coping with problems, bringing together strategies for primary control of stressors (planning and instrumental support seeking) with others aimed at secondary control (positive reappraisal and emotional support seeking). In general, research suggests that when facing problems,

the most effective method is to use primary control strategies when the situation is deemed controllable, whereas relying on secondary control strategies is more beneficial when the challenge is perceived as uncontrollable (Zimmer-Gembeck and Skinner, 2016). From this perspective, the HACS profile would be highly adaptive, as the students in this group would have both types of strategy available. Our findings also demonstrated the existence of two profiles of students who displayed lower levels of coping flexibility than the HACS profiles, as their repertoires included high levels of some but not all of the three approach coping strategies we examined. One group was characterized by the combination of high levels of positive reappraisal and planning, with low levels of support seeking (the CAC profile). The other, in contrast, combined high levels of support seeking with low levels of the other two strategies (the SAC profile).

These two profiles are, to a certain extent, opposites, as students in the SAC group exhibited predominantly social coping, prioritizing their sources of support as the routes to find advice and/or emotional consolation about their problematic situations, whereas students in the CAC group preferred to opt for a more cognitive coping (i.e., focus on the positives of the situation and plan how to deal with it) rather than sharing their problems socially. According to this characterization, the students with a SAC profile would have a much smaller repertoire of approach coping strategies, which could indicate excessive instrumental and emotional dependence on their significant social circle when they have to deal with academic and non-academic stressors. Students with a CAC profile would choose to respond to stressors more autonomously, either because of a lack of interpersonal skills to ask for help or because they feel they do not have this social support or because they feel the advantages of seeking help are outweighed by the disadvantages (Scharp and Dorrance Hall, 2019), such as being considered incompetent or weak. Finally, in this study, we identified the existence of a group of students characterized by a low use of positive reappraisal, support seeking, and planning (the LACS profile). Assuming that these three strategies are highly functional in academic contexts (Skinner et al., 2016), the reduced availability of them in this profile would seem to indicate the students' lack of flexibility to respond adaptively to the various demands of day-to-day university life.

The identification of these four profiles adds to the growing line of work which supports the benefits of analyzing coping with stress in the university context with a person-centered approach (e.g., Cheng, 2001; Kato, 2012; Doron et al., 2014; Freire et al., 2018; Gabrys et al., 2018; González Cabanach et al., 2018; Hasselle et al., 2019). To be specific, the four-profile solution in our study coincides with results from González Cabanach et al. (2018), in a study which also examined flexibility of coping based on the combination of positive reappraisal, support seeking, and planning strategies. This may point to a potential generalization of the profiles identified when the flexibility of approach coping with stress is examined in a university context.

Beyond affirming the existence of student profiles characterized by differences in the flexibility of coping, the objective of our study was to determine whether these groups diverged in their expectations of self-efficacy. In accordance with our hypothesis, the greater the flexibility in approach coping with stress, the higher the students' levels of general self-efficacy and vice versa. The student profiles that had most flexibility in their coping (HACS and CAC) exhibited notable differences (i.e., large effect sizes) in self-efficacy compared to less flexible profiles (SAC and LACS). Additionally, the SAC profile exhibited moderately higher self-efficacy (i.e., medium effect size) than the LACS profile.

These results could indicate, in line with other studies from the healthcare context (e.g., Haythornthwaite et al., 1998), that flexibility in coping enhances university students' perception of control over their day-to-day challenges, making them feel better able to handle them. This explanation may be connected with what Hobfoll's conservation of resources theory (Hobfoll et al., 2018) postulates. According to this theory, individuals who have high levels of personal resources (e.g., a variety of approach coping strategies) participate in an upward spiral of acquisition, development, and preservation of new resources (e.g., self-efficacy). In contrast, scarce resources in the face of a given challenge (e.g., low flexibility in coping) would put the individual into a downward spiral of losing resources (e.g., low self-efficacy) which would make them more vulnerable to stress. In this way, personal resources would act in "convoy" (Holmgreen et al., 2017), one after the other, whether upward or downward. In addition, the fact that we did not find significant differences between the HACS and CAC profiles with regard to general self-efficacy suggests that, in terms of developing generalized self-referential beliefs about personal competency in response to the demands of university life, the combination of cognitive strategies (positive reappraisal and planning) is more important than social strategies (support seeking). This idea is in line with the lower potency that Bandura's (1997) social cognitive theory ascribes to social sources in making up expectations of self-efficacy. Thus, it is possible that the low availability of cognitive coping resources exhibited by students with the SAC profile would negatively affect their beliefs of competency for dealing with stressors, which would lead them to seek feedback from their sources of support that would give them some degree of self-efficacy, albeit significantly less than students with HACS and CAC profiles, but still somewhat higher than students with the LACS profile.

## Implications of the Results of the Study

University stress is a growing psychosocial concern, both because of its prevalence and because of the negative consequences it can have for the student. Although this scenario highlights the need to implement effective coping interventions in the entire university population, this need is even more pronounced in students who are studying healthcare-related degrees (Saeed et al., 2016), in which stress levels are significantly higher (Heinen et al., 2017; Zeng et al., 2019). In line with that, the results of our study may represent a significant contribution, in that they help increase our understanding of how two important psychological resources, flexibility of approach coping strategies and general self-efficacy, function in the prevention of stress.

To be more specific, our findings allow the identification of those students who, depending on the level of their flexibility in the use of approach coping strategies, are more (LACS and SAC profiles) or less (HACS and CAC profiles) vulnerable with respect to developing their expectations of generalized self-efficacy.

Not only does self-efficacy play an important role in the prevention of university stress (Freire et al., 2019; Schönfeld et al., 2019), it is also one of the most influential factors in the motivational, cognitive, and behavioral responses of the student to the teaching–learning process (Schunk and Pajares, 2010). Consequently, in light of our results, students in the SAC and particularly in the LACS profiles should be the focus of priority intervention in order to enhance flexibility in their repertoire of approach coping strategies as a way of improving their generalized expectations of self-efficacy. In recent years, interventions aimed at improving the coping skills of university students have proliferated. Most of these initiatives have adopted an approach based on cognitive behavioral therapy (Houston et al., 2017), mindfulness (Kang et al., 2009), or a combination of the two (Recabarren et al., 2019). In these programs, students learn to identify the main symptoms associated with stress, as well as the external (environmental demands) and internal (thoughts and emotions) factors that contribute to its appearance. Furthermore, students acquire various primary control (e.g., planning and problem solving) and secondary control (e.g., positive reappraisal and meditation) adaptive coping strategies.

Although these types of interventions have shown their effectiveness both in reducing stress (Regehr et al., 2013; Yusufov et al., 2019) and in increasing self-efficacy (Molla Jafar et al., 2015; Phang et al., 2015), they have limited influence by themselves on the students' abilities to be flexible in their coping strategies (Cheng and Cheung, 2005). Prior research offers us evidence of the efficacy of focused training to enhance both individuals' repertoires of strategies and their metacognitive abilities to evaluate and select the best coping strategies in each situation (Cheng et al., 2012).

From this, it would seem that metacognitive self-regulation and executive functioning skills (e.g., planning, organization, emotional management) constitute an important resource for improving students' abilities to make their repertoires of strategies more flexible, in addition to specific training aimed at increasing their coping strategies (Bettis et al., 2017; de la Fuente et al., 2018a). Some online tools in this area, such as e-Coping with Academic Stress™, have demonstrated good results in the improvement of self-regulating skills (e.g., self-evaluation and decision making) in students when facing potentially stressful situations in the university context (de la Fuente et al., 2018b). These results also have important implications at the classroom level, given that if teachers encourage the development of self-regulation skills in university students, they increase the tendency for students to autonomously use approach coping strategies, such as establishing a plan of action, assessing the positive aspects of the situation, or seeking advice and emotional support from other people (de la Fuente et al., 2020). These self-regulatory skills have also been shown to be effective in increasing students' self-efficacy beliefs (Cerezo et al., 2019).

## Limitations of the Study and Lines for Future Research

The contributions of this study should be assessed, taking into account the limitations inherent in its design. First, the transversal nature of the study does not allow causal relationships to be established between the variables studied. Therefore, although our results suggest that flexibility in coping with stress influences the generalized expectations of self-efficacy, the causal order between these variables must be examined in the light of more rigorous study designs (e.g., longitudinal studies). A second limitation lies in the composition of the sample, which was dissimilar in terms of gender representation, university year, and degree type. In this study, those three variables were considered as covariates to statistically control their effect, with degree type and gender exhibiting a null effect and a small effect, respectively. However, new studies are needed that would be able to corroborate the extent to which these variables are important, or not, in the configuration of the profiles of coping flexibility and in the relationship between these profiles and self-efficacy. In fact, based on our findings, the levels of general self-efficacy were significantly higher in men (albeit with a small effect size) in all of the coping profiles except the group which had similar levels of representation of both sexes (the CAC profile), where there were no differences. Therefore, in order to make the results more generalizable to the university student population, future studies should use more thorough recruitment procedures that would give more balanced samples in terms of gender, university year, and degree type. In the same vein, future work should consider the extent to which variables not addressed in this study, such as students' previous academic performance, their socioeconomic status, or their intellectual abilities (e.g., cognitive and attention level), may be relevant in the relationship between stress coping profiles and general self-efficacy in the university context. The fact that all of the participants were recruited from the same university constitutes a third limitation of our study. In order to facilitate generalization of the results, new studies are needed which involve students from other geographical and cultural contexts.

Fourth, the use of self-reports as a data collection method may limit the veracity of the results, since participants may have response biases, ranging from a misunderstanding of the items to social desirability bias (i.e., the tendency of survey respondents to answer questions in a manner that will be viewed favorably by others, even if the survey is anonymous) (Rosenman et al., 2011). These biases may have been increased by the effect of the data collection method used (collective and pencil-and-paper condition). In fact, this type of method can increase the perception of a lack of privacy and confidentiality when other participants are present (van de Looij-Jansen and de Wilde, 2008), encouraging the social desirability response effect and a higher rate of questions not answered, especially with sensitive questions such as those related to mental health (Raat et al., 2007). These and other limitations—for example, data collection costs and data entry errors (Colasante et al., 2019), physical and emotional fatigue of the participants at the time data collection, and absence of a rigorous control over the time

taken to complete the questionnaires (Díaz de Rada, 2018)—could be minimized by using computerized administration of questionnaires. Likewise, future studies should corroborate our findings using a combination of methods that include not only questionnaires but also classroom observations and in-depth interviews with the students.

There is another limitation with respect to the questionnaires used, specifically the questionnaire we used to evaluate coping strategies. Although the three strategies evaluated by this instrument (positive reappraisal, support seeking, and planning) are widely used in academic contexts, that does not preclude the possibility of students using other types of strategies. Future research should examine the possible makeup of flexible coping profiles considering other strategies that were not assessed in this study.

Finally, another limitation lies in the operationalization of the concept of coping flexibility. Our results seem to be consistent with the conceptualization of coping flexibility in terms of balanced profiles, according to which the student deploys various strategies at similar levels (Kaluza, 2000). Despite this idea of coping flexibility being widely adopted in the educational field, there are other ways to operationalize this construct (e.g., a broad repertoire or cross-situational variability; for a more precise characterization, see Cheng et al., 2014), which might impede comparison between studies and the generalization of the results.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee at the University of A Coruña. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

CF and MF contributed to the conceptualization, investigation, methodology, writing, and supervision of this study. BR and SR contributed to the investigation, writing, and supervision of this study. AV and JN contributed to the methodology, writing, and supervision of this study.

## FUNDING

This work was financed by the research projects EDU2013-44062-P (MINECO), EDU2017-82984-P (MEIC), and the Consejería de Empleo, Industria y Turismo del Principado de Asturias (Department of Employment, Industry and Tourism of the Principality of Asturias, Spain) (ref. FC-GRUPIN-IDI/2018/000199).

## ACKNOWLEDGMENTS

The authors would like to thank the students who participated in the study.

## REFERENCES

American College Health Association (2018). *National College Health Assessment II: Reference Group Executive Summary Fall 2018*. Hanover, MD: American College Health Association.

Baessler, J., and Schwarzer, R. (1996). Evaluación de la autoeficacia: adaptación española de la escala de autoeficacia general [Evaluation of self-efficacy: spanish adaptation of the General Self-efficacy Scale]. *Ans. Estrés* 2, 1–8.

Bandura, A. (1997). *Self-Efficacy: The exercise of Control*. New York, NY: Freeman.

Bandura, A., Caprara, G. V., Barbaranelli, C., Gerbino, M., and Pastorelli, C. (2003). Role of affective self-regulatory efficacy in diverse spheres of psychosocial functioning. *Child Dev.* 74, 769–782. doi: 10.1111/1467-8624.00567

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi: 10.1016/j.jad.2014.10.054

Bettis, A. H., Coiro, M. J., England, J., Murphy, L. K., Zelkowitz, R. L., Dejardins, L., et al. (2017). Comparison of two approaches to prevention of mental health problems in college students: enhancing coping and executive function skills. *J. Am. Coll. Health* 65, 313–322. doi: 10.1080/07448481.2017

Blanco, C., Okuda, M., Wright, C., Hasin, D. S., Grant, B. F., Liu, S.-M., et al. (2008). Mental health of college students and their non-college-attending peers: results from the national epidemiologic study on alcohol and related conditions. *Arch. Gen. Psychiatry* 65, 1429–1437. doi: 10.1001/archpsyc.65.12.1429

Bonanno, G. A., and Burton, C. L. (2013). Regulatory flexibility: an individual differences perspective on coping and emotion regulation. *Perspect. Psychol. Sci.* 8, 591–612. doi: 10.1177/1745691613504116

Cabanach, R. G., Valle, A., Rodríguez, S., Piñeiro, I., and Freire, C. (2010). Escala de Afrontamiento del Estrés Académico (A-CEA) [The coping scale of academic stress questionnaire (A-CEA)]. *Rev. Iberoam. Psicol. Salud.* 1, 51–64.

Cerezo, R., Fernández, E., Amieiro, N., Valle, A., Rosário, P., and Núñez, J. C. (2019). Mediating role of self-efficacy and usefulness between self-regulated learning strategy knowledge and its use. *Rev. Psicodidact.* 24, 1–8. doi: 10.1016/j.psicoe.2018.09.001

Cheng, C. (2001). Assessing coping flexibility in real-life and laboratory settings: a multimethod approach. *J. Pers. Soc. Psychol.* 80, 814–833. doi: 10.1037//0022-3514.80.5.814

Cheng, C., and Cheung, M. W. L. (2005). Cognitive processes underlying coping flexibility: differentiation and integration. *J. Pers.* 73, 859–886. doi: 10.1111/j.1467-6494.2005.00331.x

Cheng, C., Kogan, A., and Chio, J. H. (2012). The effectiveness of a new, coping flexibility intervention as compared with a cognitive-behavioural intervention in managing work stress. *Work Stress* 26, 272–288. doi: 10.1080/02678373.2012.710369

Cheng, C., Lau, H.-P. B., and Chan, M. P. S. (2014). Coping flexibility and psychological adjustment to stressful life changes: a meta-analytic review. *Psychol. Bull.* 140, 1582–1607. doi: 10.1037/a0037913

Chou, P.-C., Chao, Y.-M. Y., Yang, H.-J., Yeh, G.-L., and Lee, T. S.-H. (2011). Relationships between stress, coping and depressive symptoms among overseas university preparatory Chinese students: a cross-sectional study. *BMC Public Health* 11:352. doi: 10.1186/1471-2458-11-352

Clarke, A. T. (2006). Coping with interpersonal stress and psychosocial health among children and adolescents: a meta-analysis. *J. Youth Adolesc.* 35, 10–23. doi: 10.1007/s10964-005-9001-x

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, MI: Erlbaum.

Colasante, E., Benedetti, E., Fortunato, L., Scalese, M., Potente, R., Cutilli, A., et al. (2019). Paper-and-pencil versus computerized administration mode: comparison of data quality and risk behavior prevalence estimates in the European school survey project on alcohol and other drugs (ESPAD). *PLoS One* 14:e0225140. doi: 10.1371/journal.pone.0225140

de la Fuente, J., Amate, J., González-Torres, M. C., Artuch, R., García-Torrecillas, J. M., and Fadda, S. (2020). Effects of levels of self-regulation and regulatory teaching on strategies for coping with academic stress in undergraduate students. *Front. Psychol.* 11:22. doi: 10.3389/fpsyg.2020.00022

de la Fuente, J., Mañas, I., Franco, C., Cangas, A. J., and Soriano, E. (2018a). Differential effect of level of self-regulation and mindfulness training on coping strategies used by university students. *Int. J. Environ. Res. Public Health* 15:E2230. doi: 10.3390/ijerph15102230

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., González-Torres, M. C., Artuch, R., and Garzón-Umerenkova, A. (2018b). Satisfaction with the self-assessment of university students through e-Coping with academic stress UtilityTM. *Front. Psychol.* 9:1932. doi: 10.3389/fpsyg.2018.01932

Deasy, C., Coughlan, B., Pironom, J., Jourdan, D., and Mannix-McNamara, P. (2014). Psychological distress and coping amongst higher education students: a mixed method enquiry. *PLoS One* 9:e115193. doi: 10.1371/journal.pone.0115193

DeRosier, M. E., Frank, E., Schwartz, V., and Leary, K. A. (2013). The potential role of resilience education for preventing mental health problems for college students. *Psychiatr. Ann.* 43, 538–544. doi: 10.3928/00485713-20131206-05

Díaz de Rada, V. (2018). Face-to-face surveys using paper or a computer: difference in attitudes. *Papers* 103, 199–227. doi: 10.5565/rev/papers.2301

Doron, J., Trouillet, R., Maneveau, A., Neveu, D., and Ninot, G. (2014). Coping profiles, perceived stress and health-related behaviors: a cluster analysis approach. *Health Promot. Int.* 30, 88–100. doi: 10.1093/heapro/dau090

Eisenbarth, C. (2012). Coping profiles and psychological distress: a cluster analysis. *N. Am. J. Psychol.* 14, 485–496.

Erschens, R., Herrmann-Werner, A., Keifenheim, K. E., Loda, T., Bugaj, T. J., Nikendei, C., et al. (2018). Differential determination of perceived stress in medical students and high-school graduates due to private and training-related stressors. *PLoS One* 13:e0191831. doi: 10.1371/journal.pone.0191831

Feldman, D. B., and Kubota, M. (2015). Hope, self-efficacy, optimism, and academic achievement: distinguishing constructs and levels of specificity in predicting college grade-point average. *Learn Indiv. Differ.* 37, 210–216. doi: 10.1016/j.lindif.2014.11.022

Findley-Van Nostrand, D., and Pollenz, R. S. (2017). Evaluating psychosocial mechanisms underlying STEM persistence in undergraduates: evidence of impact from a six-day pre–college engagement STEM Academy Program. *CBE Life Sci. Educ.* 16, 1–15. doi: 10.1187/cbe.16-10-0294

Freire, C., Ferradás, M. M., Núñez, J. C., and Valle, A. (2018). Coping flexibility and eudaimonic well-being in university students. *Scand. J. Psychol.* 59, 433–442. doi: 10.1111/sjop.12458

Freire, C., Ferradás, M. M., Núñez, J. C., Valle, A., and Vallejo, G. (2019). Eudaimonic well-being and coping with stress in university students: the mediating/moderating role of self-efficacy. *Int. J. Environ. Res. Public Health* 16:48. doi: 10.3390/ijerph16010048

Gabrys, R. L., Tabri, H., Anisman, N., and Matheson, K. (2018). Cognitive control and flexibility in the context of stress and depressive symptoms: the cognitive control and flexibility questionnaire. *Front. Psychol.* 9:2219. doi: 10.3389/fpsyg.2018.02219

Galatzer-Levy, I. R., Burton, C. L., and Bonanno, G. A. (2012). Coping flexibility, potentially traumatic life events, and resilience: a prospective study of college student adjustment. *J. Soc. Clin. Psychol.* 31, 542–567. doi: 10.1521/jscp.2012.31.6.542

González Cabanach, R., Souto-Gestal, A., González-Doniz, L., and Franco, V. (2018). Perfiles de afrontamiento y estrés académico en estudiantes universitarios [Profiles of coping and academic stress among university students]. *Rev. Invest. Educ.* 36, 421–433. doi: 10.6018/rie.36.2.290901

Gustems-Carnicer, J., Calderón, C., and Calderón-Garrido, D. (2019). Stress, coping strategies and academic achievement in teacher education students. *Eur. J. Teach. Educ.* 42, 375–390. doi: 10.1080/02619768.2019.1576629

Hasselle, A. J., Schwartz, L. E., Berlin, K. S., and Howell, K. H. (2019). A latent profile analysis of coping responses to individuals' most traumatic event: associations with adaptive and maladaptive mental health outcomes. *Anxiety Stress Copin* 32, 626–640. doi: 10.1080/10615806.2019.1638733

Haythornthwaite, J. A., Menefee, L. A., Heinberg, L. J., and Clark, M. R. (1998). Pain coping strategies predict perceived control over pain. *Pain* 77, 33–39. doi: 10.1016/s0304-3959(98)00078-5

Heinen, I., Bullinger, M., and Kocalevent, R. D. (2017). Perceived stress in first year medical students - associations with personal resources and emotional distress. *BMC Med. Educ.* 17:4. doi: 10.1186/s12909-016-0841-8

Hipp, J. R., and Bauer, D. J. (2006). Local solutions in the estimation of growth mixture models. *Psychol. Methods* 11, 36–53. doi: 10.1037/1082-989X.11.1.36

Hobfoll, S. E., Halbesleben, J., Neveu, J. P., and Westman, M. (2018). Conservation of resources in the organizational context: the reality of resources and their consequences. *Ann. Rev. Organ. Psychol. Organ. Behav.* 5, 103–128. doi: 10.1146/annurev-orgpsych-032117-104640

Holmgreen, L., Tirone, V., Gerhart, J., and Hobfoll, S. E. (2017). "Conservation of resources theory. Resource caravans and passageways in health contexts," in *The Handbook of Stress and Health: A Guide to Research and Practice*, eds C. L. Cooper and J. C. Quick (Oxford: Wiley), 443–458.

Honicke, T., and Broadbent, J. (2016). The relation of academic self-efficacy to university student academic performance: a systematic review. *Educ. Res. Rev.* 17, 63–84. doi: 10.1016/j.edurev.2015.11.002

Houston, J. B., First, J., Spialek, M. L., Sorenson, M. E., Mills-Sandoval, T., Lockett, M., et al. (2017). Randomized controlled trial of the resilience and coping intervention (RCI) with undergraduate university students. *J. Am. Coll. Health* 65, 1–9. doi: 10.1080/07448481.2016.1227826

Howard, D. E., Schiraldi, G., Pineda, A., and Campanella, R. (2006). "Stress and mental health among college students: overview and promising prevention interventions," in *Stress and Mental Health of College Students*, ed. M. V. Landow (New York, NY: Nova Science Publishers), 91–124.

Huang, C. (2013). Gender differences in academic self-efficacy: a meta-analysis. *Eur. J. Psychol. Educ.* 28, 1–35. doi: 10.1007/s10212-011-0097-y

IBM Corp. (2019). *SPSS STATISTICS for Windows, Version 26.0*. Armonk, NY: IBM Corp.

Kaluza, G. (2000). Changing unbalanced coping profiles-A prospective controlled intervention trial in worksite health promotion. *Psychol. Health* 15, 423–433. doi: 10.1080/08870440008402003

Kang, Y. S., Choi, S. Y., and Ryu, E. (2009). The effectiveness of a stress coping program based on mindfulness meditation on the stress, anxiety, and depression experienced by nursing students in Korea. *Nurse Educ. Today* 29, 538–543. doi: 10.1016/j.nedt.2008.12.003

Kato, T. (2012). Development of the coping flexibility scale: evidence for the coping flexibility hypothesis. *J. Couns. Psychol.* 59, 262–273. doi: 10.1037/a0027770

Keefe, F. J., Kashikar-Zuck, S., Robinson, E., Salley, A., Beaupre, P., Caldwell, D., et al. (1997). Pain coping strategies that predict patient's and spouses' rating of patients' self-efficacy. *Pain* 73, 191–199. doi: 10.1016/S0304-3959(97)00109-7

Kim, J. E., Saw, A., and Zane, N. (2015). The influence of psychological symptoms on mental health literacy of college students. *Am. J. Orthopsychiatry* 85, 620–630. doi: 10.1037/ort0000074

Kobylińska, D., and Kusev, P. (2019). Flexible emotion regulation: how situational demands and individual differences influence the effectiveness of regulatory strategies. *Front. Psychol.* 10:72. doi: 10.3389/fpsyg.2019.00072

Lanin, D. G., Guyll, M., Cornish, M. A., Vogel, D. L., and Madon, S. (2019). The importance of counseling self-efficacy: physiologic stress in student helpers. *J. College Stud. Psychother.* 33, 14–24. doi: 10.1080/87568225.2018.1424598

Lanza, S. T., Flaherty, B. P., and Collins, L. M. (2003). "Latent class and latent transition analysis," in *Handbook of Psychology: Research Methods in Psychology*, eds J. A. Schinka and W. F. Velicer (Hobobken, NJ: Wiley), 663–685.

Laursen, B., and Hoff, E. (2006). Person-centered and variable-centered approaches to longitudinal data. *Merrill-Palmer Q.* 52, 377–389. doi: 10.1353/mpq.2006.0029

Lazarus, R. S., and Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York, NY: Springer.

Leiva-Bianchi, M., Baher, G., and Poblete, C. (2012). The effects of stress coping strategies in post-traumatic stress symptoms among earthquake survivors. An explanatory model of post-traumatic stress. *Terapia Psicol.* 30, 51–59. doi: 10.4067/s0718-48082012000200005

Lo, Y., Mendell, N. R., and Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika* 88, 767–778. doi: 10.1093/biomet/88.3.767

Milojevich, H. M., and Lukowski, A. F. (2016). Sleep and mental health in undergraduate students with generally healthy sleep habits. *PLoS One* 11:e0156372. doi: 10.1371/journal.pone.0156372

Molla Jafar, H., Salabifard, S., Mousavi, S. M., and Sobhani, Z. (2015). The effectiveness of group training of CBT-based stress management on anxiety, psychological hardiness and general self-efficacy among university students. *Glob. J. Health Sci.* 8, 47–54. doi: 10.5539/gjhs.v8n6p47

Muthén, L. K., and Muthén, B. O. (1998–2012). *Mplus User's Guide*, 6th Edn. Los Angeles, CA: Muthén & Muthén.

Nylund, K. L., Asparouhov, T., and Muthén, B. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: a monte carlo simulation study. *Struct. Equ. Modeling* 14, 535–569. doi: 10.1080/10705510701575396

Phang, C. K., Mukhtar, F., Ibrahim, N., Keng, S. L., and Mohd Sidik, S. (2015). Effects of a brief mindfulness-based intervention program for stress management among medical students: the Mindful-Gym randomized controlled study. *Adv. Health Sci. Educ. Theory Pract.* 20, 1115–1134. doi: 10.1007/s10459-015-9591-3

Raat, H., Mangunkusumo, R. T., Landgraf, J. M., Kloek, G., and Brug, J. (2007). Feasibility, reliability, and validity of adolescent health status measurement by the child health questionnaire child form (CHQ-CF): internet administration compared with the standard paper version. *Qual. Life Res.* 16, 675–685. doi: 10.1007/s11136-006-9157-1

Recabarren, R. E., Gaillard, C., Guillod, M., and Martin-Soelch, C. (2019). Short-term effects of a multidimensional stress prevention program on quality of life, well-being and psychological resources. A randomized controlled trial. *Front. Psychiatry* 10:88. doi: 10.3389/fpsyt.2019.00088

Regehr, C., Glancy, D., and Pitts, A. (2013). Interventions to reduce stress in university students: a review and meta-analysis. *J. Affect. Disord.* 148, 1–11. doi: 10.1016/j.jad.2012.11.026

Ritchie, L. (2016). *Fostering self-Efficacy in Higher Education Students*. London: Palgrave MacMillan.

Rosenman, R., Tennekoon, V., and Hill, L. G. (2011). Measuring bias in self-reported data. *Int. J. Behav. Healthc. Res.* 2, 320–332. doi: 10.1504/IJBHR.2011.043414

Saeed, A. A., Bahnassy, A. A., Al-Hamdan, N. A., Almudhaibery, F. S., and Alyahya, A. Z. (2016). Perceived stress and associated factors among medical students. *J. Family Community Med.* 23, 166–171. doi: 10.4103/2230-8229.189132

Sahin, F., and Çetin, F. (2017). The mediating role of general self-efficacy in the relationship between the big five personality traits and perceived stress: A weekly assessment study. *Psychol. Stud.* 62, 35–46. doi: 10.1007/s12646-016-0382-6

Sandler, I. N., Tein, J.-Y., Mehta, P., Wolchik, S., and Ayers, T. (2000). Coping efficacy and psychological problems of children of divorce. *Child Dev.* 71, 1099–1118. doi: 10.1111/1467-8624.00212

Scharp, K. M., and Dorrance Hall, E. (2019). Examining the relationship between undergraduate student parent social support-seeking factors, stress, and somatic symptoms: a two-model comparison of direct and indirect effects. *Health Commun.* 34, 54–64. doi: 10.1080/10410236.2017.1384427

Scholz, U., Doña, B. G., Sud, S., and Schwarzer, R. (2002). Is general self-efficacy a universal construct? Psychometric findings from 25 countries. *Eur. J. Psychol. Assess.* 18, 242–251. doi: 10.1027//1015-5759.18.3.242

Schönfeld, P., Brailovskaia, J., Bieda, A., Zhang, X. C., and Margraf, A. (2016). The effects of daily stress on positive and negative mental health: mediation through self-efficacy. *Int. J. Clin. Health Psychol.* 16, 1–10. doi: 10.1016/j.ijchp.2015.08.005

Schönfeld, P., Brailovskaia, J., Zhang, X. C., and Margraf, A. (2019). Self-efficacy as a mechanism linking daily stress to mental health in students: a three-wave cross-lagged study. *Psychol. Rep.* 122, 2074–2095. doi: 10.1177/0033294118787496

Schunk, D., and Pajares, F. (2010). "Self-efficacy beliefs," in *International Encyclopedia of Education*, 3rd Edn, eds P. Peterson, E. Baker, and B. McGaw (New York, NY: Elsevier), 668–672.

Siltanen, S., Rantanen, T., Portegijs, E., Tourunen, A., Poranen-Clark, T., Eronen, J., et al. (2019). Association of tenacious goal pursuit and flexible goal adjustment with out-of-home mobility among community-dwelling older people. *Aging Clin. Exp. Res.* 31, 1249–1256. doi: 10.1007/s40520-018-1074-y

Skinner, E. A., Edge, K., Altman, J., and Sherwood, H. (2003). Searching for the structure of coping: A review and critique of category systems for classifying ways of coping. *Psychol. Bull.* 129, 216–269. doi: 10.1037/0033-2909.129.2.216

Skinner, E. A., Pitzer, J. R., and Steele, J. S. (2016). Can student engagement serve as a motivational resource for academic coping, persistence, and learning during late elementary and early middle school? *Dev. Psychol.* 52, 2099–2117. doi: 10.1037/dev0000232

Syed, M., and Seiffge-Krenke, I. (2015). Change in ego development, coping, and symptomatology from adolescence to emerging adulthood. *J. Appl. Dev. Psychol.* 41, 110–119. doi: 10.1016/j.appdev.2015.09.003

Tavolacci, M. P., Ladner, J., Grigioni, S., Richard, L., Villet, H., and Dechelotte, P. (2013). Prevalence and association of perceived stress, substance use and behavioral addictions: a cross-sectional study among university students in France, 2009-2011. *BMC Public Health* 13:724. doi: 10.1186/1471-2458-13-724

Tran, A. W. Y., and Lumley, M. N. (2019). Internalized stigma and student well-being: the role of adaptive and maladaptive coping. *Soc. Work Ment. Health* 17, 408–425. doi: 10.1080/15332985.2018.1563023

Turner, J., Bartlett, D., Andiappan, M., and Cabot, L. (2015). Students' perceived stress and perception of barriers to effective study: impact on academic performance in examinations. *Br. Dent. J.* 219, 453–458. doi: 10.1038/sj.bdj.2015.850

van de Looij-Jansen, P. M., and de Wilde, E. J. (2008). Comparison of web-based versus paper-and-pencil self-administered questionnaire: effects on health indicators in Dutch adolescents. *Health Serv. Res.* 43, 1708–1721. doi: 10.1111/j.1475-6773.2008.00860.x

Vizoso, C. M., and Arias, O. (2016). Estresores académicos percibidos por estudiantes universitarios y su relación con el burnout y el rendimiento académicos [Academic stressors perceived by university students and their relationship with academic burnout, efficacy and performance]. *Anu. Psicol.* 46, 90–97. doi: 10.1016/j.anpsic.2016.07.006

Volz, M., Voelkle, M. C., and Werheid, K. (2019). General self-efficacy as a driving factor of post-stroke depression: a longitudinal study. *Neuropsychol. Rehabil.* 29, 1426–1438. doi: 10.1080/09602011.2017.1418392

Waqas, A., Khan, S., Sharif, W., Khalid, U., and Ali, A. (2015). Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: a cross sectional survey. *PeerJ* 3:e840. doi: 10.7717/peerj.840

Webber, J., Skodda, S., Muth, T., Angerer, P., and Loerbroks, A. (2019). Stressors and resources related to academic studies and improvements suggested by medical students: a qualitative study. *BMC Med. Educ.* 19:312. doi: 10.1186/s12909-019-1747-z

Wood, R. E., and Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *J. Pers. Soc. Psychol.* 56, 407–415. doi: 10.1037/0022-3514.56.3.407

Yusufov, M., Nicoloro-SantaBarbara, J., Grey, N. E., Moyer, A., and Lobel, M. (2019). Meta-analytic evaluation of stress reduction interventions for undergraduate and graduate students. *Int. J. Stress Manag.* 26, 132–145. doi: 10.1037/str0000099

Zeng, Y., Wang, G., Xie, C., Hu, X., and Reinhardt, J. D. (2019). Prevalence and correlates of depression, anxiety and symptoms of stress in vocational college nursing students from Sichuan. China: a cross-sectional study. *Psychol. Health Med.* 24, 798–811. doi: 10.1080/13548506.2019.1574358

Zimmer-Gembeck, M. J., and Skinner, E. A. (2016). "The development of coping: Implications for psychopathology and resilience," in *Developmental Psychology: Risk, Resilience, and Intervention*, ed. D. Cicchetti (New York, NY: John Wiley & Sons), 485–545.

Zumbrunn, S., Broda, M., Varier, S., and Conklin, S. (2019). Examining the multidimensional role of self-efficacy for writing on student writing self-regulation and grades in elementary and high school. *Br. J. Educ. Psychol.* doi: 10.1111/bjep.12315 [Epub ahead of print].

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

REVIEW
published: 03 June 2020
doi: 10.3389/fpsyg.2020.01063

# Optimizing Students' Mental Health and Academic Performance: AI-Enhanced Life Crafting

*Izaak Dekker[1,2]*, Elisabeth M. De Jong[1], Michaéla C. Schippers[1], Monique De Bruijn-Smolders[1,2], Andreas Alexiou[1,3] and Bas Giesbers[4]*

*[1] Department of Technology and Operations Management, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, [2] Research Centre Urban Talent, Rotterdam University of Applied Sciences, Rotterdam, Netherlands, [3] Department of Management, Tilburg School of Economics and Management, Tilburg University, Tilburg, Netherlands, [4] Information Management and Consulting, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands*

One in three university students experiences mental health problems during their study. A similar percentage leaves higher education without obtaining the degree for which they enrolled. Research suggests that both mental health problems and academic underperformance could be caused by students lacking control and purpose while they are adjusting to tertiary education. Currently, universities are not designed to cater to all the personal needs and mental health problems of large numbers of students at the start of their studies. Within the literature aimed at preventing mental health problems among students (e.g., anxiety or depression), digital forms of therapy recently have been suggested as potentially scalable solutions to address these problems. Integrative psychological artificial intelligence (AI) in the form of a chatbot, for example, shows great potential as an evidence-based solution. At the same time, within the literature aimed at improving academic performance, the online life-crafting intervention in which students write about values and passions, goals, and goal-attainment plans has shown to improve the academic performance and retention rates of students. Because the life-crafting intervention is delivered through the curriculum and doesn't bear the stigma that is associated with therapy, it can reach larger populations of students. But life-crafting lacks the means for follow-up or the interactiveness that online AI-guided therapy can offer. In this narrative review, we propose to integrate the current literature on chatbot interventions aimed at the mental health of students with research about a life-crafting intervention that uses an inclusive curriculum-wide approach. When a chatbot asks students to prioritize both academic as well as social and health-related goals and provides personalized follow-up coaching, this can prevent -often interrelated- academic and mental health problems. Right on-time delivery, and personalized follow-up questions enhance the effects of both -originally separated- intervention types. Research on this new combination of interventions should use design principles that increase user-friendliness and monitor the technology acceptance of its participants.

**Keywords: life crafting, chatbot, mental health, academic performance, academic success, academic achievement, goal setting, well-being**

OPEN ACCESS

***Edited by:***
*Douglas F. Kauffman, Medical University of the Americas – Nevis, United States*

***Reviewed by:***
*Judit García-Martín, University of Salamanca, Spain*
*Cecilia María Ruiz Esteban, University of Murcia, Spain*

****Correspondence:***
*Izaak Dekker*
*dekker@rsm.nl*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *14 February 2020*
***Accepted:*** *27 April 2020*
***Published:*** *03 June 2020*

***Citation:***
*Dekker I, De Jong EM, Schippers MC, De Bruijn-Smolders M, Alexiou A and Giesbers B (2020) Optimizing Students' Mental Health and Academic Performance: AI-Enhanced Life Crafting. Front. Psychol. 11:1063. doi: 10.3389/fpsyg.2020.01063*

## INTRODUCTION

One in three students leaves higher education without attaining the higher education degree for which they enrolled (Organisation for Economic Co-operation and Development (OECD), 2010, 2013, 2019). Research suggests that students are having trouble adjusting to tertiary education, leading them to underperform academically (Perry, 1991). For example, students are said to have problems with integrating academically and socially (Tinto, 1998, 1999) and with managing their learning processes (e.g., goal setting, planning, monitoring, and time management; Robbins et al., 2004; Richardson et al., 2012). Not only does the first year of college come with a relatively high risk of not succeeding academically, it also coincides with a higher risk of mental health-related issues and subsequently low levels of well-being (Hunt and Eisenberg, 2010; Auerbach et al., 2018; Bruffaerts et al., 2018; Choi, 2018). Mental health and well-being are related and contribute to the decrease of students' academic performance (in the current study defined as student retention, grade point average and obtained credits Bruffaerts et al., 2018). College students with mental health problems are twice as likely to drop out (Kessler et al., 1995; Hartley, 2010), and depression and suicidal thoughts relate to a lower GPA (Mortier et al., 2015; De Luca et al., 2016). Mental health and academic performance are thus interrelated.

Underlying both mental health and academic performance is a broader conception of 'eudaimonic' well-being as self-realization and meaning (Waterman, 1993; Ryan and Deci, 2001). Research suggests that undergraduate students often have difficulty with finding meaning (Steger et al., 2008) or a clear sense of purpose or direction in life (Schippers and Ziegler, 2019). However, having self-concordant goals (i.e., goals that align with one's values and passions), relates to higher academic performance (Sheldon and Houser-Marko, 2001), higher subjective well-being (Sheldon, 2002), and lower symptoms of depression (Sheldon and Kasser, 1998).

From this point of view, Schippers and Ziegler (2019) suggested using life-crafting interventions in order to help students reflect on their salient personal goals and improve their academic performance and well-being. Life crafting is a combination of techniques that allows people to (1) find their values and passions using expressive writing, (2) contrast desired habits and domains of life with the current state using mental contrasting, (3) use goal setting to prioritize ambitions and guide effort, and (4) effectuate their plans using implementation intentions. Thus, it helps people to become more specific about their goals and goal achievement plans (GAP). Together the exercises lead to a process of life crafting, defined as:

> *A process in which people actively reflect on their present and future life, set goals for important areas of life—social, career, and leisure time—and, if required, make concrete plans and undertake actions to change these areas in a way that is more congruent with their values and wishes. (Schippers and Ziegler, 2019, p. 3).*

The potential impact of life-crafting interventions seems promising, particularly because it is online and, therefore, scalable. However, it also has three weaknesses. First off, the current intervention technique does not ask follow-up questions. When students write brief answers to the life-crafting questions, the online questionnaire is not programmed to encourage the students to explicate their thoughts further and write more. A second shortcoming regards the methods for follow-up. Students who participated in the life-crafting exercises suggested that the intervention would improve if the intervention includes personal guidance after the initial phase. The email reminders used so far were not interactive or personalized. Thirdly, the current program does not differentiate for individual needs. For students without problems or with minor problems, the life-crafting program might be enough to boost their academic performance and well-being. However, others might require more follow-up and interaction, or might need coaching on mental health problems that interfere with their academic performance. Coaches and psychologists could facilitate personalized follow-up and interaction, but it would be time-consuming and costly. Most higher education institutions do not have the capacity to offer this kind of support. Therefore, there is a need for other scalable solutions, that offer a personalized and interactive program and contribute to early recognition of problems with academic performance or well-being, in order to prevent more severe problems.

A contemporary solution that is gaining momentum in the mental health-care sector is a mental-health chatbot (Provoost et al., 2017; Abd-alrazaq et al., 2019; Vaidyam et al., 2019). A chatbot is a computer program designed to simulate human conversation and is able to create the illusion of intelligent conversation (Warwick and Shah, 2014; Abdul-Kader and Woods, 2015) (for a review, see Fulmer, 2019). In a university setting, chatbots are predominantly used to provide cognitive behavioral therapy (Fitzpatrick et al., 2017; Fulmer et al., 2018; for an overview see Lattie et al., 2019). Other potential positive effects (e.g., on academic performance or well-being) have not yet been studied. Although in general chatbots show promising results (Provoost et al., 2017; Lattie et al., 2019), they are focused on offering therapy, and individuals may not use a health care service due to fears of stigma (Clement et al., 2015; Stewart et al., 2019). To illustrate: fewer than half of the college students who report suffering from one or more mental disorders seek treatment for those problems (Zivin et al., 2009; Auerbach et al., 2018; Stewart et al., 2019). Furthermore, the majority of students will probably not require cognitive behavioral therapy but would benefit from individualized coaching to overcome the problems they face during the transition to tertiary education. Therefore, in this narrative review, we propose to combine the two lines of research and to deliver a life-crafting intervention through an interactive chatbot. The chatbot can stimulate students to elaborate their answers to the life-crafting intervention, offer interactive and personalized follow-up, and also mental health coaching if needed.

Several studies (e.g., Tinto, 1975, 1998, 1999) indicate that both the transition to tertiary education as well as processes underlying student attrition never occur in isolation, but are the result of a longitudinal process of interrelated individual and environmental factors. We, therefore, advocate a holistic approach that stimulates students to steer their academic

work, their social life, and health in the right direction. This proposed life-crafting method offers a positive approach aimed at improvement instead of a more narrow problem-centered approach toward remediation of mental health problems in student populations (Schippers and Ziegler, 2019). Therefore, the intervention can be targeted at all first-year students instead of a group of identified at-risk students, which lowers the threshold to engage with the intervention and avoids stigma.

Below, we first provide more background information about the mental health and well-being of students and how this relates to academic performance. Subsequently, to provide a rationale for combining a life-crafting intervention with a mental health chatbot, we will first outline what a life-crafting intervention looks like, and then focus on describing in more detail current internet-based mental health care and especially mental health-care chatbots. After that, we describe how we propose to integrate life crafting into an AI-enhanced mental health chatbot. Finally, we present a conceptual model and guidelines for future research to examine the effectiveness of the proposed intervention.

## MENTAL HEALTH, WELL-BEING AND ACADEMIC PERFORMANCE

Generally speaking, mental health problems have a high prevalence among students in higher education. One in three college students reports one or more mental health problems (Hunt and Eisenberg, 2010; Auerbach et al., 2018; Bruffaerts et al., 2018). According to a recent study, including students attending 19 colleges across eight countries ($N$ = 13,984), depression disorders are most common, followed by generalized anxiety disorders (Auerbach et al., 2018). At this moment, worldwide, roughly 70% of high school graduates attend college (Auerbach et al., 2018; Bruffaerts et al., 2018). The college years are a peak period for the onset of many common mental disorders, particularly mood, anxiety, and substance use disorders (De Girolamo et al., 2012; Ibrahim et al., 2013).

Part of these problems can be explained by 'study stress' and academic underperformance. Having to study and perform under pressure in college is found to correlate with anxiety and lower well-being (Centre for Education Statistics and Evaluation, 2015; Cant, 2018). Procrastinating and underperforming in college have been found to predict depression, low self-esteem, and anxiety (Saddler and Sacks, 1993; van Eerde and Klingsieck, 2018). Simultaneously, mental health-related issues influence academic performance (Kessler et al., 1995; Steel et al., 2001; Hartley, 2010; Kim and Seo, 2015; Bruffaerts et al., 2018). There is, as such, an interrelatedness between academic performance and mental health issues. In order to understand this interrelatedness, and propose solutions that do not improve one at the cost of the other, we should clarify two different underlying conceptions of well-being.

The symptoms of mental health issues are mostly coined in terms of negative affect: feelings of pain, stress, depletion. The absence of negative affect, in combination with positive affect (feelings of pleasure and joy), determines one's subjective (or 'hedonic') well-being (Kahneman, 1999). In itself, this hedonic perspective on well-being can be a bad indicator of healthy living, given that it can lead to a focus on symptoms only or shortcuts (Ryff and Singer, 2008). A lifestyle aimed solely at hedonic well-being is more likely to be detrimental to well-being in the long run (Huppert et al., 2004; Anić and Tončić, 2013; Baumeister et al., 2013). More specifically, pursuing hedonic well-being can conflict with academic and career success, given that studying or working is not always fun and can require hard and arduous work.

Contrary to the hedonic view on well-being, the 'eudaimonic' view on well-being, states that well-being is attained when people live according to their most deeply felt values and are holistically engaged (Waterman, 1993). Both types of well-being are overlapping, yet distinct, and correlate moderately (Compton et al., 1996). Ryan and Deci (2001) argue that obtaining the basic needs (competence, relatedness, and autonomy) improves both hedonic as well as eudaimonic well-being. Lacking one or more of these needs, on the other hand, decreases both types of well-being.

When students attend college, they make the transition from late adolescence to emerging adulthood. Emerging adulthood (ages 18–29 years) is a developmentally crucial period that can be defined by shifts in autonomy (e.g., leaving the home, being expected to organize self-study), relational instability, and shifts in expected competence (Burris et al., 2009; Evans et al., 2009; Auerbach et al., 2018; Bruffaerts et al., 2018). This could explain why this period, and the first year of university, in particular, involves such a high rate of dropout and academic underperformance. Interventions that aid students in their shifts in autonomy, relatedness, and competence could thus be of particular value at the start of the study.

## LIFE CRAFTING

As a method of improving both the academic performance of students and their well-being, Schippers and Ziegler proposed using a 'life-crafting' intervention. The online life-crafting intervention consists of several integrated components. These components build on a range of empirically tested mechanisms that aid its participants to reflect on the present and future life, set goals and make plans and undertake actions in a way that is congruent with their values (Schippers and Ziegler, 2019).

The first stage of the intervention guides participants through the process of finding a self-concordant passion or purpose. This phase is not merely aimed at understanding what one likes or enjoys (hedonic well-being), but about finding out what one values as relevant and meaningful. Similar to the Japanese concept of 'Ikigai'; a reason for being (Sone et al., 2008), and eudaimonic well-being, which includes meaning and self-realization (Ryan and Deci, 2001). This purpose is self-concordant when it is both intrinsically as well as extrinsically worth pursuing (Sheldon and Houser-Marko, 2001; Sheldon, 2002). The exercises stimulate participants to choose goals that the person truly believes to be important. This improves the chance that one's (goal pursuing) actions are in accordance with one's values.

Secondly, the planning phase involves ranking goals and mental contrasting (Oettingen, 2000, 2012). This phase helps students to formulate how their desired future differs from their current state. Participants contrast their imagined best possible outcome that is related to the goal with an inner obstacle that stands in the way. This technique is applied to competencies, habits, social life, career, and health. Questions direct the students to describe what competencies and habits they already possess and which desired and needed competencies and habits they lack. Merely thinking about an ideal future can lead to positive affect but decreases the chances that a person takes action in order to realize the desired future (Oettingen and Sevincer, 2018). Contrasting the ideal future with the current state, on the other hand, leads to more effort and positive outcomes (Oettingen et al., 2010; Oettingen, 2012). Knowing which habits one would like to change, improves the chances of actual behavioral change (Holland et al., 2006; Graybiel and Smith, 2014). With the use of a goal attainment plan (GAP), participants can bridge this gap (Schippers and Ziegler, 2019). The same questions are then applied both on their social life, their career/study, and their health.

Thirdly, participants use the goal-setting technique to formulate and prioritize their most important goals. They are encouraged to balance and prioritize social, career, and health-related goals. By doing so, they are stimulated to develop harmonious passion instead of obsessive work passion, which is related to conflicts between different domains of life (Curran et al., 2015). When writing their goals, they are asked to formulate ambitious but specific and attainable goals. This is a technique which is developed by Locke and Latham. Goal setting directs energy to the goal-related actions and improves self-regulated learning and motivation. Prior research has shown that writing about passions and goals is related to increased academic performance (Morisano et al., 2010; Schippers et al., 2015, 2020). Although it matters whether these are grade goals or task goals (Clark et al., 2019), and reflective goal setting has shown both positive (Morisano et al., 2010; Schippers et al., 2015, 2020) as well as no results (Dobronyi et al., 2019).

Finally, as part of the life-crafting process, participants design implementation intentions they require to execute their plans. Implementation intentions are 'if-then' plans which aid the person in making goal-related choices in a clutch situation (Gollwitzer, 1993, 1999). These are especially beneficial when they face obstacles or distractions and have a strong effect on goal achievement (Gollwitzer and Sheeran, 2006). Allowing oneself to get distracted from studying (procrastination) is a particular risk for students and a predictor of depression (Saddler and Sacks, 1993), decreased well-being, personal health (van Eerde and Klingsieck, 2018), and academic achievement (Steel et al., 2001; Kim and Seo, 2015). Imagine that someone wants to spend more time studying, but knows that his/her phone often distracts him/her from doing so for a longer period of time. The implementation intention could then be: 'when I am going to study, I turn off my phone until I've spent at least 4 h studying.'

When students have trouble adjusting to the demands and context of tertiary education, they risk finding out about study issues when it's too late. By the time the first exam results come in, it is hard to catch up, given that resits compete with the next exams that are scheduled (Schmidt et al., 2010). Self-efficacy and self-esteem moderately predict success, but the relationship works both ways (Lane et al., 2004; Honicke and Broadbent, 2016). In other words: past performance is also a predictor of self-efficacy and self-esteem. A weak or strong start thus reinforces the self-image and role of efficacy and esteem. When offered at the start of the study, the life-crafting intervention can kickstart self-regulated learning in time (Schippers and Ziegler, 2019).

Preventing these problems right on time, at the start of the study, could prevent a negative spiral. But apart from preventing these negative processes, this approach can also inspire a positive upward spiral. Walton (2014) reviewed an array of short, scalable psychological interventions that have large effects. He deems these wise because when they are offered to the right people at the right time, they can start a recursive process that reinforces itself. Reflective goal setting, according to participants who were followed over a longer period of time with a journal study (Travers et al., 2015) does just that, by bringing about engagement and experiences of flow. We thus propose that a life-crafting intervention right at the start of the study can start a recursive process. Life crafting shows great promise in terms of enhancing academic performance. Combining it with internet-based care could tackle three problems at the same time: the problems associated with adjusting to college life and self-discipline in studying, and mental health issues of students, as well as finding more meaning in life (Schippers and Ziegler, 2019). Below, we discuss findings related to internet-based care.

## INTERNET-BASED MENTAL HEALTH CARE

Compared to online treatment, treating mental health issues with traditional face to face methods is costly. Internet-based or digital forms of mental health care can have the advantage of being scalable and, therefore, cost-effective. Several recent meta-analyses show that internet-based care can be as effective as traditional face to face therapy in treating mental health problems (Andersson et al., 2014; Carlbring et al., 2018). Because of its positive effects and its broad potential benefits, the Royal College of Psychiatrists in the United Kingdom advised universities to increase the availability of evidence-based online interventions for students (Royal College of Psychiatrists, 2011). Australia even has an official e-mental health strategy since 2006 (Meurk et al., 2016).

Although meta-analyses seem to show that online and analog therapeutic interventions have similar effects, some forms of online therapy and coaching have better adherence rates than others. We know, for instance, that (mental) health apps are generally used for a short period of time (about 2 weeks) before being abandoned (Baumel et al., 2019). While it may be that within this period, the beneficial effects are being delivered, it may also be desirable that people make use of such solutions for a longer period of time. Diefenbach and Niess (2015) found that 42% of users stop self-improvement technologies before significant progress is made. Lattie et al. (2019) showed that trials that lasted for 8 weeks showed the largest treatment effects in university student populations.

A recent meta-analysis aimed at online interventions in university contexts (Harrer et al., 2019) showed significant general effects of the interventions on stress ($g$[1] = 0.20), depression ($g$ = 0.20) and anxiety reduction ($g$ = 0.27), role functioning ($g$ = 0.41), and eating disorders ($g$ = 0.52). Only four studies out of the 48 included trials measured outcomes on well-being. These four studies all used different scales for well-being (PWB, Core-OM, WEMWBS, and MHC). One of these studies (Kvillemo et al., 2016) used expressive writing exercises as an active control, to measure the effect of a mindfulness intervention, while expressive writing is known to improve well-being (Pennebaker et al., 1990; Pennebaker, 2004). If the latter study is excluded for this reason, a general significant effect of $g$ = 0.25 on well-being can be found. Harrer et al. (2019) urge future researchers to study which interventions work best for specific types of students. They expect this 'differentiation' to further improve the effectiveness of the interventions.

Lattie et al. (2019) did a meta-analysis on internet-based care for university students, which included two trials that involved a chatbot (Fitzpatrick et al., 2017; Fulmer et al., 2018). Both trials reported high retention rates and significant positive effects on anxiety and depression. Other potential positive effects (e.g., performance or well-being) have not yet been studied, and chatbots have so far only been used to deliver CBT in a university context. However, these results seem promising. An intervention integrated with a chatbot is scalable, easily accessible, and adherence rates seem to be better than those for traditional online care.

Although the mental health and academic performance of students at the start of tertiary education are related, the literature and interventions aimed at preventing the interrelated problems are mostly separated. The first one aims at treating or preventing anxiety, depression, and other mental health problems among first-year students with online, digital interventions (Harrer et al., 2019; Lattie et al., 2019). This research and debate take place at the crossroads of clinical psychology, psychiatry, and information technology. Within this line of research, it is argued that going to college coincides with a decisive developmental phase into emerging adulthood (Arnett, 2006). The start of tertiary education coincides with a peak in the occurrence of mental health issues (Ibrahim et al., 2013; Auerbach et al., 2018; Bruffaerts et al., 2018). Online or digital treatment is (mainly) a more scalable and cost-efficient method to treat these difficulties (Ebert et al., 2018). The expected mechanism by which online therapy can help or aid is implied to be similar to the mechanisms that guide the effects of the 'analog' type of therapy (with a particular effective and often-used therapy: Cognitive Behavioral Therapy; Davies et al., 2014; Harrer et al., 2019). A potential unique beneficial quality of online treatment is anonymity, which was found to be related to more self-disclosure (Lucas et al., 2014, 2017). A downside seems to be higher attrition rates of participants (Baumel et al., 2019). Regrettably, students often do not feel inclined to volunteer to use these available treatments in time; only 20% of those who need it receive minimally adequate treatment (Auerbach et al., 2016), which is likely to result in worse clinical outcomes (Cheung et al., 2017). Research about the more durable and campuswide practical implementation of these treatments lacks in the current literature (Lattie et al., 2019). Chatbots that use AI and offer interactive therapy are at the forefront of the technological development within this field (Fitzpatrick et al., 2017; Fulmer et al., 2018), with more of the advantages of online therapy, and with a more personalized approach. These are applications that combine the benefits of anonymity with 'rapport' (Lucas et al., 2017).

The second line of research is aimed at improving the academic performance and well-being among students with goal-setting interventions. The data so far shows that goal setting can improve effort and direct effort to the right priorities (Locke and Latham, 2002). Goal setting helps students to allocate their time wisely and improve their academic performance and retention. Within this line of research, life crafting aims beyond just educational goals and strategies (Schippers and Ziegler, 2019). These integrative interventions stimulate students to formulate any type of goal, be they academic-, social- or health-related goals. Formulating goals and strategies to obtain the goals improves academic performance, regardless of whether the students formulated academic goals (Schippers et al., 2020). They argue that a potential spill-over effect is in place: If one formulates goals and does well in pursuing these within one field of life, this translates to positive effects in other domains. A meta-analysis from Klug and Maier (2015) shows that goal pursuit defined as progress instead of attainment, indeed increases (subjective) well-being. Together with Schippers et al.'s (2020) findings, this supports the hypothesis that formulating and strategizing about goals can be beneficial to both academic performance and well-being simultaneously.

We argue that the first line of research lacks the benefits of a more inclusive 'positive' approach that is aimed at all students through the curriculum of their university. This approach can be found in the second line of research. However, the second line of research, in turn, lacks the interactiveness and follow-up that online CBT therapy and chatbot technology provide. By combining these lines by integrating a goal-setting intervention with a chatbot and online CBT, we expect to activate three core mechanisms (right on time, inclusive approach, differentiated follow-up) that allow the integration of mental health chatbot- and life-crafting interventions to be worth more than the cumulation of its parts. In the following, we will specify how these mechanisms work within a chatbot platform and show concrete examples.

## MENTAL HEALTH CARE CHATBOTS

Chatbots, also known as conversational agents, have gradually established themselves as companions to a multitude of modern devices. In the 1960s of the last century, Joseph Weizenbaum at MIT developed ELIZA (Weizenbaum, 1966), an early natural language processing computer program that simulated conversation and that is generally perceived as being the starting point in the development of conversational agents (Henderson, 2007; Jacques et al., 2019). **Figure 1** shows a sample of a conversation between a human and ELIZA. Weizenbaum wanted

[1]Hedges $g$ was used as a common denominator in the meta-analysis of Harrer et al. (2019) because it adjusts for small sample size bias (Hedges and Olkin, 2014).

A typical conversation is the following:

Men are all alike.

IN WHAT WAY?

They're always bugging us about something or other.

CAN YOU THINK OF A SPECIFIC EXAMPLE?

Well, my boyfriend made me come here.

YOUR BOYFRIEND MADE YOU COME HERE

He says I'm depressed much of the time.

I AM SORRY TO HEAR YOU ARE DEPRESSED

**FIGURE 1 |** Conversation beween a human and chatbot [Reprinted with permission Weizenbaum (1966)].

to show how superficial the communication was between a human and a machine, but was surprised to find out that many individuals (including his secretary) would become emotionally attached to the program. They would even forget that they were conversing with a computer, and Weizenbaum's secretary reportedly even asked him to leave the room from time to time in order to have a "real conversation" with the program (Bassett, 2019). The most famous script, DOCTOR, simulated a therapist that used the Rogerian way of conversing. Carl Rogers was a therapist who used non-directional questioning and often repeated back what a client said. The system would parrot phrases back, or ask to elaborate.

Since then, conversational systems have come a long way via intelligent assistants like Siri (Apple), Alexa (Amazon), and Cortana (Microsoft), social chatbots aimed at general conversation, and task-focused chatbots (Park et al., 2018; Shum et al., 2018; Jacques et al., 2019). Chatbots are spreading fast among websites and online services in functional areas such as customer service, marketing, entertainment, healthcare, and more. In order to improve the clarity of the discourse on chatbots, Braun and Matthes (2019) propose a framework via which chatbots can be categorized in terms of four characteristics beyond the functional application domain (see **Table 1**). Despite developments in speech recognition based on (a combination of) keywords, the development of *conversational skills* (e.g., actively keep a conversation going that feels natural) of AI has not improved in a similar pace (e.g., Park et al., 2018; Jacques et al., 2019).

Early chatbots depended on deterministic responses that are the result of a rule-based process, which results in chatbots that are perceived as less smart. The more commonly used machine learning techniques allow chatbots to go beyond fixed semantic responses. These techniques have the form of 'supervised learning,' using large datasets to train the chatbot which answers are appropriate and which are not; 'unsupervised learning' using Markov-chain based models; and 'hybrid intelligence' which combines both (c.f., Radziwill and Benton, 2017). The result has the form of highly complex decision trees consisting of if-then statements. Though this may sound like a simple principle, the fact that there is no fixed semantic model underlying the communication (i.e., an open conversation can be about anything, using any phrasing) leads to highly complex decision trees or even networks of decision trees. Training an algorithm capable of providing appropriate responses is complex and takes a lot of time, effort, and large quantities of training material and processing power (Lambert, 2018). Mass availability of personalized and autonomous chatbots, therefore, is expected only in 5–10 years (Weidauer, 2018).

## DESIGN OF A MENTAL HEALTH-ORIENTED CHATBOT FOR EDUCATION

The use of chatbots in education is still in its infancy. Though AI applications have been used to support learning for several decades, the overall application appears to be modest, but expectations regarding the future application and added value are high (Winkler and Söllner, 2018). A systematic review of 80 scientific papers on the use of chatbots in education (Winkler and Söllner, 2018) shows the main focus areas are health and well-being, language learning, providing feedback, and the support of metacognitive thinking, motivation, and self-efficacy. They found the usage of chatbot technology in support of learning to be influenced by individual student characteristics like personality traits, trust of and attitude toward technology, educational background, technological skills, and levels of self-efficacy and self-regulation. These findings match findings from the field of information systems research on technology acceptance (e.g., Davis, 1989; Venkatesh and Davis, 2000; Taherdoost, 2018).

The most prominent theories of technology acceptance include the Technology Acceptance Model (TAM; Davis, 1989; Venkatesh and Davis, 2000) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which both are rooted in the Theory of Reasoned action (TRA; Ajzen, 1985) and the Theory of planned behavior (TPB; Fishbein and Ajzen, 1975). Research in this area has revealed a multitude of factors that contribute to technology acceptance, of which key predictors include the perceived ease of use and perceived usefulness of an application (Davis, 1989), playfulness (Moon and Kim, 2001), perceived presentation attractiveness (van der Heijden, 2004) and peer Influence (Chau and Hu, 2002). In the case of chatbots, perceived helpfulness has been found as an important predictor of user attitudes toward the use of technology (Zarouali et al., 2018). Technological applications in the area of education, personal development, and healthcare all share these characteristics underlying user acceptance.

The appeal of social chatbots in the area of mental health and well-being is large and primarily lies in their ability to make a social connection to users (Bickmore et al., 2005; Fitzpatrick et al., 2017; Shum et al., 2018). These chatbots show more promise than general mental health applications, through their potential to dynamically recognize emotion and to engage

**TABLE 1 |** Chatbot classification framework (adapted from Braun and Matthes, 2019).

| Characteristic | Elements | Description | |
|---|---|---|---|
| *I/O* | Voice | Speaking | The majority of current chatbots are text based. |
| | Text | Typing | |
| *Timing* | Synchronous | Real-time, direct interaction. | |
| | Asynchronous | Delayed interaction. | |
| *Flow* | Sequential | A specified order in which interaction is structured. | |
| | Dynamic | Information is processed in an arbitrary order. | |
| *Platform* | Messenger | Most current chatbots are connected to or build in a related functionality (like a website) and only a limited number are standalone. | |
| | Social media | | |
| | Standalone | | |
| *Understanding* | Notifications | Only sending messages. | |
| | Keywords | Automated word recognition. | |
| | Contextual | Include previous messages in the conversation thereby demonstrating understanding of context. | |
| | Personalized | Take information from external sources and/or previous conversations into account. | |
| | Autonomous | Independently communicate with humans and even other chatbots. | |

the user throughout conversations by showing appropriate responses (Shum et al., 2018). One of their main shortcomings, however, regards the so far inchoate ability to convincingly convey empathy to the user (Morris et al., 2018). In a clinical environment, for example, empathy has been identified as a key contributor toward better clinical outcomes as it lowers anxiety and distress, enhances satisfaction, and is directly related to higher patient enablement (Derksen et al., 2013). These effects are even more pronounced in the context of mental health interventions (Gateshill et al., 2011). Just as humans, non-human agents may struggle to express empathy (Morris et al., 2018). Still, research on mental health-oriented applications shows an overall user preference toward a chatbot compared to general non-conversational applications. Moreover, the use of non-conversational applications has been found to be abandoned after about 2 weeks by the majority of users (Baumel et al., 2019). By comparison, the adherence rate for a chatbot with a similar focus seems to be four times as long, as a chatbot can actively reach out and initiate communication with participants in a conversational way (Bickmore et al., 2005; Fulmer et al., 2018; Kamita et al., 2019). Expectations regarding the ability of chatbots to understand natural language and have meaningful natural conversations have not been met yet. However, as systems improve, the difference between humans and machine responses are expected to diminish (Jacques et al., 2019).

## INTEGRATING THE LIFE-CRAFTING INTERVENTION WITH THE AI-ENHANCED MENTAL HEALTH CHATBOT

Both life-crafting interventions and online mental health chatbot interventions have shown promising results when it comes to improving academic performance as well as mental health and subjective well-being. Integrating both can help in compensating for the downsides of each intervention. For instance, the life-crafting intervention is relatively static in its current form and could profit from the more interactional style from the chatbot. As mentioned before, a downside of the life-crafting intervention was that it did not respond to answers they gave or ask any follow-up questions whenever answers were brief. Writing more words corresponded with a larger effect of the treatment (Schippers et al., 2020), and stimulating students to write more, might make the intervention more effective. The life-crafting intervention starts in a browser and shows uniform texts, images, and videos that introduce uniform writing exercises (Schippers and Ziegler, 2019). Apart from demanding that students write at least one letter per question, there is no response to the brevity or content of what students write. Also, there is no differentiation in the intervention based on choices or texts from the students. All questions and follow up consisted of identical emails with goal setting diaries, which, according to students, did not feel personal and were soon experienced as spam.

The previously mentioned downsides of AI mental health chatbots are that students might be reluctant to volunteer for these interventions because of the stigma that is associated with mental health problems and because many students have trouble recognizing early symptoms of potentially serious mental health issues. Furthermore, these applications are mainly focused on alleviating mental health problems, and not on improving academic performance or eudaimonic well-being.

For these reasons, applying the chatbot to a more holistic approach (aimed not only at mental health problems but at life in general), in which the life-crafting intervention is integrated with an AI-enhanced mental health chatbot shows great promise. By combining a focus on life crafting, personal interactive coaching, and mental health, this approach is aimed at increasing general student academic performance and well-being, instead of merely focusing on potential problem areas. We suggest that all students receive this intervention at the beginning of their first year in tertiary education. That way, accessibility is large as all potential

users will receive the intervention at the beginning of their first year. The opportunity to start using the chatbot at the start of the university studies has an added benefit toward early recognition and remediation of potential problems. The chatbot can play an important role in detecting (the development of) mental health problems as well as academic problems early on in the academic year. This way, we expect that the development of mental health problems can be prevented, or the student can receive additional online coaching on mental health issues by the chatbot early on, or the chatbot can refer the student to other sources of mental health coaching. Furthermore, the chatbot can also pro-actively seek contact with the student on the moments that the students' stress level is expected to be on a high. For example, in the 3 weeks before a test week, the chatbot may check in with the student, inform whether the student is doing well, what learning goals have priority for the student at the moment, and ask if the student might need some help. We propose that this holistic, positive program aimed at what is most important for students combined with more differentiation could further enhance the user experience and improve its subsequent effects. A chatbot can thus be used not only in a curative way but also to detect problems early on and to prevent mental health issues from arising (Bendig et al., 2019; Schippers and Ziegler, 2019). Furthermore, the life-crafting intervention integrated into the chatbot can enhance academic performance and increase well-being for all participating students.

Within the chatbot platform, it is possible to differentiate between the needs of different students and thus offer a more personalized intervention. This personalization can be achieved in several ways. With regard to goal setting, self-regulated learning, and academic performance, students might report a wide range of issues. For example, some students might need help with the formulation or the prioritization of goals. Others might need help with regard to planning, monitoring, and time management, or ask for advice on how to learn in a better manner, for example with respect to learning strategies. With the chatbot, the set of effective self-regulatory processes for academic performance in higher education (De Bruijn-Smolders et al., 2016), based on the framework of self-regulatory processes as proposed by Sitzmann and Ely (2011) will be addressed with complementing evidence-based interventions. For example, with regard to planning, monitoring, and time management, students can be offered guidelines such as to study each day, to study the most difficult part first, and to use a to-do list when studying, and to make three kinds of planning, that is, for the day, the week, and for the long-term (for example until the test week; Gettinger and Seibert, 2002; Plant et al., 2005; Hattie, 2009). With respect to mental health, in line with the literature, we expect anxiety and depression to be most prevalent among the students (Auerbach et al., 2018). If students score high on the surveys on anxiety or depression, the chatbot will advise them to visit a student-advisor, and will advise them to follow cognitive behavioral therapy, online via the chatbot, or with an external professional. With respect to both, we want the chatbot to check in with the student at the right time (Walton, 2014); on the moments when we expect that students' stress peaks will be on the rise, for example in the weeks before important exams, the chatbot will check-in with the student and offer customized coaching. **Table 2** shows examples of what these conversations between a student and the chatbot could look like.

Moreover, within the life-crafting intervention, differentiation could also be applied. For example, according to Powers et al. (2005), implementation intentions, which is a part of goal setting, can be detrimental to students who score high on perfectionism. Some parts of the life-crafting intervention or even the complete intervention could not be beneficial to this particular subgroup. Short personality scales could be used before the onset of the intervention, to diversify the content of the intervention or even the complete intervention. A chatbot could start with an intake in which the student answers a survey on personality and well-being that allows the chatbot to offer a tailor-made program.

After the intake and a tailor made life-crafting intervention, the chatbot should remain readily available for regular cognitive behavioral therapy. But, as was also described by students who evaluated the life-crafting intervention, there should be a pro-active follow-up on the intervention. The chatbot will use the goals and strategies that the student has decided on to check-in on their progress. A chatbot can stimulate students to regularly reflect on, and remind them of, their goal progress with questions and personalized feedback. Schippers and Ziegler (2019) mention examples of questions that could be used for effective follow-up on the intervention: "Did I invest enough time into my goals? What could I do to improve this? Which smaller sub-goals could help me to achieve my objective? What obstacles do you face? What ways do you see to overcome them?" (pp. 11, 12). The chatbot can use cues in the answers of the students to offer the right type of strategies, for improved planning or combating procrastination for example.

## CONCEPTUAL MODEL

Some researchers state that merely having a goal already improves well-being (e.g., Klinger, 1977; Freund and Baltes, 2002). Gollwitzer and Brandstätter (1997) distinguish different phases in goal pursuit: predecisional (deciding about preferences between different goals or wishes), preactional (the initiation of goal directed actions), actional (successfully performing actions that bring a goal about) and postactional (evaluating results with the original intentions). Gollwitzer and Brandstätter state that it is to be expected that setting goals triggers predecisional and preactional goal pursuit. We predict that adding follow-up questioning and coaching via a chatbot can also improve the actional and postactional part of goal pursuit. In other words, setting goals initiates goal pursuit, but the follow-up through coaching from a chatbot can also improve the later phases of the pursuit of goals. Prior research has shown that goal pursuit, when conceptualized as goal progress instead of goal attainment in turn has an average effect of $r = 0.45$ on subjective well-being (Klug and Maier, 2015).

We expect the low-threshold CBT therapy that the chatbot can offer based on intakes and scales that are included in the first part of the intervention to decrease anxiety and depression (Fitzpatrick et al., 2017; Fulmer et al., 2018). Including a large

**TABLE 2 |** Artificial enhanced life crafting, sample conversations chatbot and student.

| | | |
|---|---|---|
| **Life crafting intervention, four stages (Schippers and Ziegler, 2019)** | | |
| **Stage 1: Finding Self-concordant passion or purpose (Sheldon and Houser-Marko, 2001)** | | |
| **Chatbot:** What do you like to do? Write about this for approximately 2 min. . . | **Student:** Windsurfing | **Chatbot:** Hello <<student>> I notice that you have answered this question with one word. To use this intervention optimally, for your academic performance and well-being, it is important that you elaborate more on this. Can you tell me more about why you like windsurfing? Write about this for approximately 2 min. . . |
| **Stage 2: Mental contrasting (Oettingen, 2000, 2012) and formulating goal attainment plans (Schippers and Ziegler, 2019)** | | |
| **Chatbot:** What do you admire in others. . . | **Student:** I admire fashion designers. Take for example Marc Jacobs. In a documentary I was inspired by his enormous drive, high energy level and positivity. His work really seemed to align with his passion. I hope I will also find what my passion is, my goal in life, and which job may fit with my passion optimally. . . | **Chatbot:** Thank you for your detailed answer, <<student>>. With the following questions, I aim to help you with finding your passion, your goal in life, and with making steps to attain your goal. |
| **Stage 3: Formulating and prioritizing students' most important social, career, and health-related goals (Curran et al., 2015)** | | |
| **Chatbot:** Now that you have your ideal future in mind, describe the goals that you can derive from this. . . | **Student:** Study more often (Academic goal), find a study-related job (Career-goal), Learn to deal with stress (Mental Health goal). . . | **Chatbot:** Thank you <<student>>! Good to hear about your goals. I clearly see that you know what you want to achieve, which will be conducive for your academic success and well-being. However, unfortunately you will not be able to achieve all your goals at once. For this reason, can you rank them in order of importance? |
| **Stage 4: Designing implementation intentions ["If-then plans which help the student to set the right priorities in a complex situation (Gollwitzer, 1993, 1999)"]** | | |
| **Chatbot:** Now you have specified your goals, make an if-then plan that will allow you to choose to do something that will help you to achieve your goal. | **Student:** I am not sure, can you give me an example? | **Chatbot:** Sure <<student>>. With respect to studying, an if-then plan might be: If I come home and am tempted to watch a drama series, then I will make sure that I first study for 2 h. |
| | **Student:** Ah, thank you <chatbot> When I am going to study, I turn off my phone until I've spent at least 4 h studying. | **Chatbot:** A solid if then-plan <<STUDENT>>, for studying more! Can you also formulate if-then plans for your other goals? |
| **Measurement scales well-being (anxiety, depression, self-efficacy, test anxiety,. . .)** | | |
| **Chatbot:** This scale will help me get a better sense of your experience with anxiety OK? . . . | Student fills out General Anxiety Disorder 7-item scale (GAD7) (Spitzer et al., 2006). | **Possible answers chatbot:**<br>This screening is not meant to be a diagnosis. . ..<br>**Option 1:** Your responses indicate no or very few signs of anxiety. Keep in mind that minor ups and downs are normal.<br>**Option 2:** However, your responses indicate some signs of anxiety. Would you like me to offer you cognitive behavioral therapy? This has helped other students in the past.<br>**Option 3:** However, your responses indicate symptoms of anxiety. I recommend visiting one of the university student councilors, click here <<HYPERLINK>> to make an appointment. If you need immediate support you can call this number free of charge <<CRISIS_NUMBER>>. |
| **Follow up: Stimulating and monitoring students goal progression via goal diaries[a]** | | |
| **Chatbot:** OK <<STUDENT>>, let's review the goals you worked on this week. Are you ready? | **Student:** Yes | **Chatbot:** What was the most important goal you wanted to accomplish last week? |
| | **Student:** Studying more | **Chatbot:** And, did you successfully complete what you were trying to accomplish? |
| | **Student:** No | **Chatbot:** What was the main reason for you that you were not able to study more? |
| | **Student:** I had not foreseen that certain tasks would take so much time. I did not have enough time to finish my study tasks this week. | **Chatbot:** Sorry to hear that <<STUDENT>>, do I understand it well that you had problems planning in your study tasks this week, and with your time management? |
| | **Student:** Yes | **Chatbot:** I want you to know that I can offer some coaching on this point. Are you interested to hear more from me about possible strategies to manage your time better, for studying more? |

*(Continued)*

**TABLE 2 |** Continued

| | | |
|---|---|---|
| | **Student:** Yes | **Chatbot:** Alright <<STUDENT>> Let's start (chatbot offers study interventions for better planning, monitoring, and time management) (e.g., see Gettinger and Seibert, 2002; Plant et al., 2005; Hattie, 2009). |
| **Chatbot pro-actively seeks contact with student. To begin with, the chatbot checks in on a weekly basis. Later on, the chatbot will check in more or less frequently, dependent on student's needs.** | | |
| **(1) Monitoring goal progression** | | |
| **Chatbot:** <<STUDENT>> I want to check-in with you. Have you been making progress to your goals this week? To start with your health-related goal: did you exercise two times last week? | **Student:** No | **Chatbot:** What has gotten in the way? |
| | **Student:** I could not motivate myself to go to the gym, after I had had dinner at home. | **Chatbot:** I see, what can you do to make more progress with respect to your goal: exercise two times per week? Let me rephrase your if-then plan: "If I want to go to the gym the next day, then I will pack my sports bag the night before." Was this if-then plan helpful with respect to your goal? |
| | **Student:** No, my if-then plan was not supportive for reaching my goal. | **Chatbot:** Can you think of an alternative if-then plan that will help you to accomplish your goal? |
| | **Student:** Yes. If I want to go to the gym, I will take my sports bag with me and go right after attending college. | **Chatbot:** Great! Well done <<STUDENT>>! Let's see if your new if-then plan helps you better to reach your goal. |
| **(2) Emotional check-in** | | |
| *Sample conversation chatbot and student* | | |
| **Chatbot:** Hello <<STUDENT>>. How are you? | **Student:** I am worried, my grades are not so high, I do not know if I will pass this year. | **Chatbot:** I am sorry to hear that, <<STUDENT>>. In case you want to talk with someone about your situation, please feel welcome to contact one of the student advisers of <<educational program>>. You can click here <<HYPERLINK>> to make an appointment right now. |
| **(3) Check-in right in time (e.g., 3 weeks before an exam period)** | | |
| **Chatbot:** Hello <<STUDENT>>. Just checking in. How are you? | **Student:** I am very stressed. I am so busy preparing for my exams. | **Chatbot:** I am sorry to hear that, <<STUDENT>>. I can coach you on this, also I can offer you some strategies for dealing better with Stress. Sounds good? |
| **Student seeks contact with chatbot (24/7)** | | |
| **Sample conversation chatbot and student** | | |
| | **Student:** Hello <<chatbot>> I am feeling very lonely at the moment. | **Chatbot:** I am sorry to hear that <<STUDENT>>. Can you tell me more about why you are feeling lonely? . . . |

[a] *As a follow up of the life-crafting intervention, the student receives six goal diaries to fill out, two-monthly, for monitoring and stimulating goal-progression.*

population of regular students in the treatment group might lead to results that differ from previous studies that only included students who volunteered to participate. Testing this is a necessary next step in the development of the literature. It is expected that goal progress influences SWB through an increase in positive affect, and the prevention of depression and anxiety improves SWB mainly through the negation of negative affect (see **Figure 2**). It is thus important to know how such a chatbot can be designed.

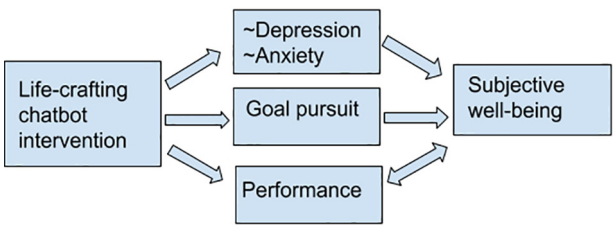


**FIGURE 2 |** Conceptual model with expected mechanism of a life-crafting chatbot intervention.

## DESIGN PRINCIPLES FOR A LIFE-CRAFTING CHATBOT

Extant literature and experience have shown that the use of experimental or novel technologies is always associated with risks of low adoption. As Lattie et al. (2019) observe, digital mental health interventions, in particular, tend to fail due to acceptability, usability and feasibility issues. While in the previous parts we discussed potential issues and limitations that oftentimes plague such implementations, we stress the importance of the design philosophy before zooming in on the different design aspects themselves. Overall, human–computer interaction (HCI), in the context of every application, is a complex and dynamic experience that ever-evolves (as software

gets updated). Naturally, the goal-setting intervention underlying the present study, as well as the chatbot used as the agent of delivery, also evolve based on the feedback and results received with each intake of students. The design principles, however, guiding the blueprint and evolution of the intervention should be grounded in suitable paradigms of HCI. In our cases, these are the design rationale (what user requirements does the platform intend to address? What are the reasons behind its particular features or the ones it doesn't have? What are the trade-offs?) and usability engineering (*iterative development* based on usability specifications, *participatory design* by involving students in the development of the platform, *impact analysis* and overall cost-effectiveness evaluations) (Carroll, 1997). Following these two paradigms will allow us to address a number of issues related to the successful implementation of the intervention in a structured manner.

Current chatbot interventions in the university context can further improve their user-friendliness by (1) being more tailored to the intended users, (2) addressing issues that are most important to the users, (3) ensuring user privacy, (4) offering a trustworthy experience, and (5) offering aid in emergencies (Lattie et al., 2019). If user-friendliness is low, this will likely have a negative effect on the scalability, and durability of the intervention. Following a design rationale perspective, future research could address the first two concerns by identifying the specific needs of the target audience and their key issues that the intervention should be seeking to address. Following a usability engineering approach, we aim at fine-tuning and evolving the intervention in order to address its key shortcomings. This process involves focus groups and regular surveys over a prolonged period. To address the privacy and trust concerns of students, thorough regulation and transparency regarding the data management should be employed and effectively communicated to all participants.

The success of the intervention should be evaluated not only based on user satisfaction metrics but also by the overall user acceptance. The prolonged involvement of students with the chatbot is dependent on its user-friendliness. A chatbot is, by its nature, inherently more interactive and open then most used online interventions. Still, in the Fulmer et al. (2018) trial students did report that the chatbot biggest shortcomings included the chatbot not feeling natural (12/50), misunderstanding replies (11/50), not interactive enough (7/50) and impersonal (6/50). Extensive tests could make the chatbot more user-friendly.

If the chatbot is supposed to play a catalytic role in sustaining user-engagement throughout the intervention, key principles of HCI design need to be combined with key findings from the Technology Acceptance literature. As technology acceptance is concerned not with the unique experience and satisfaction but with the intention of users to change their ways and adopt a new technology in their routines, there needs to be focus on aspects of the design stimulating the key antecedents of acceptance, namely perceived usefulness/helpfulness, ease of use, and playfulness (Moon and Kim, 2001) as well as related antecedents of those such as technology readiness (optimism, innovativeness, discomfort, and insecurity) (Parasuraman, 2000) or technostress (Ayyagari et al., 2011). Developing such an integrated chatbot, with the use of modern technology combined with insights from positive psychology interventions such as life crafting, shows great potential in optimizing student well-being and (academic) achievement.

## DISCUSSION

As many students struggle with academic underperformance and mental health problems during their transition to tertiary education, we sought to outline possible solutions that involve both the use of contemporary AI solutions and combine this with the latest insights from effective positive psychology interventions, specifically a promising life-crafting intervention. The advantages of such a solution are that it is scalable, has a low threshold, would contribute to early detection of academic or mental health problems, and would be interactive and personalized. We proposed an inclusive approach: all students could potentially benefit from the resulting intervention. Combining insights from two lines of research, namely the life-crafting (goal-setting) literature, and the literature on online mental health care, we proposed integrating a life-crafting intervention with a mental health chatbot could offer a solution for all students.

Our focus on scalability as an important criterion has to do with the fact universities are currently not able to cater to be 24/7 responsive to all the personal needs and mental health problems of their students. A chatbot is a scalable solution that is constantly available, because all students can individually take part in this intervention online. Only students with serious academic or mental health problems would be referred to the student advisor for further coaching or to, for example, psychologists. Our focus on a low threshold had to do with the fact that mental health problems bear a stigma that prevents many students from seeking help for these problems. Using a chatbot is anonymous, which is related to more self-disclosure and rapport (Lucas et al., 2014, 2017).

We proposed an inclusive approach, in which all students within a certain study program receive access to the intervention at the beginning of their first year of tertiary education. The main focus of the intervention is not mental health problems, but life crafting and setting personal goals, which can be beneficial to all students. Having this positive focus will probably also decrease the association with stigma on mental health problems. Only students who need it will also be able to receive mental health coaching via the chatbot. This touches another important criterion that we set for the intervention: differentiation. With a chatbot, it is possible to offer interactive and personalized coaching, based on the students' individual needs. Moreover, the chatbot can also follow-up and interact with the students in later stages on what they have written in their intervention.

Finally, the chatbot can assist in early recognition of academic and mental health problems in two ways. First off, we expect that the life-crafting intervention integrated into the chatbot will make students more aware of their goals and potential obstacles.

This will help them to set priorities for themselves, and may also encourage them to seek help for their problems in an early stage. Secondly, the chatbot itself can also recognize signals of academic or mental health problems, and offer in-app coaching (for mild problems) or refer to external help (for more severe problems) in early stages, if necessary. An additional advantage is that mental health chatbots often have higher adherence rates than other internet-based mental health care.

Future research should experimentally test the effects of interventions that combine insights from positive psychology which lend itself for curriculum wide implementation with the interactive potential of a chatbot. In line with Lattie et al. (2019) we propose that it would be of great value if these experiments were conducted in professional colleges or community colleges as well, besides research universities. It would also be highly recommended, to monitor technology acceptance, usability and implementation feasibility with validated scales. As Harrer et al. (2019) concluded, research on the effects of chatbots has so far not yet defined student subsets for which the intervention is most effective. A large scale experiment in which different student subsets are followed could, therefore, open up valuable new vistas which can further explore the added value of differentiation that a chatbot can offer.

In short, we expect that the proposed AI-enhanced life-crafting intervention will help students to overcome the difficulties they face when transitioning into tertiary education. We anticipate that it will increase students' academic performance and decrease the development of mental health problems. Future studies will need to uncover the specific effects of this intervention. Ideally, this intervention will be able to optimize both student well-being and academic achievement.

## AUTHOR CONTRIBUTIONS

MS and ID played the primary role in the conceptual conception of the manuscript. ED played a major role in structuring the manuscript. ED and ID together were principally responsible for the editing and revision process. MD, MS, and BG provided important intellectual feedback on several versions of the manuscript. ID, MD, BG, AA, ED, and MS contributed content for the original draft preparation of the manuscript. All authors agreed to all aspects of the manuscript and approved the final version.

## FUNDING

Research funded with a Senior Comenius Fellowship Grant awarded to MS by the Dutch Ministry of Education, Culture and Science. Publishing costs funded by the Erasmus University Open Access fund.

## ACKNOWLEDGMENTS

The authors thank Marleen Schäfer and Gabrielle Martins van Jaarsveld for their assistance with the references and formatting of the manuscript.

## REFERENCES

Abd-alrazaq, A. A., Alajlani, M., Alalwan, A. A., Bewick, B. M., Gardner, P., and Househ, M. (2019). An overview of the features of chatbots in mental health: a scoping review. *Int. J. Med. Inform.* 132:103978. doi: 10.1016/j.ijmedinf.2019.103978

Abdul-Kader, S. A., and Woods, J. (2015). Survey on chatbot design techniques in speech conversation systems. *Int. J. Adv. Comp. Sci. Appl.* 6, 72–80. doi: 10.14569/IJACSA.2015.060712

Ajzen, I. (1985). "From intentions to actions: a theory of planned behavior," in *Action Control: From Cognition to Behavior*, eds J. Kuhl and J. Beckmann (New York, NY: Springer Verlag), 11–39. doi: 10.1016/j.addbeh.2005.08.012

Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., and Hedman, E. (2014). Guided internet−based vs. face−to−face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta−analysis. *World Psychiatry* 13, 288–295. doi: 10.1002/wps.20151

Anić, P., and Tončić, M. (2013). Orientations to happiness, subjective well-being and life goals. *Psihologijske teme* 22, 135–153. doi: 10.1177/0146167215573211

Arnett, J. J. (2006). "Emerging adulthood: understanding the new way of coming of age," in *Emerging Adults in America: Coming of Age in the 21st Century*, eds J. J. Arnett and J. L. Tanner (Washington, DC: American Psychological Association), 3–19. doi: 10.1037/11381-001

Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., et al. (2016). Mental disorders among college students in the world health organization world mental health surveys. *Psychol. Med.* 46, 2955–2970. doi: 10.1017/S0033291716001665

Auerbach, R. P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., et al. (2018). WHO world mental health surveys international college student project: prevalence and distribution of mental disorders. *J. Abnorm. Psychol.* 127, 623–638. doi: 10.1037/abn0000362

Ayyagari, R., Grover, V., and Purvis, R. (2011). Technostress: technological antecedents and implications. *MIS Q.* 35, 831–858. doi: 10.2307/41409963

Bassett, C. (2019). The computational therapeutic: exploring Weizenbaum's ELIZA as a history of the present. *AI Soc.* 34, 803–812. doi: 10.1007/s00146-018-0825-9

Baumeister, R. F., Vohs, K. D., Aaker, J. L., and Garbinsky, E. N. (2013). Some key differences between a happy life and a meaningful life. *J. Posit. Psychol.* 8, 505–516. doi: 10.1080/17439760.2013.830764

Baumel, A., Muench, F., Edan, S., and Kane, J. M. (2019). Objective user engagement with mental health apps: systematic search and panel-based usage analysis. *J. Med. Intern. Res.* 21:e14567. doi: 10.2196/14567

Bendig, E., Erb, B., Schulze-Thuesing, L., and Baumeister, H. (2019). The next generation: chatbots in clinical psychology and psychotherapy to foster mental health–a scoping review. *Verhaltenstherapie* 27, 1–13. doi: 10.1159/000501812

Bickmore, T., Gruber, A., and Picard, R. (2005). Establishing the computer–patient working alliance in automated health behavior change interventions. *Patient Educ. Counsel.* 59, 21–30. doi: 10.1016/j.pec.2004.09.008

Braun, D., and Matthes, F. (2019). "Towards a framework for classifying chatbots," in *Proceedings of the 21th International Conference on Enterprise Information Systems (ICEIS 2019)*, Vol. 2, eds J. Filipe, M. Smialek, A. Brodsky, and S. Hammoudi (Heraklion: European Commission), 496–501. doi: 10.5220/0007772704960501

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., et al. (2018). Mental health problems in college freshmen: prevalence and academic functioning. *J. Affect. Disord.* 225, 97–103. doi: 10.1016/j.jad.2017.07.044

Burris, J. L., Brechting, E. H., Salsman, J., and Carlson, C. R. (2009). Factors associated with the psychological well-being and distress of university students. *J. Am. College Health* 57, 536–544. doi: 10.3200/JACH.57.5.536-544

Cant, S. (2018). Hysteresis, social congestion and debt: towards a sociology of mental health disorders in undergraduates. *Soc. Theor. Health* 16, 311–325. doi: 10.1057/s41285-017-0057-y

Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., and Hedman-Lagerlöf, E. (2018). Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: an updated systematic review and meta-analysis. *Cogn. Behav. Ther.* 47, 1–18. doi: 10.1080/16506073.2017.1401115

Carroll, J. M. (1997). Human-computer interaction: psychology as a science of design. *Annu. Rev. Psychol.* 48, 61–83. doi: 10.1146/annurev.psych.48.1.61

Centre for Education Statistics and Evaluation (2015). *Student Wellbeing*. Sydney, NSW: NSW Department of Education and Communities.

Chau, P. Y. K., and Hu, P. J. (2002). Examining a model of information technology acceptance by individual professionals: an exploratory study. *J. Manag. Inform. Syst.* 18, 191–229. doi: 10.1080/07421222.2002.11045699

Cheung, R., O'Donnell, S., Madi, N., and Goldner, E. M. (2017). Factors associated with delayed diagnosis of mood and/or anxiety disorders. *Health Promot. Chronic Dis. Prevent. Can.* 37, 137–148. doi: 10.24095/hpcdp.37.5.02

Choi, A. (2018). *Emotional Well-Being of Children and Adolescents: Recent Trends and Relevant Factors*. (No. 169). Paris: OECD Publishing, doi: 10.1787/41576fb2-en

Clark, D., Gill, D., Prowse, V., and Rush, M. (2019). Using goals to motivate college students: theory and evidence from field experiments. *Rev. Econ. Stat.* 1–45. doi: 10.1162/rest_a_00864

Clement, S., Schauman, O., Graham, T., Maggioni, F., Evans-Lacko, S., Bezborodovs, N., et al. (2015). What is the impact of mental health-related stigma on help-seeking? A systematic review of quantitative and qualitative studies. *Psychol. Med.* 45, 11–27. doi: 10.1017/S0033291714000129

Compton, W. C., Smith, M. L., Cornish, K. A., and Qualls, D. L. (1996). Factor structure of mental health measures. *J. Pers. Soc. Psychol.* 71, 406. doi: 10.1037/0022-3514.71.2.406

Curran, T., Hill, A. P., Appleton, P. R., Vallerand, R. J., and Standage, M. (2015). The psychology of passion: a meta-analytical review of a decade of research on intrapersonal outcomes. *Motiv. Emot.* 39, 631–655. doi: 10.1007/s11031-015-9503-0

Davies, E. B., Morriss, R., and Glazebrook, C. (2014). Computer-delivered and web-based interventions to improve depression, anxiety, and psychological well-being of university students: a systematic review and meta-analysis. *J. Med. Intern. Res.* 16:e130. doi: 10.2196/jmir.3142

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* 13, 319–340. doi: 10.2307/249008

De Bruijn-Smolders, M., Timmers, C. F., Gawke, J. C. L., Schoonman, W., and Born, M. P. (2016). Effective self-regulatory processes in higher education: research findings and future directions: a systematic review. *Stud. High. Educ.* 41, 139–158. doi: 10.1080/03075079.2014.915302

De Girolamo, G., Dagani, J., Purcell, R., Cocchi, A., and McGorry, P. D. (2012). Age of onset of mental disorders and use of mental health services: needs, opportunities and obstacles. *Epidemiol. Psychiatr. Sci.* 21, 47–57. doi: 10.1017/S2045796011000746

De Luca, S. M., Franklin, C., Yueqi, Y., Johnson, S., and Brownson, C. (2016). The relationship between suicide ideation, behavioral health, and college academic performance. *Commun. Ment. Health J.* 52, 534–540. doi: 10.1007/s10597-016-9987-4

Derksen, F., Bensing, J., and Lagro-Janssen, A. (2013). Effectiveness of empathy in general practice: a systematic review. *Br. J. Gener. Pract.* 63, e76–e84. doi: 10.3399/bjgp13X660814

Diefenbach, S., and Niess, J. (2015). "Vom wunsch zum ziel?! Potential von technologien zur selbstverbesserung," in *Proceedings of the Mensch und Computer*, (Stuttgart: Mensch und Computer), 391–394. doi: 10.1515/9783110443929-060

Dobronyi, C. R., Oreopoulos, P., and Petronijevic, U. (2019). Goal setting, academic reminders, and college success: a large-scale field experiment. *J. Res. Educ. Effect.* 12, 38–66. doi: 10.1080/19345747.2018.1517849

Ebert, D. D., Van Daele, T., Nordgreen, T., Karekla, M., Compare, A., Zarbo, C., et al. (2018). Internet-and mobile-based psychological interventions: applications, efficacy, and potential for improving mental health: a report of the EFPA E-health taskforce. *Eur. Psychol.* 23, 167–187. doi: 10.1027/1016-9040/a000318

Evans, N. J., Forney, D. S., Guido, F. M., Patton, L. D., and Renn, K. A. (2009). *Student Development in College: Theory, Research, and Practice*. Hoboken, NJ: John Wiley and Sons.

Fishbein, M., and Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Fitzpatrick, K. K., Darcy, A., and Vierhile, M. (2017). Delivering cognitive behavior therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (woebot): a randomized controlled trial. *JMIR Ment. Health* 4, e19. doi: 10.2196/mental.7785

Freund, A. M., and Baltes, P. B. (2002). Life-management strategies of selection, optimization and compensation: measurement by self-report and construct validity. *J. Pers. Soc. Psychol.* 82:642.

Fulmer, R. (2019). Artificial intelligence and counseling: four levels of implementation. *Theor. Psychol.* 29, 807–819. doi: 10.1177/0959354319853045

Fulmer, R., Joerin, A., Gentile, B., Lakerink, L., and Rauws, M. (2018). Using psychological artificial intelligence (tess) to relieve symptoms of depression and anxiety: randomized controlled trial. *JMIR Ment. Health* 5:e64. doi: 10.2196/mental.9782

Gateshill, G., Kucharska-Pietura, K., and Wattis, J. (2011). Attitudes towards mental disorders and emotional empathy in mental health and other healthcare professionals. *Psychiatrist* 35, 101–105. doi: 10.1192/pb.bp.110.029900

Gettinger, M., and Seibert, J. K. (2002). Contributions of study skills to academic competence. *Sch. Psychol. Rev.* 31, 350–365. doi: 10.1080/02796015.2002.12086160

Gollwitzer, P. M. (1993). Goal achievement: the role of intentions. *Eur. Rev. Soc. Psychol.* 4, 141–185. doi: 10.1080/14792779343000059

Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *Am. Psychol.* 54, 493–503. doi: 10.1037/0003-066X.54.7.493

Gollwitzer, P. M., and Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *J. Pers. Soc. Psychol.* 73, 186–199. doi: 10.1037/0022-3514.73.1.186

Gollwitzer, P. M., and Sheeran, P. (2006). Implementation intentions and goal achievement: a meta−analysis of effects and processes. *Adv. Exp. Soc. Psychol.* 38, 69–119. doi: 10.1016/S0065-2601(06)38002-1

Graybiel, A. M., and Smith, K. S. (2014). Good habits, bad habits. *Sci. Am.* 310, 38–43. doi: 10.1038/scientificamerican0614-38

Harrer, M., Adam, S. H., Baumeister, H., Cuijpers, P., Karyotaki, E., Auerbach, R. P., et al. (2019). Internet interventions for mental health in university students: a systematic review and meta−analysis. *Int. J. Methods Psychiatr. Res.* 28:e1759. doi: 10.1002/mpr.1759

Hartley, M. T. (2010). Increasing resilience: strategies for reducing dropout rates for college students with psychiatric disabilities. *Am. J. Psychiatr. Rehabil.* 13, 295–315. doi: 10.1080/15487768.2010.523372

Hattie, J. A. C. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analysis Relating to Achievement*. Abingdon: Routledge.

Hedges, L., and Olkin, I. (2014). *Statistical Methods for Meta-Analysis*, 1st Edn. London: Academic Press.

Henderson, H. (2007). *Artificial Intelligence: Mirrors for the Mind*. New York, NY: Infobase Publishing.

Holland, R. W., Aarts, H., and Langendam, D. (2006). Breaking and creating habits on the working floor: a field-experiment on the power of implementation intentions. *J. Exp. Soc. Psychol.* 42, 776–783. doi: 10.1016/j.jesp.2005.11.006

Honicke, T., and Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: a systematic review. *Educ. Res. Rev.* 17, 63–84. doi: 10.1016/j.edurev.2015.11.002

Hunt, J., and Eisenberg, D. (2010). Mental health problems and help-seeking behavior among college students. *J. Adolesc. Health* 46, 3–10. doi: 10.1016/j.jadohealth.2009.08.008

Huppert, F. A., Baylis, N., Keverne, B., Ryff, C. D., Singer, B. H., and Love, G. D. (2004). Positive health: connecting well–being with biology. *Philos. Trans. R. Soc. B Biol. Sci.* 359, 1383–1394. doi: 10.1098/rstb.2004.1521

Ibrahim, A. K., Kelly, S. J., Adams, C. E., and Glazebrook, C. (2013). A systematic review of studies of depression prevalence in university students. *J. Psychiatr. Res.* 47, 391–400. doi: 10.1016/j.jpsychires.2012.11.015

Jacques, R., Følstad, A., Gerber, E., Grudin, J., Luger, E., Monroy-Hernández, A., et al. (2019). "Conversational agents: acting on the wave of research and development," in *Paper Presented at the Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, (New York,

NY: Association for Computing Machinery), 1–8. doi: 10.1145/3290607.3299034

Kahneman, D. (1999). "Objective happiness," in *Well-Being: Foundations of Hedonic Psychology*, eds D. Kahneman, E. Diener, and N. Schwarz (New York, NY: Russell Sage Foundation).

Kamita, T., Ito, T., Matsumoto, A., Munakata, T., and Inoue, T. (2019). A chatbot system for mental healthcare based on SAT counseling method. *Mobile Inform. Syst.* 2019:9517321. doi: 10.1155/2019/9517321

Kessler, R. C., Foster, C. L., Saunders, W. B., and Stang, P. E. (1995). Social consequences of psychiatric disorders. I: Educational attainment. *Am. J. Psychiatry* 152, 1026–1032. doi: 10.1176/ajp.152.7.1026

Kim, K. R., and Seo, E. H. (2015). The relationship between procrastination and academic performance: a meta-analysis. *Pers. Indiv. Differ.* 82, 26–33. doi: 10.1016/j.paid.2015.02.038

Klinger, E. (1977). *Meaning and Void: Inner Experience and the Incentives in Peoples Lives*. Minneapolis, MN: University of Minnesota Press.

Klug, H. J. P., and Maier, G. W. (2015). Linking goal progress and subjective well-being: a meta-analysis. *J. Happiness Stud.* 16, 37–65. doi: 10.1007/s10902-013-9493-0

Kvillemo, P., Brandberg, Y., and Bränström, R. (2016). Feasibility and outcomes of an internet-based mindfulness training program: a pilot randomized controlled trial. *JMIR Ment. Health* 3:e33. doi: 10.2196/mental.5457

Lambert, M. (2018). *Chatbot Decision Trees*. Available online at: https://chatbotslife.com/chatbot-decision-trees-a42ed8b8cf32 (accessed 2 April, 2020).

Lane, J., Lane, A. M., and Kyprianou, A. (2004). Self-efficacy, self-esteem and their impact on academic performance. *Soc. Behav. Pers.* 32, 247–256. doi: 10.2224/sbp.2004.32.3.247

Lattie, E. G., Adkins, E. C., Winquist, N., Stiles-Shields, C., Wafford, Q. E., and Graham, A. K. (2019). Digital mental health interventions for depression, anxiety, and enhancement of psychological well-being among college students: systematic review. *J. Med. Intern. Res.* 21:e12869. doi: 10.2196/12869

Locke, E. A., and Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: a 35-year odyssey. *Am. Psychol.* 57, 705–717. doi: 10.1037//0003-066X.57.9.705

Lucas, G. M., Gratch, J., King, A., and Morency, L. (2014). It's only a computer: virtual humans increase willingness to disclose. *Comp. Hum. Behav.* 37, 94–100. doi: 10.1016/j.chb.2014.04.043

Lucas, G. M., Rizzo, A., Gratch, J., Scherer, S., Stratou, G., Boberg, J., et al. (2017). Reporting mental health symptoms: breaking down barriers to care with virtual human interviewers. *Front. Robot. AI* 4:51. doi: 10.3389/frobt.2017.00051

Meurk, C., Leung, J., Hall, W., Head, B. W., and Whiteford, H. (2016). Establishing and governing e-mental health care in australia: a systematic review of challenges and a call for policy-focussed research. *J. Med. Intern. Res.* 18:e10. doi: 10.2196/jmir.4827

Moon, J., and Kim, Y. (2001). Extending the TAM for a world-wide-web context. *Inform. Manag.* 38, 217–230. doi: 10.1016/S0378-7206(00)00061-6

Morisano, D., Hirsh, J. B., Peterson, J. B., Pihl, R. O., and Shore, B. M. (2010). Setting, elaborating, and reflecting on personal goals improves academic performance. *J. Appl. Psychol.* 95, 255–264. doi: 10.1037/a0018478

Morris, R. R., Kouddous, K., Kshirsagar, R., and Schueller, S. M. (2018). Towards an artificially empathic conversational agent for mental health applications: system design and user perceptions. *J. Med. Intern. Res.* 20:e10148. doi: 10.2196/10148

Mortier, P., Demyttenaere, K., Auerbach, R. P., Green, J. G., Kessler, R. C., Kiekens, G., et al. (2015). The impact of lifetime suicidality on academic performance in college freshmen. *J. Affect. Disord.* 186, 254–260. doi: 10.1016/j.jad.2015.07.030

Oettingen, G. (2000). Expectancy effects on behavior depend on self-regulatory thought. *Soc. Cogn.* 18, 101–129. doi: 10.1521/soco.2000.18.2.101

Oettingen, G. (2012). Future thought and behaviour change. *Eur. Rev. Soc. Psychol.* 23, 1–63. doi: 10.1080/10463283.2011.643698

Oettingen, G., Mayer, D., and Brinkmann, B. (2010). Mental contrasting of future and reality. *J. Pers. Psychol.* 9, 138–144. doi: 10.1027/1866-5888/a000018

Oettingen, G., and Sevincer, A. T. (2018). "Fantasy about the future as friend and foe," in *The psychology of thinking about the future*, eds G. Oettingen, A. T. Sevincer, and P. M. Gollwitzer (New York, NY: The Guilford Press), 127–149.

Organisation for Economic Co-operation and Development (OECD) (2010). *Education at a Glance 2010: OECD Indicators*. Paris: OECD.

Organisation for Economic Co-operation and Development (OECD) (2013). *Education at a Glance 2013: OECD Indicators*. Paris: OECD.

Organisation for Economic Co-operation and Development (OECD) (2019). *Education at a Glance 2019: OECD Indicators*. Paris: OECD.

Parasuraman, A. (2000). Technology readiness index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *J. Serv. Res.* 2, 307–320. doi: 10.1177/109467050024001

Park, M., Aiken, M., and Salvador, L. (2018). How do humans interact with chatbots? an analysis of transcripts. *Int. J. Manag. Inform. Technol.* 14, 3338–3350. doi: 10.24297/ijmit.v14i0.7921

Pennebaker, J. W. (2004). Theories, therapies, and taxpayers: on the complexities of the expressive writing paradigm. *Clin. Psychol. Sci. Pract.* 11, 138–142. doi: 10.1093/clipsy.bph063

Pennebaker, J. W., Colder, M., and Sharp, L. K. (1990). Accelerating the coping process. *J. Pers. Soc. Psychol.* 58, 528–537. doi: 10.1037//0022-3514.58.3.528

Perry, R. P. (1991). "Perceived control in college students: implications for instruction in higher education," in *Higher Education: Handbook of Theory and Research*, Vol. 7, ed. J. Smart (New York, NY: Agathon Press), 1–56.

Plant, E. A., Ericsson, K. A., Hill, L., and Asberg, K. (2005). Why study time does not predict grade point average across college students: implications of deliberate practice for academic performance. *Contemp. Educ. Psychol.* 30, 96–116. doi: 10.1016/j.cedpsych.2004.06.001

Powers, T. A., Koestner, R., and Topciu, R. A. (2005). Implementation intentions, perfectionism, and goal progress: perhaps the road to hell is paved with good intentions. *Pers. Soc. Psychol. Bull.* 31, 902–912. doi: 10.1177/0146167204272311

Provoost, S., Lau, H. M., Ruwaard, J., and Riper, H. (2017). Embodied conversational agents in clinical psychology: a scoping review. *J. Med. Intern. Res.* 19:e151. doi: 10.2196/jmir.6553

Radziwill, N. M., and Benton, M. C. (2017). Evaluating quality of chatbots and intelligent conversational agents. *ArXiv*[Preprint] Available online at: https://arxiv.org/abs/1704.04579 (accessed April 2, 2020).

Richardson, M., Abraham, C., and Bond, R. (2012). Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychol. Bull.* 138, 353–387. doi: 10.1037/a0026838

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., and Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychol. Bull.* 130, 261–288. doi: 10.1037/0033-2909.130.2.261

Royal College of Psychiatrists (2011). *Mental Health of Students in Higher Education College Report CR166*. London: Royal College of Psychiatrists.

Ryan, R. M., and Deci, E. L. (2001). On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. *Annu. Rev. Psychol.* 52, 141–166. doi: 10.1146/annurev.psych.52.1.141

Ryff, C. D., and Singer, B. H. (2008). Know thyself and become what you are: a eudaimonic approach to psychological well-being. *J. Happiness Stud.* 9, 13–39. doi: 10.1007/s10902-006-9019-0

Saddler, C. D., and Sacks, L. A. (1993). Multidimensional perfectionism and academic procrastination: relationships with depression in university students. *Psychol. Rep.* 73, 863–871. doi: 10.2466/pr0.1993.73.3.863

Schippers, M. C., Morisano, D., Locke, E. A., Scheepers, A. W. A., Latham, G. P., and De Jong, E. M. (2020). Writing about personal goals and plans regardless of goal type boosts academic performance. *Contemp. Educ. Psychol.* 60:101823. doi: 10.1016/j.cedpsych.2019.101823

Schippers, M. C., Scheepers, A. W. A., and Peterson, J. B. (2015). A scalable goal-setting intervention closes both the gender and ethnic minority achievement gap. *Palgrave Commun.* 1:15014. doi: 10.1057/palcomms.2015.14

Schippers, M. C., and Ziegler, N. (2019). Life crafting as a way to find purpose and meaning in life. *Front. Psychol.* 10:2778. doi: 10.3389/fpsyg.2019.02778

Schmidt, H. G., Cohen-Schotanus, J., Van Der Molen, H. T., Splinter, T. A. W., Bulte, J., Holdrinet, R., et al. (2010). Learning more by being taught less: a "time-for-self-study" theory explaining curricular effects on graduation rate and study duration. *High. Educ.* 60, 287–300. doi: 10.1007/s10734-009-9300-3

Sheldon, K. M. (2002). "The self-concordance model of healthy goal striving: when personal goals correctly represent the person," in *Handbook of Self-Determination Research*, eds E. L. Deci and R. M. Ryan (Rochester, NY: The University of Rochester Press), 65–86.

Sheldon, K. M., and Houser-Marko, L. (2001). Self-concordance, goal attainment, and the pursuit of happiness: can there be an upward spiral? *J. Pers. Soc. Psychol.* 80, 152–165. doi: 10.1037/0022-3514.80.1.152

Sheldon, K. M., and Kasser, T. (1998). Pursuing personal goals: skills enable progress, but not all progress is beneficial. *Pers. Soc. Psychol. Bull.* 24, 1319–1331. doi: 10.1177/01461672982412006

Shum, H., He, X., and Li, D. (2018). From Eliza to XiaoIce: challenges and opportunities with social chatbots. *Front. Inform. Technol. Electron. Eng.* 19:10–26. doi: 10.1631/FITEE.1700826

Sitzmann, T., and Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: what we know and where we need to go. *Psychol. Bull.* 137, 421–442. doi: 10.1037/a0022777

Sone, T., Nakaya, N., Ohmori, K., Shimazu, T., Higashiguchi, M., Kakizaki, M., et al. (2008). Sense of life worth living (ikigai) and mortality in japan: ohsaki study. *Psychosom. Med.* 70, 709–715. doi: 10.1097/PSY.0b013e31817e7e64

Spitzer, R. L., Kroenke, K., Williams, J. B. W., and Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

Steel, P., Brothen, T., and Wambach, C. (2001). Procrastination and personality, performance, and mood. *Pers. Indiv. Differ.* 30, 95–106. doi: 10.1016/S0191-8869(00)00013-1

Steger, M. F., Kashdan, T. B., Sullivan, B. A., and Lorentz, D. (2008). Understanding the search for meaning in life: personality, cognitive style, and the dynamic between seeking and experiencing meaning. *J. Pers.* 76, 199–228. doi: 10.1111/j.1467-6494.2007.00484.x

Stewart, G., Kamata, A., Miles, R., Grandoit, E., Mandelbaum, F., Quinn, C., et al. (2019). Predicting mental health help seeking orientations among diverse undergraduates: an ordinal logistic regression analysis. *J. Affect. Disord.* 257, 271–280. doi: 10.1016/j.jad.2019.07.058

Taherdoost, H. (2018). A review of technology acceptance and adoption models and theories. *Proc. Manufact.* 22, 960–967. doi: 10.1016/j.promfg.2018.03.137

Tinto, V. (1975). Dropout from higher education: a theoretical synthesis of recent research. *Rev. Educ. Res.* 45, 89–125. doi: 10.3102/00346543045001089

Tinto, V. (1998). Colleges as communities: taking research on student persistence seriously. *Rev. High. Educ.* 21, 167–177.

Tinto, V. (1999). Taking retention seriously: rethinking the first year of college. *NACADA J.* 19, 5–9. doi: 10.12930/0271-9517-19.2.5

Travers, C. J., Morisano, D., and Locke, E. A. (2015). Self−reflection, growth goals, and academic outcomes: a qualitative study. *Br. J. Educ. Psychol.* 85, 224–241. doi: 10.1111/bjep.12059

Vaidyam, A. N., Wisniewski, H., Halamka, J. D., Kashavan, M. S., and Torous, J. B. (2019). Chatbots and conversational agents in mental health: a review of the psychiatric landscape. *Can. J. Psychiatry* 64, 456–464. doi: 10.1177/0706743719828977

van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Q.* 28, 695–704. doi: 10.2307/25148660

van Eerde, W., and Klingsieck, K. B. (2018). Overcoming procrastination? A meta-analysis of intervention studies. *Educ. Res. Rev.* 25, 73–85. doi: 10.1016/j.edurev.2018.09.002

Venkatesh, V., and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Manag. Sci.* 46, 186–204. doi: 10.1287/mnsc.46.2.186.11926

Walton, G. M. (2014). The new science of wise psychological interventions. *Curr. Dir. Psychol. Sci.* 23, 73–82. doi: 10.1177/0963721413512856

Warwick, K., and Shah, H. (2014). Good machine performance in turing's imitation game. *IEEE Trans. Comp. Intelligen. AI Games* 6, 289–299. doi: 10.1109/TCIAIG.2013.2283538

Waterman, A. S. (1993). Two conceptions of happiness: contrasts of personal expressiveness (eudaimonia) and hedonic enjoyment. *J. Pers. Soc. Psychol.* 64:678. doi: 10.1037/0022-3514.64.4.678

Weidauer, A. (2018). *Conversational AI: Your Guide to Five Levels of AI Assistants in Enterprise*. Available online at: https://blog.rasa.com/conversational-ai-your-guide-to-five-levels-of-ai-assistants-in-enterprise/ (accessed April 2, 2020).

Weizenbaum, J. (1966). ELIZA—a computer program for the study of natural language communication between man and machine. *Commun. ACM* 9, 36–35. doi: 10.1145/365153.365168

Winkler, R., and Söllner, M. (2018). "Unleashing the potential of chatbots in education: a state-of-the-art analysis," in *Proceedings of the Academy of Management Annual Meeting*, (Chicago, IL: AOM), doi: 10.5465/AMBPP.2018.15903abstract

Zarouali, B., Van den Broeck, E., Walrave, M., and Poels, K. (2018). Predicting consumer responses to a chatbot on Facebook. *Cyberpsychol. Behav. Soc. Netw.* 21, 491–497. doi: 10.1089/cyber.2017.0518

Zivin, K., Eisenberg, D., Gollust, S. E., and Golberstein, E. (2009). Persistence of mental health problems and needs in a college student population. *J. Affect. Disord.* 117, 180–185. doi: 10.1016/j.jad.2009.01.001

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 15 June 2020
doi: 10.3389/fpsyg.2020.01141

# Revealing Nuanced Relationships Among Cognitive Test Anxiety, Motivation, and Self-Regulation Through Curvilinear Analyses

*Jerrell C. Cassady* and W. Holmes Finch*

*Department of Educational Psychology, Ball State University, Muncie, IN, United States*

Student motivational profiles and self-regulated learning strategies are significant influences on overall academic success in university settings. Test anxiety has been repeatedly linked to maladaptive learning strategies and ineffective motivational frameworks. However, the results in the field have been inconsistent with respect to the precise interactions among these variables. This study employed anonymous responses from a group of volunteer students in a mid-sized Midwestern United States university, serving a primarily Caucasian and female population with an average age of 20 years. Adopting a curvilinear analytic design, this study attempted to examine the relationships among these common domains of inquiry into student thriving. The results of this study provide insights examining under which conditions cognitive test anxiety is most likely to be heightened or diminished. The results demonstrated that levels of test anxiety were greatest when (a) learners adopted primarily extrinsic or primarily intrinsic goal orientations, (b) academic tasks where the outcome was uncertain, (c) learners adopted passive learning strategies, and (d) learning strategies were more personally involved (as opposed to externalized study behaviors). Our results add to the field by identifying curvilinear models provide greater utility in identifying the relationships among these critical emotional and cognitive factors in academic settings. Furthermore, we advocate for employing identification and intervention strategies that recognize individually specific profiles of interactions among test anxiety, motivation, and self-regulation to promote more optimal success in supporting learners in university settings.

**Keywords: cognitive test anxiety, self-regulated learning, motivation, goals, expectancy**

OPEN ACCESS

***Edited by:***
*Meryem Yilmaz Soylu, University of Nebraska–Lincoln, United States*

***Reviewed by:***
*Antonio Granero-Gallegos, University of Almería, Spain*
*Antonio Baena Extremera, University of Granada, Spain*

****Correspondence:***
*Jerrell C. Cassady*
*jccassady@bsu.edu*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *19 February 2020*
***Accepted:*** *04 May 2020*
***Published:*** *15 June 2020*

***Citation:***
*Cassady JC and Finch WH (2020) Revealing Nuanced Relationships Among Cognitive Test Anxiety, Motivation, and Self-Regulation Through Curvilinear Analyses. Front. Psychol. 11:1141. doi: 10.3389/fpsyg.2020.01141*

## INTRODUCTION

In contemporary educational settings, the success and thriving of students is of critical concern to university leaders as rates of retention and graduation are challenged across all sectors (Cheslock and Kroc, 2012). With more students gaining access to post-secondary education, the initial readiness to perform in university curricula has been demonstrated to be more varied than in

any prior generation. To that effect, support mechanisms have been increasingly proposed to support those students in meeting the challenges they face in academic, emotional, and financial domains (Heller and Cassady, 2017). While we recognize all these domains promote challenges to optimal performance, our attention centers on the impact of negative affective experiences triggered by stressors in academic settings (e.g., Pekrun, 2006; Putwain, 2007). Research in the field illustrates between 20 and 45% of students experience debilitating emotional states (e.g., anxiety, depression) that impact their performance in universities (Kessler et al., 2005). A related finding in this domain is that these indicators of academic anxieties in college campuses are good indicators of students who currently experience or are at heightened risk to develop anxiety and/or depression (Cassady et al., 2019).

These growing trends in the field have largely driven our work, which involves three primary goals in this domain: (a) effectively identify students at-risk for maladaptive affective experiences such as test anxiety, (b) isolate contributing factors that promote deleterious performance due to test anxiety, and (c) promote intervention efforts that can support thriving. Over the course of 25 years of research in this domain, attention to cognitive test anxiety and academic behaviors has repeatedly demonstrated that elevated levels of test anxiety are clearly related to key issues in university success such as motivation and study skills. However, recent trends in the field pointing to moderating variables have sparked renewed interest in reviewing the hypothesis that test anxiety may have some facilitative or functional aspects. To that end, our attention has turned to examining more nuanced relationships among motivation, self-regulation, and test anxiety.

## Test Anxiety

Test anxiety influences learners in academic settings through the beliefs, behaviors, and eventual performance differences noted for people with varied levels of experienced affective response in evaluative settings (Cassady, 2010). Research has demonstrated that learners adopt failure accepting and task avoidance motivational sets (Zeidner and Matthews, 2005), are prone to cognitive distractions during both test preparation and test performance phases, and have difficulty with self-regulatory skills such as organization, time management, attentional control, and effective study strategies (Bar-Tal et al., 1999; Eysenck et al., 2007; Cassady, 2010). There are at least two dimensions of test anxiety: emotionality (or physiological) and cognitive test anxiety (or worry; Liebert and Morris, 1967), with more recent models attempting to validate a third aspect (social; Lowe et al., 2008). However, the findings focused on social test anxiety have not effectively determined if social aspects of test anxiety are a clearly distinct factor, or a significantly important environmental influence that promotes test anxiety in the other two domains.

The emotionality component of test anxiety is generally context-specific and is commonly identified through heightened physiological arousal (e.g., heart rate, nausea, agitation; Cassady, 2010). The worry component, or cognitive test anxiety, is characterized by poor processing efficiency (i.e., cognitive overload), unproductive cognitive distractions, and perseveration on fear of failure (Rojas and Furlan, 2017). While most models of test anxiety identify that cognitive test anxiety and emotionality are related, interact with one another, and may best be explained through an additive relationship (Zohar, 1998), the data generally support the conclusion that cognitive test anxiety is more directly related to performance decrements (Hembree, 1988; Cassady, 2004) and stable over time (Cassady, 2001).

Several accounts for the mechanism through which cognitive test anxiety drives down performance have been identified, pointing to reduced working memory capacity (Mowbray, 2012), inability to organize cognitive information effectively (Naveh-Benjamin et al., 1987; Bar-Tal et al., 1999), and perseveration on negative self-thoughts or engaging in avoidance strategies that limit cognitive resources available to engage in the task at hand (Sarason, 1986; Raffety et al., 1997; O'Carroll and Fisher, 2013). The Attentional Control Theory (ACT; Eysenck et al., 2007) provides an effective model that provides a comprehensive explanatory framework for these findings to date. One of the key premises offered in ACT is that when test anxiety is heightened, learners overload their cognitive resources through an inability to inhibit distracting thoughts (e.g., worry over fear of failure). This leads to cognitive overload due to the increase in extraneous processing (e.g., Mayer, 2014), limiting the ability to engage in goal-directed cognition (e.g., effective study strategies, focus during tests). Another strong prediction offered by ACT is that the negative impact on learner performance is primarily an operation of reduced processing efficiency, not processing efficacy (Eysenck and Calvo, 1992). That is, ACT does not presume that individuals with test anxiety are necessarily incapable of activating effective coping strategies or cognitive operations. Wong et al. (2013) provided compelling support for this efficiency proposal, illustrating that as basic cognitive tasks became more challenging, significant differences in time taken to respond (but not actual performance) were noted between learners with high and low levels of trait anxiety.

The standard approach to analyzing outcomes in test anxiety research has relied heavily on basic linear models of analyses. However, one of the earliest (and most durable) conceptions for stress and anxiety is the Yerkes-Dodson Law (Yerkes and Dodson, 1908), which proposed that there is an optimal point of arousal (or stress) at which performance is maximized – but once that threshold is crossed, performance outcomes decline rapidly. One justification for the focus on linear effects is that "anxiety" is a maladaptive level of "stress," so the Yerkes-Dodson threshold has already been crossed and any degree of anxiety is maladaptive. However, this overlooks the broad tendency in the field to explain differential influences for students with "levels" of anxiety (e.g., Thomas et al., 2017a). Moreover, the results have been clear that there are interactions in student outcomes that would be missed without attention to interactions or non-linear trends. For instance, Mattarella-Micke et al. (2011) demonstrated that the influence of cortisol (a measure generally indicating high stress) on performance was only understood when examining the interactive relationships among working memory and math anxiety in those tasks. Similarly, Stowell et al. (2008) found that explaining the influence of cortisol, test anxiety, and coping strategies on course performance and affective states was only possible when examining moderation effects of the

coping mechanisms in the specific context. These trends are even more variable in contexts that openly identify aspects of "facilitative anxiety," which are levels or behaviors connected to anxiety over examinations that do not drive a negative affective experience (Raffety et al., 1997). Taken together, the research suggest that much of the research in the field may have missed the nuance of the relationships among test anxiety, motivational variables, student behaviors, and performance.

## Self-Regulated Learning

Self-regulated learning strategies are a collection of cognitive and behavioral strategies that promote optimal success by ensuring that learning activities are strategic and targeted planning, self-monitoring, and effortful control over cognitive processes in directing efforts toward attaining achievement goals (Zimmerman, 2002; Schunk and Zimmerman, 2003). The value of SRL has become increasingly important in educational contexts as students have been progressively expected to engage in more self-directed learning experiences in educational settings – that is, as instruction becomes less teacher-centered (Bjork et al., 2013). To illustrate the power of SRL in contemporary settings, Duckworth and Seligman (2005) demonstrate that self-discipline (i.e., monitoring and maintaining effort control) was twice as effective in predicting academic performance than IQ. Kitsantas and Zimmerman (2009) also showed that SRL mediated the positive relationship between homework activity and achievement, demonstrating that actively monitoring and controlling the independent learning experiences was necessary to explain the performance gains. While the evidence is strong that effective use of self-regulated learning strategies and effective learning techniques can promote positive outcomes, it has also become evident that students often fail to engage in quality strategies due to their perceived utility, lack of skill practice, or simple preference for less effective methods (e.g., Dunlosky et al., 2013). While the bulk of attention in the SRL domain has targeted cognitive and metacognitive control, Pintrich (2004) argued effectively that effective models need to also take into consideration learners' regulation of affect, behavior, and the context within which they are operating.

Following Pintrich (2004) call for attention to the broader regulatory functions involved in self-regulation, the Emotional Information Processing model (Cassady and Boseck, 2008; Cassady and Thomas, 2020) proposed an iterative process for (a) encoding and interpreting internal and external cues in academic settings, (b) developing and evaluating goals to respond to the perceived context, and (c) implementing solutions to achieve established goals. Central to this model is the recognition that the learner's representation of stressors in academic settings dictates the goals established, appraisal of the likelihood of managing those stressors, and the coping mechanisms that will be adopted to manage the context in an effort to reduce the level of perceived threat. Similarly, Gross (1998, 2015) Process Model for emotion regulation identified there are two broad approaches learners employ to manage perceived stress or threat in academic settings: (a) activate proactive or problem-focused coping strategies that aim to improve success directly, or (b) change the emotional set or mitigate the severity of the emotional response through emotion regulation strategies.

The operationalization of effective SRL in response to stressors can generally be identified by examining the coping strategies learners employ when navigating the stressful or threatening academic context. Lazarus and Folkman (1987) foundational Transactional Stress and Coping model and more recent conceptualizations such as the Self-Referent Executive Processing model (Wells and Matthews, 1996; Putwain, 2019) demonstrated that the individual's appraisal of perceived stressors or threats as well as their metacognitive knowledge regarding potential coping strategies determine the probable strategies that would be employed. The research that has followed in this line has classified three broad forms of coping. Problem-focused, or adaptive, coping are those strategies that are focused on promoting positive study behaviors or actively pursuing strategies that will promote competency in the domain where perceived ability is in question (e.g., Zeidner and Saklofske, 1996). Examinations of the interactions among active coping strategies and academic buoyancy demonstrate that the maladaptive outcomes associated with high test anxiety are significantly reduced when students engage in effective test preparation coping strategies and maintain a higher degree of buoyancy (Putwain et al., 2016). Avoidance strategies are coping mechanisms such as procrastination, withdrawal, or self-handicapping that remove the learner from the context that promotes the stress (Kalechstein et al., 1989; Cassady and Thomas, 2020). Finally, emotion-focused coping strategies target the appraisal of the event itself, attempting to reduce the perceived threat through strategies such as cognitive reappraisal (Brady et al., 2018).

A key debate in the field centers on the utility of the activation of emotion-focused coping strategies. Several studies have demonstrated that learners who rely on strategies that primarily focus on emotion-focused or avoidance coping are maladaptive when compared to problem-focused (or adaptive) coping strategies (Thomas et al., 2017a,b). However, some studies have demonstrated that emotion-focused and avoidance coping strategies can support learners by moderating the influence of cognitive test anxiety (or worry) leading to positive outcomes in affect response (Stowell et al., 2008) and even performance (Brady et al., 2018). However, the positive effects of avoidant or emotional coping strategies are seldom simple effects, revealing their potential is achieved through interactions with other personological and environmental factors (e.g., de la Fuente et al., 2019). Referring back to the EIP framework, our synthesis of the data in the field argues that coping strategies (adaptive, avoidant, emotional) all have potential proactive influence, provided the strategies collectively enable the learner to represent the academic situation as less threatening as well as engage in positive strategies that increase their cognitive and behavioral engagement toward meeting the external needs imposed (Cassady and Thomas, 2020).

## Achievement Motivation

Closely related to the concept of self-regulated learning is the broad domain of achievement motivation. There are

many viable models of motivation in the academic context that have been used to explain volitional control effectively, including Weiner (2018) attribution theory, Deci and Ryan (2012) Self-Determination Theory, and Wigfield and Eccles (2002) Expectancy–Value Theory (EVT). Across these models, two primary motivational constructs are central to most treatments of test anxiety, self-regulated learning, and success in university settings. The first motivation theme is the learner's expectancy for success in the given context. The likelihood that a learner will perform well on a given task, and perform well over a period of time, is greatly enhanced by the belief in their ability to be successful, or self-efficacy (Bandura, 1977; Wigfield and Eccles, 2002). A second general influence on motivation is the underlying impetus that learners focus on when determining perceived value for achieving success in the task. A simplified method for pursuing this second domain includes examining the goal orientations individuals adopt, that is working to achieve success for purposes of satisfying extrinsic or intrinsic interests. It should be stated that although our attention in this study aligns with the EVT model primarily, motivational researchers with preference for SDT models or attribution theories have clearly and effectively explained these constructs from their own perspectives (Wigfield and Eccles, 2002; Weiner, 2018).

## Expectancy for Success

Bandura (1977) and Bandura and Schunk (1981) work on self-efficacy has been instrumental in demonstrating that learners' beliefs in their ability to successfully complete a task is instrumental in determining positive academic behaviors and is strongly tied to performance. Simply stated, when students believe they possess the talent and tools necessary to complete a task, they adopt more proactive and adaptive strategies to achieve success. However, when they believe that the task is beyond their skills or abilities, there is a considerable lack of motivational drive to pursue success. Within the framework of this investigation, the data demonstrate that higher levels of self-efficacy are associated with reductions in test anxiety (Brandmo et al., 2019). In cases where the appraisal of either personal attributes or the learning environment suggest to students that success is not likely, motivation to engage in positive academic strategies or SRL wanes (Gorges and Göke, 2015).

Using this framework, researchers have demonstrated strong relationships among expectancy for success and proactive coping, persistence in the face of failure, academic interest, and performance (Bandura and Schunk, 1981; Durik et al., 2015). While the data have been clear in identifying the positive influence of high expectancy ratings (e.g., self-efficacy, confidence, control; Putwain and Aveyard, 2018), Weiner (2018) has also identified that attention to the attributional set of the learner is critical. Specifically, if the expectation for successful performance is based merely on ability, adequate preparation may suffer when compared to attributional styles that presume success is attainable due to diligent effort. In line with this domain of explaining the influence of expectancy for success is the perception of control over the outcomes of an examination, with evidence that higher perceived control led to greater performance particularly when test worry was low to moderate (Putwain and Aveyard, 2018). This line of work has demonstrated further that the impact of perceived control was less instrumental at high levels of worry (Putwain and Aveyard), but additional work has demonstrated that promoting perceptions of control over the situation can also reduce the overall levels of cognitive test anxiety components (Putwain and Prescod, 2018).

### *Goal orientation*

There has also been a considerable amount of research examining the influence of achievement goal orientation on learner outcomes (Schunk, 1990; Brandmo et al., 2019). A common theme in research on learners' motivational approaches to learning from a goal orientation perspective tends to cast dimensional or dichotomous accounts for "types" of goal setting. A dominant orientation toward examining achievement motivation goals focuses on the purpose of the learning experience (from the perspective of the learner). Mastery-focused (or learning) goals have a primary orientation to successfully mastering the content faced by the learner. Conversely, performance goals tend to be focused on the learner demonstrating competence or success in relation to a set standard or in comparison to peers (Shim et al., 2011). Early discussions on mastery vs. performance goal structures often suggested a qualitatively superior status for mastery goals, leading to greater enjoyment, persistence, and eventual long-term success. Research on goal orientations has demonstrated that in general, performance goals are positively related to test anxiety, perhaps exacerbating the situational threat imposed by exam situations (Brandmo et al., 2019). However, continued work in the field has demonstrated that the context matters, demonstrating that performance goals (both approach and avoidance) can be adaptive strategies to promote positive motivational impulses (Brady et al., 2018).

An alternative (but similar) orientation to explaining goal structures focuses on explaining where the primary drive for achieving the goal comes from, and the underlying affective responses to those differentially sourced goals (Pekrun, 2006). Extrinsic goal orientation represents those goals that are established primarily to achieve an externally imposed criterion or satisfaction (e.g., grades, peer approval, access to resources). Conversely, intrinsic goal orientations are those goals that are adopted primarily to satisfy internal needs (e.g., satisfaction, personal growth, skill development; Deci and Ryan, 2012). While educators have been repeatedly coached to prefer intrinsic goal orientations, the research is also mixed in this classification system – essentially generating the conclusion that contextual variations lend themselves to different "optimal" goal orientations, and that the efficacy of those goal orientations are mediated through coping strategies (Brdar et al., 2006).

Our synthesis of the research on these broad motivational constructs highlights once again the importance of person × context interactions (Cassady and Thomas, 2020). Essentially,

we argue that reliance on simplified representations of goal orientations (e.g., "intrinsic goals are better than extrinsic") as well as expectancy frameworks (e.g., "high self-efficacy is always good") fail to capture the nuances among diverse learners as well as the experiences of individual learners across multiple settings.

## CURRENT STUDY

While the data in this field has consistently demonstrated connections among these motivational and self-regulatory processes and test anxiety, we have noted a considerable gap in the literature regarding the examination of non-linear relationships. That is, primarily linear relationships have been reported in the literature despite the widely known Yerkes-Dodson law of arousal and performance that is established on findings over 100 years old (Yerkes and Dodson, 1908), which asserted a curvilinear relationship between arousal (stress) and performance. Optimal levels of performance occurred when arousal (stress) was moderate. This explanation is the source of several coping and self-regulation explanations for behavioral exhibition in academic settings related to balancing the level of "pressure" to induce quality performance in academic settings. However, test anxiety research is primarily based on findings centered on linear relationships (Cassady, 2010). Studies that have explored moderation effects among these variables (e.g., Owens et al., 2012) as well as those that identify contexts in which some degree of test anxiety is facilitative (e.g., Raffety et al., 1997; Eysenck et al., 2007) has prompted our attention to examining non-linear relationships among test anxiety, self-regulation, and motivation in a university setting. To the point, our investigation was focused on exploring potential non-linear effects in an attempt to determine if we can identify levels of test anxiety that may serve as activating or facilitative impulses in university settings, and more importantly when that level of test anxiety reaches a tipping point and becomes an entirely negative influence on the learning experience.

## MATERIALS AND METHODS

This study examined curvilinear relationships among cognitive test anxiety, self-regulation, and motivation (as measured by the Motivated Strategies for Learning Questionnaire, MSLQ) in a university sample ($n$ = 298). Participants were enrolled in undergraduate courses in developmental psychology and educational psychology at a mid-sized university in the Midwestern United States. All participants were volunteers, and participation in this survey study was one option of several to satisfy a course requirement. The study protocol and procedures were reviewed and approved as "exempt" by the University Institutional Review Board in accordance with federal guidelines (approval identification number BSU-447466-1). The nature of the data collection process precluded directly identifying gender, race, or age of the students, but prior studies on this population as well as aggregate demographic data on the classes involved in the recruitment indicate that the sample is predominantly Caucasian, female, average age of 20 years, and from the Midwestern United States, consistent with the programs served by the courses. Analyses of the submitted responses demonstrated that fewer than 1% of the observations contained missing values, therefore listwise deletion was employed.

### Measures

#### Motivated Strategies for Learning Questionnaire (MSLQ)

The MSLQ is an 81-item questionnaire addressing student self-reported motivational profiles as well as use of self-regulated learning strategies in academic settings (Pintrich et al., 1991). Students respond to each item after identifying a class or topic of focus – orienting their responses to a specific task for the duration of the scale. Responses are offered on a 7-point Likert-type scale with the extremes marked by "not at all true of me" or "very true of me."

Fifteen subscales were generated in the original MSLQ and broadly represent motivation and learning strategies. The subscales identified as *Motivation* used in this study include five of the original six offered by Pintrich et al. (1991). In this study, the "Test Anxiety" factor was removed due to the interest in examining test anxiety as a separate variable in the main analyses, leaving (a) internal goal orientation, (b) external goal orientation, (c) task value, (d) control over learning beliefs, and (e) self-efficacy. The nine learning strategies subscales are (a) time and study environment, (b) effort regulation, (c) peer learning, (d) help seeking, (e) rehearsal, (f) elaboration, (g) critical thinking, (h) organization, and (i) metacognitive self-regulation. Pintrich et al. (1991) reported acceptable psychometrics for the 15 scales, with internal consistency estimates across the 15 subscales exceeding a Cronbach's alpha value of 0.70 on average. Several attempts to generate differential factor structures for the MSLQ subscales (e.g., Cho and Summers, 2012) have revealed no clear agreement in an optimal factor structure that supersedes the initial solution offered in the factor analytic work with the original scale. However, there have been no prior attempts to examine the MSLQ through a multidimensional scaling approach as has been employed in our study.

#### The Cognitive Test Anxiety Scale–Revised (CTAR)

The Cognitive Test Anxiety Scale was originally developed by Cassady and Johnson (2002) as a measure of the cognitive dimension of trait test anxiety, building upon the traditional construct of "worry" in classic representations of test anxiety (Liebert and Morris, 1967; Sarason, 1986). Items in the scale address various aspects of the cognitive test anxiety structure (e.g., worry about doing well on tests, tend to freeze up on tests, forget facts I really know, don't seem to have much control over my test scores; see Cassady and Finch, 2014, for full scale). Scale validation studies with the original CTAS repeatedly demonstrated problems with the use of "reverse-coded" items in that version (Cassady and Finch, 2014; Thomas et al., 2017a), leading to the creation of a 25-item revised version (CTAR). The CTAR involves no reverse-coded

items and was also modified to include items that identify cognitive aspects of test anxiety during all three phases of the learning-testing cycle. Validation studies with the CTAR have demonstrated that the CTAR maintains strong construct validity when compared to other validated measures of test anxiety and related anxiety disorders (Cassady and Finch, 2014, 2015; Cassady et al., 2019), and the current sample demonstrated strong internal consistency for the items once again, $a = 0.970$.

## Analyses

The initial analysis involved the exploration of the dimensional structure of the two domains of the MSLQ (5 motivation subscales; 9 self-regulation subscales) using unfolding multidimensional scaling model (UMSM; Armstrong et al., 2014). UMSMs are a special case of multidimensional scaling, which is a statistical technique designed to reduce dimensionality in a set of variables. Statistical distance values among the variables are calculated, and the resulting weights can then be applied to the variables in order to create scale scores. Variables that are in relatively close in proximity will have similar weights, and those with the largest weights provide primary definition of the resulting scale scores. In the case of the UMSMs used in this study, the R (Version 3.6.0; R Core Team, 2019) smacof library version 2.0 was used to fit the models. The maximum number of iterations was set at 10,000, the lambda (penalty strength) and omega (penalty width) parameters were set to 0.5 and 0.1, respectively, and finally the convergence criterion was 0.000001. Viable two-dimensional representations of both the motivation and self-regulation subscales resulted, yielding four dimensional variables representing students' responses.

Using these four dimensional variables, we explored linear and curvilinear relationships with test anxiety using Generalized Additive Models (GAM; Hastie and Tibshirani, 1990). GAMs are modeling tools that employ splines to estimate relationships among variables. Splines allow for fitting non-linear complex non-linear relationships between variables. GAMs extend the spline paradigm by identifying the degree of non-linearity that optimizes model fit to the data. For this study, the gam function in the mgcv (version 1.8-31) R library was used for this purpose. A thin plate spline was used in fitting the model, with the generalized cross validation (GCV) score serving to identify the optimal model. The GAMs provided information regarding relationships between each of the dimensional factors and test anxiety. The goal of this analysis was to ascertain the nature of relationships between self-regulation and goal orientation, respectively, with test anxiety, as a way of understanding factors that drive learners' emotional and cognitive responses to academic challenges or threats. *A priori* hypotheses for the findings of this study included (a) exploration of the structure of the MSLQ would provide a dimensional solution that supported a new and validated approach to represent student motivation and self-regulated learning; and (b) curvilinear modeling would provide superior fit for explaining the relationships among test anxiety and motivational factors (as measured by the MSLQ) as well as self-regulated learning strategies.

# RESULTS

## Unfolding Multidimensional Scaling

The results of the unfolding model demonstrated that for the motivational variables in the MSLQ (Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Self-Efficacy for Learning and Performance, Control of Learning Beliefs) two dimensions were detected (**Figure 1**). The two variables generated that represent the motivational subscales provide dimensional data on "Goal Orientation" and "Expectancy for Success." Low levels of Goal Orientation (GO) were associated with endorsement of externalized or extrinsic locus of goal construction, whereas high levels demonstrate learners' affiliation with intrinsic goal orientations. This dimension aligns with a representation of performance (low values) and mastery goal structures. The Expectancy dimensional variable is a simple representation of the learners' perceived likelihood for success on the target task. High values represent high self-esteem, control over learning outcomes, and confidence in the projected outcome.

With respect to the Self-Regulated Learning components of the MSLQ, an unfolding model was also used, revealing two clear dimensions for those variables (**Figure 2**), representing "Personal Responsibility for Learning" and "Active Engagement of Learning Strategies." Personal Responsibility (PR) is focused on the degree to which the self-regulated learning strategy or study skill captured by the MSLQ subscales requires externally supported as opposed to independent self-regulation strategies. This dimension is in line with the SRL vs. ERL framework, with low values on the dimensional variable representing external or social influences in the learning task and high values aligned with strategies and activities that are independent learning approaches. The second self-regulation dimensional variable characterizes the level of Active Learning Engagement (AE) in the learning strategies assessed by the MSLQ. Low values on this dimension represent the more passive learning activities (organizing materials, rote repetition) and high values on the scale are associated with deeply engaged active learning approaches (effort control, elaborative rehearsal).

## Generalized Additive Modeling

Using the four dimensional variables discerned from the unfolding model described above as predictor variables, we explored relationships among cognitive test anxiety and the motivational and self-regulated learning dimensions using Generalized Additive Models (GAMs), with the purpose of ascertaining whether curvilinear functions were present. The resulting GAMs are described below in turn.

### Cognitive Test Anxiety and Goal Orientation (GO)

The results of the GAM exploring the relationship between CTA and the GO dimensional variable demonstrated a statistically significant curvilinear relationship between GO and CTA [$F_{(5{\cdot}75,\ 6{\cdot}94)} = 4.51$, $p < 0.0001$]. The curve in **Figure 3** demonstrated that heightened levels of test anxiety ($y$-axis) were present for individuals who reported predominantly extrinsic or intrinsic goal orientations, as illustrated by the heightened anxiety noted on the outer extreme values on

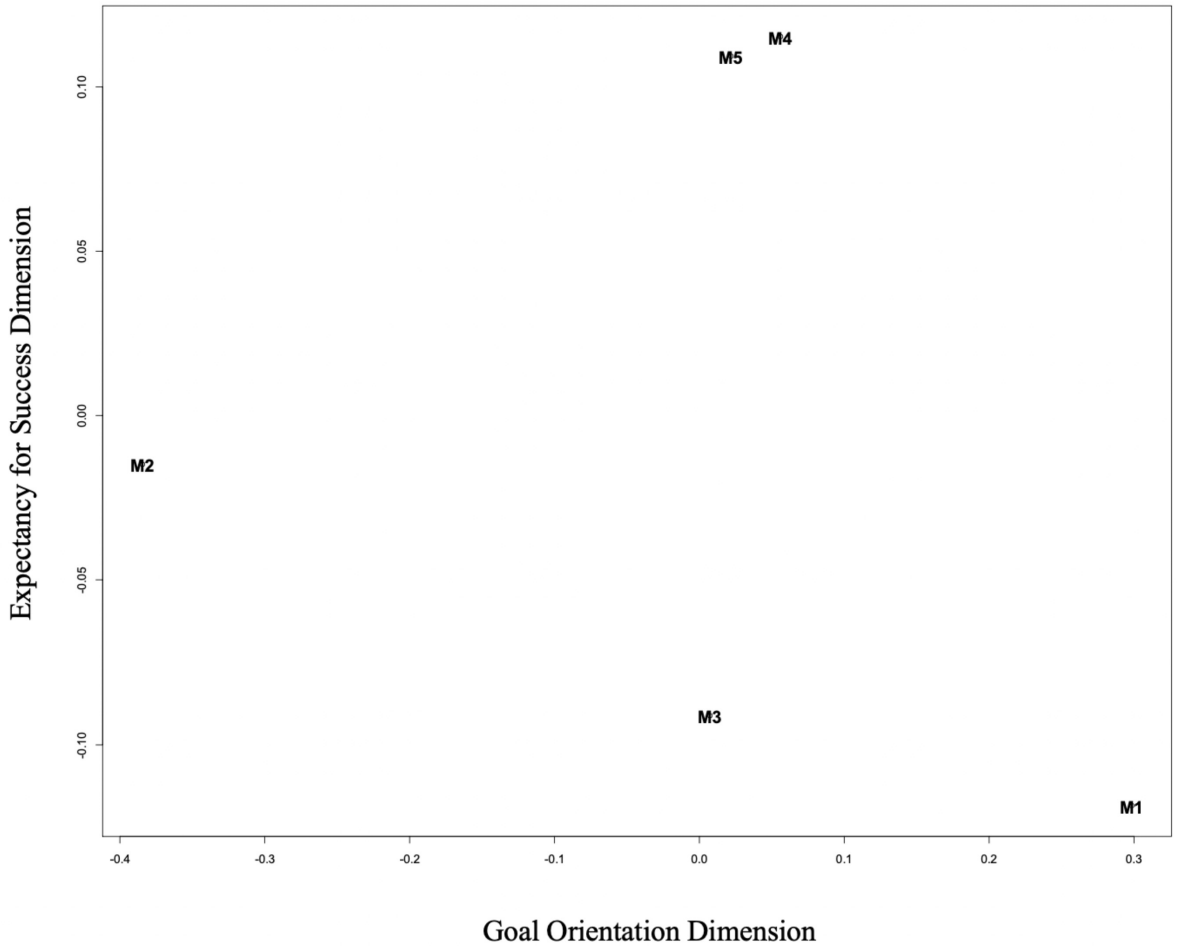


**FIGURE 1 |** Unfolding model results for MSLQ motivation scales. M1, intrinsic goal orientation; M2, extrinsic goal orientation; M3, task value; M4, self efficacy for learning and performance; M5, control of learning beliefs.

the *x*-axis. Reported cognitive test anxiety was lowest for individuals with more even mixtures of goal orientations (mid-level on the *x*-axis). More specifically, the lowest reliably predicted point of anxiety occurs when the mixture between extrinsic and intrinsic goal orientation tendencies slightly favor the intrinsic category. The curvilinear relationship for GO explained approximately 10% of the variance in reported test anxiety.

## Cognitive Test Anxiety and Expectancy of Success

The GAM curve for the model relating CTA and the Expectancy dimension appears in **Figure 4**. This non-linear relationship was statistically significant [$F_{(3.63,\ 4.57)} = 7.12$, $p < 0.0001$], representing an "inverted U" pattern. Test anxiety (*y*-axis) was highest when expected success (*x*-axis) was just below the center point, which is more precisely conveyed as the point of greatest uncertainty. Conversely, lower levels of test anxiety were noted when performance outcomes were at either extreme of the *x*-axis. As such, when success predictions were highly certain (either for success or failure), students reported the lowest degree of cognitive test anxiety. This relationship explained approximately 11% of the variance in test anxiety.

## Cognitive Test Anxiety and Active Learning Engagement

There was not a statistically significant curvilinear relationship between cognitive test anxiety and the Active Learning dimension. However, there was a significant inverse linear relationship between these two variables [$F_{(1,\ 1)} = 11.62$, $p < 0.0001$]. As can be seen in **Figure 5**, increasing levels of engagement in active learning strategies were directly associated with lower cognitive test anxiety. This relationship accounted for approximately 4% of the variation in cognitive test anxiety scores.

## Cognitive Test Anxiety and Personal Responsibility for Learning

The final dimension yielded by the multidimensional scaling, Personal Responsibility for Learning (PRL), had a

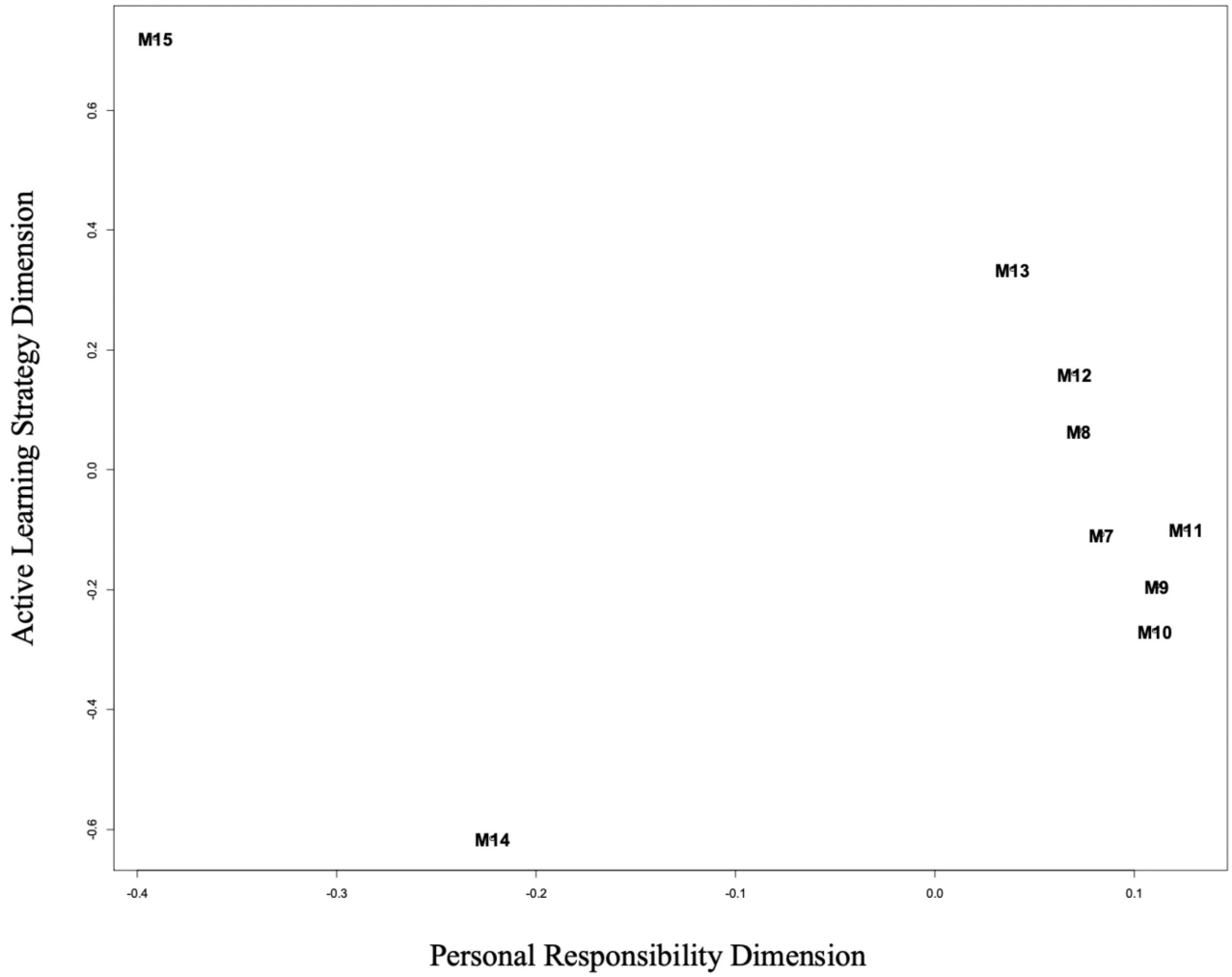


**FIGURE 2 |** Unfolding model results for MSLQ self-regulated learning scales. M7, rehearsal; M8, elaboration; M9, organization; M10, critical thinking; M11, metacognitive self-regulation; M12, time and study environment; M13, effort regulation; M14, peer learning; M15, help seeking.

statistically significant curvilinear relationship with CTA [$F_{(4.12,\ 5.14)} = 2.46$, $p = 0.03$]. **Figure 6** shows that lower values on the *x*-axis were associated with lower levels of cognitive test anxiety. In practice, this means that students with a greater reliance or use of socially oriented learning activities tended to have lower levels of CTA. As levels of PRL increased, the level of reported cognitive test anxiety also increased, but overall values of CTA were moderate and stable overall after the first increase noted. This result suggests that above a certain threshold of using socially engaged strategies (e.g., help seeking, peer study activities) there was not a clear direct relationship between PRL and elevated levels test anxiety. However, below that threshold cognitive test anxiety was relatively lower, suggesting that higher reliance on the low-personally responsible activities (cf, socially engaged strategies) or low use of self-regulated strategies high on the PRL dimension are associated with lower test anxiety. This non-linear relationship accounted for approximately 5% of the variation in cognitive test anxiety.

## DISCUSSION

The results of this study provided several insights to the fields of test anxiety and learner outcomes, both in theoretical and practical domains. First, the use of multidimensional scaling to review the data from the MSLQ provides a new approach to represent this commonly used scale in the literature, offering an alternative representation to examine motivational and self-regulatory constructs measured on Pintrich et al. (1991) classic measurement device. From a practical approach to the exploration of test anxiety, the data in this study also confirm our presumption that a high reliance on linear models of examining the relationships among test anxiety and learners' experiences may have

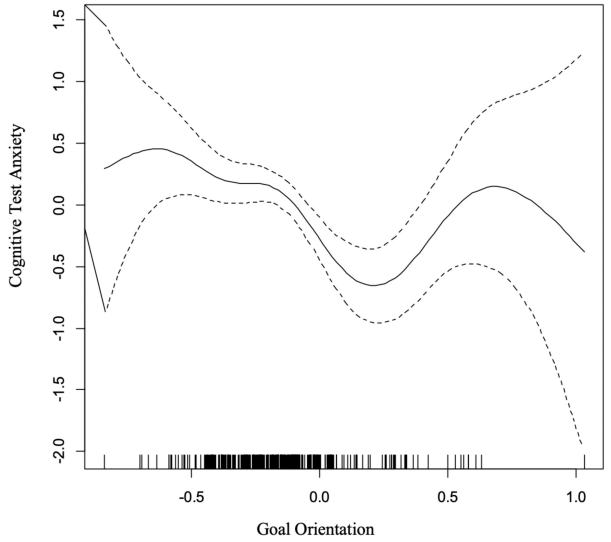


**FIGURE 3 |** GAM curve relating cognitive test anxiety (*y*-axis) and goal orientation (*x*-axis). High value indicates alignment with Intrinsic Goal Orientation.

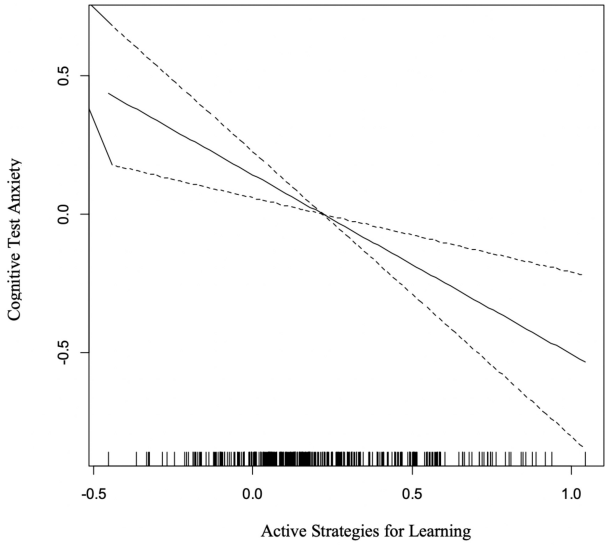


**FIGURE 5 |** Linear Relationship Cognitive Test Anxiety (*y*-axis) and Active Strategies for Learning (*x*-axis).

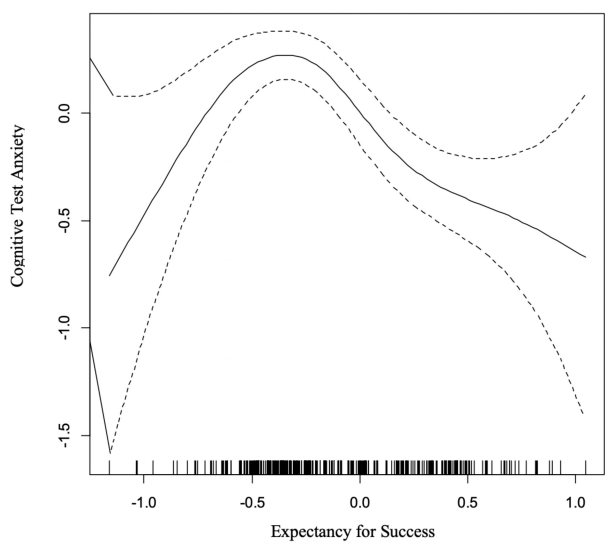


**FIGURE 4 |** GAM Curve Relating Cognitive Test Anxiety (*y*-axis) and Expectancy for Success (*x*-axis).

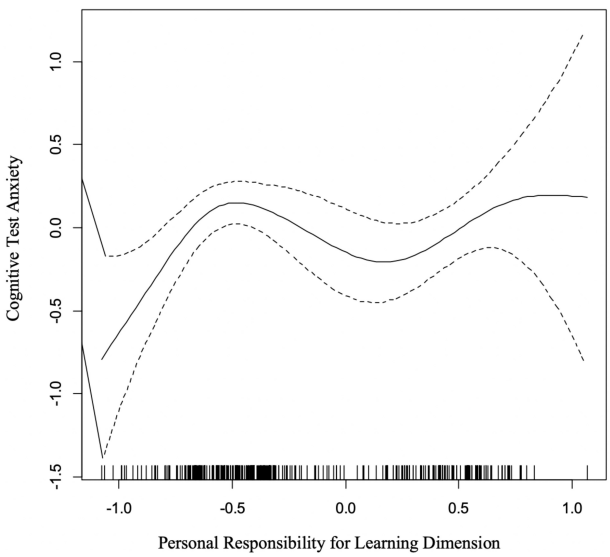


**FIGURE 6 |** GAM Curve Relating Cognitive Test Anxiety (*y*-axis) and the Personal Responsibility for Learning Activities Dimension (*x*-axis).

suppressed overall comprehension of the test anxiety construct. Finally, the results of the GAMs elucidate more nuanced relationships among test anxiety and motivation and study behaviors.

## Dimensional Representation for the MSLQ

Over the last 30 years, several attempts to identify a factorial structure that is universally accepted for the MSLQ have been offered. No clear consensus has been achieved in these efforts, leaving most researchers to rely upon ill-fitting solutions or referring to the separate subscales specifically in their investigations. Composite scores for the Motivation domain items separate from the Self-Regulated Learning domain are often used, but typically preclude strong theoretical tests because the subscales that form the composite scores often represent contradictory orientations that do not combine clearly to create an overall "motivation" score (e.g., Extrinsic and Intrinsic Goal Orientations cannot be added to create a conceptual outcome). The dimensional

variables that were articulated in the multidimensional scaling analyses provided remarkably clear theoretical consistency with the overall intent of the MSLQ, as reported by Pintrich et al. (1991).

The analysis of the motivational variables used in this analysis revealed a clear two-dimensional representation for the five constructs measured in the MSLQ, providing what we interpreted as a Goal Orientation axis and an Expectancy axis. These two broad constructs are encompassed within all leading theories of motivation, and suggest that the MSLQ motivation scales can inform understanding of motivational goal theories (e.g., Shim et al., 2011; Deci and Ryan, 2012) as well as an expectancy-value orientations (Wigfield and Eccles, 2002). It is conceivable to represent the 2-dimensional solution as a simple expectancy-value model, where the Goal Orientation dimension representing value, with high value represented by Intrinsic Goal Orientation. However, we have avoided the potential conflation of value and goal orientation with the limited data available to explore this relationship directly. Furthermore, the MSLQ was not explicitly designed for EVT, and stretching conclusions to fit this model seem unwarranted at this point.

## Curvilinear Relationships and Test Anxiety

Our primary goal in this study was to expand the literature by exploring the potential for better identifying the relationships among test anxiety and motivational and self-regulated learning constructs. Eysenck et al. (2007) provided a clear call for correcting a long-standing failure of cognitive models for test anxiety to account for conditions in which learners with high levels of test anxiety perform at high levels. Similarly, researchers examining moderation effects among cognitive and emotional constructs in academic settings (e.g., Stowell et al., 2008; Owens et al., 2012) have demonstrated that studies limiting their analyses to simple effects often overlook variations due to moderating effects or variations across contexts.

While the data provide clear evidence of curvilinear effects, it's important to clarify that traditional methods employed with this data set would have generated significant values and meaningful results. Simple linear effects were significant, but inferior overall in the reported outcomes. Striking a regression line for the "best fit" on a linear scale would indeed generate a line, but the nuance missed that is seen with curvilinear analyses would have masked the true relationships. We anticipate that examination of curvilinear effects in future studies on test anxiety (and related measures) will provide greater precision in isolating the debilitating and facilitative effects of emotional constructs within the academic arenas.

### Goal Orientation

The significant curvilinear relationship between Goal Orientation and Test Anxiety indicated heightened levels of test anxiety for students who tended to report extreme levels of extrinsic or intrinsic goal orientations. When there were more moderate levels of GO, which indicates a mixed representation for extrinsic and intrinsic goals – as well as a high "task value" orientation in the MDSM – cognitive test anxiety levels were lowest. Compared to recent work with goal orientation that generally indicates that performance goals tend to be overly maladaptive (e.g., Brandmo et al., 2019), these findings demonstrate that a moderate mixture of performance and mastery goals may be more adaptive with respect to test anxiety.

### Expectancy for Success

The significant "inverted U" pattern observed between Expectancy for Success and Cognitive Test Anxiety was reminiscent of the classic Yerkes-Dodson curve (1908). In this case, the curvilinear relationship exposes an intimate relationship between cognitive test anxiety and uncertainty. When learners are able to reliably predict their performance outcomes, the degree of anxiety was suppressed. Overall, this finding is the most significant theoretical contribution to the test anxiety literature, lending confirmatory empirical evidence to multiple theoretical accounts for test anxiety simultaneously by examining the data in this non-linear approach. In addition, it provides an advancement in the explanation of how these various representations may be fostered and lead to sub-optimal performances.

The value of this curvilinear analysis is the isolation on the key issue in the expectancy–test anxiety relationship. Traditional representations examining linear models conclude that high self-efficacy is associated with lower test anxiety. However, the data in this model suggests that relationship may have been misleading. While it is true that higher self-efficacy tends to be related to higher performance – and lower test anxiety – the data in this case suggest that when it comes to test anxiety, low levels of self-efficacy would not necessarily produce high degrees of anxiety. What has been most clear in these analyses is that the critical issue that tends to drive anxiety upward most readily is a sense of uncertainty or low confidence levels in predicting outcomes. In this way, we see a connection with the findings demonstrating that low levels of perceived control or predicted outcomes for forthcoming evaluative events are likely to be associated with increased test anxiety (e.g., Putwain and Aveyard, 2018; Putwain and Prescod, 2018).

### Personal Responsibility

A weak statistically significant effect was identified for the Personal Responsibility dimension, which identifies the degree to which learning behaviors or study skills require independent personal engagement. Cognitive test anxiety increased, then plateaued after reaching a critical level of personal responsibility, indicating that those learners who infrequently endorse engaging in individually driven learning activities or frequently employed externalized learning support activities had the lowest levels of cognitive test anxiety. This finding may demonstrate that socially dependent learning strategies provide an "escape" function that allows release from anxiety, consistent with Stowell et al. (2008) findings.

The plateau effect observed with test anxiety once level of personal responsibility reached a critical level may better explain previous findings related to test anxiety and study strategies.

There has been ample evidence that students with high-test anxiety engage in various study support strategies, but the divergence when compared to low-test anxious learners is in the quality of chosen strategies (Cassady, 2004; Putwain et al., 2016). Students with high levels of test anxiety are known to employ less efficient processing when engaged in cognitive tasks (Eysenck et al., 2007), primarily presumed to be due to an interference with optimal cognitive functioning (Eysenck and Calvo, 1992; Mattarella-Micke et al., 2011). In contexts where time is not pressed (and sufficient cognitive resources can be tapped), it is possible for learners with academic anxieties to overcome these limitations by extending time on task, resulting in satisfactory performance (Cassady and Johnson, 2002; Owens et al., 2012; Wong et al., 2013). However, in most academic settings, time is a factor and inefficiency will impair overall performance. Furthermore, this extended time of engaging in study occurs within a context of heightened anxiety, promoting a cumulative negative effect for overall affect, increasing the risk for experiencing maladaptive outcomes such as depression and anxiety (Cassady et al., 2019).

### Active Learning Engagement

There was no curvilinear pattern observed between cognitive test anxiety and the Active Learning dimensional variable. Rather, the data demonstrated a clear and strong inverse linear relationship, demonstrating that as learners were more likely to endorse active learning behaviors, their degree of test anxiety declined. This pattern is once again consistent with research identifying students with high levels of test anxiety are more likely to engage in passive or avoidant coping strategies (e.g., procrastination; Kalechstein et al., 1989; Zeidner and Matthews, 2005), as well as employing more surface-level strategies and engage in repetitive processing that tend to be less effective in promoting deep understanding and learning (Cassady, 2004). Intervention efforts in this domain are promising, provided positive study strategies (e.g., Dunlosky et al., 2013) can be adopted. Several studies have demonstrated that explicit training efforts with test anxious learners can be effective provided the strategies are within their cognitive skill set, the learners recognize the potential for the coping strategy to be successful, and the learners are able to simultaneously manage the other components of test anxiety during the study activities (Lowe et al., 2008; Mowbray, 2012).

## CONCLUSION

The results of this study continue to refine our understanding of the potential to interrupt the deleterious effects of test anxiety on learners' experiences in academic domains. Specifically, within a framework consistent with the EIP (Cassady and Thomas, 2020), we propose that the results show promise for future work in both identifying and treating academic anxieties with a more fine-grained approach. Classic studies on effective interventions for those with test anxiety often resulted in weak or moderate effects (e.g., Hembree, 1988; von der Embse et al., 2018). However, we believe this was often due to an over-simplified approach to intervention, where a single intervention was applied to all learners who presented with elevated test anxiety. This approach overlooked the variety of test anxiety profiles (e.g., Zeidner and Matthews, 2005), precluding an individual-specific intervention strategy that would likely have greater utility in practical settings.

Using a multiple domain approach to examining challenges faced by specific learners with test anxiety provides greater promise – identifying interventions that will directly support the learner in the domain(s) where they struggle. That is, we advocate for examining learners' perceptions of the events (degree of perceived threat and perceived competence to succeed), reviewing the goal structures that have been adopted for the learning event, and identifying specific coping strategies that support optimal performance in meeting those situation-specific goals. While our results demonstrate trend data suggesting that anxiety will peak in situations where the outcome is uncertain, passive learning strategies are adopted, or polarized goal orientations are adopted, truly effective interventions for individual learners will only be achieved when unique profiles are examined and addressed (see de la Fuente et al., 2019, for related perspectives). We see great promise for individual successes in mitigating negative effects associated with test anxiety when these greater levels of refined attention to unique patterns of motivation and self-regulation strategies are used to specify direct interventions.

While the results of this study clearly supported our initial hypotheses that examining relationships among motivational and self-regulated learning dimensions measured by the MSLQ would be better achieved with attention to curvilinear relationships, there are limitations to the current study that require attention in future studies. First, the conditions of our data collection method in this study precluded specific demographic information from individual participants. We know that future studies will add to this literature with the ability to examine differential patterns based on gender, race, prior academic skills, and other variables in the field that have proven instructive. Second, the current study resulted in a dynamic solution for the dimensional scaling of the MSLQ. Repeated examinations with the MSLQ have revealed several competing explanations for representing the structure of the underlying constructs, and our study adds to that list. However, the dimensional analysis results would need to be re-run in future studies to estimate those representations of the dimensions in the MSLQ, as there is no simple translation generated in this procedure. Continued attention to a dimensional representation of the MSLQ is recommended to provide an alternative solution for representing motivation and self-regulated learning in students. Finally, the population from which this sample was drawn was a predominantly female, Caucasian, and from the Midwestern United States. Continued examination of these constructs in more diverse samples would be important for greater generalization.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available due to IRB restrictions. Requests to access the datasets should be directed to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ball State University Institutional Review Board. The ethics committee waived the requirement of written informed consent for participation.

## AUTHOR CONTRIBUTIONS

JC conceptualized the data collection process, collected the data, and initiated the interpretation of the findings related to the field. WF conceptualized the analytic approach, conducted all analyses, and collaborated on the interpretation of the findings. JC and WF agreed to the order of authorship but also acknowledge the work was a true collaboration and equitable worth of both authors' contributions is asserted.

## ACKNOWLEDGMENTS

This work was support from the Academic Anxiety Resource Center and Research Design Studio at Ball State University was instrumental in moving this work forward.

## REFERENCES

Armstrong, D. A. II, Bakker, R., Carroll, R., Hare, C., Poole, K. T., and Rosenthal, H. (2014). *Analyzing Spatial Models of Choice and Judgment with R*. Boca Raton, FL: CRC Press, Taylor & Francis Group.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychol. Rev.* 84:191. doi: 10.1037/0033-295x.84.2.191

Bandura, A., and Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *J. Pers. Soc. Psychol.* 41, 586–598. doi: 10.1037/0022-3514.41.3.586

Bar-Tal, Y., Raviv, A., and Spitzer, A. (1999). The need and ability to achieve cognitive structuring: individual differences that moderate the effect of stress on information processing. *J. Pers. Soc. Psychol.* 77, 33–51. doi: 10.1037/0022-3514.77.1.33

Bjork, R. A., Dunlosky, J., and Kornell, N. (2013). Self-regulated learning: beliefs, techniques, and illusions. *Ann. Rev. Psychol.* 64, 417–444. doi: 10.1146/annurev-psych-113011-143823

Brady, S. T., Hard, B. M., and Gross, J. J. (2018). Reappraising test anxiety increases academic performance of first-year college students. *J. Educ. Psychol.* 110, 395–406. doi: 10.1037/edu0000219

Brandmo, C., Bråten, I., and Schewe, O. (2019). Social and personal predictors of test anxiety among Norwegian secondary and postsecondary students. *Soc. Psychol. Educ.* 22, 43–61. doi: 10.1007/s11218-018-9461-y

Brdar, I., Rijavec, M., and Loncaric, D. (2006). Goal orientations, coping with school failure and school achievement. *Eur. J. Psychol. Educ.* 21, 53–70. doi: 10.1007/BF03173569

Cassady, J. C. (2001). The stability of undergraduate students' cognitive test anxiety levels. *Pract. Assess. Res. Eval.* 7:20.

Cassady, J. C. (2004). The influence of cognitive test anxiety across the learning-testing cycle. *Learn. Instr.* 14, 569–592. doi: 10.1016/j.learninstruc.2004.09.002

Cassady, J. C. (2010). "Test anxiety: contemporary theories and implications for learning," in *Anxiety in Schools: The Causes, Consequences, and Solutions for Academic Anxieties*, ed. J. C. Cassady (New York, NY: Peter Lang), 5–26.

Cassady, J. C., and Boseck, J. J. (2008). "Educational psychology and emotional intelligence: toward a functional model for emotional information processing in schools," in *Emotional Intelligence: Perspectives of Educational and Positive Psychology*, eds J. C. Cassady and M. A. Eissa (New York, NY: Peter Lang Publishing), 3–24.

Cassady, J. C., and Finch, W. H. (2014). Confirming the factor structure of the Cognitive Test Anxiety Scale: comparing the utility of three solutions. *Educ. Assess. J.* 19, 229–242. doi: 10.1080/10627197.2014.934604

Cassady, J. C., and Finch, W. H. (2015). Using factor mixture modeling to identify dimensions of cognitive test anxiety. *Learn. Individ. Differ.* 41, 14–20. doi: 10.1016/j.lindif.2015.06.002

Cassady, J. C., and Johnson, R. E. (2002). Cognitive test anxiety and academic procrastination. *Contemp. Educ. Psychol.* 27, 270–295.

Cassady, J. C., Pierson, E. E., and Starling, J. M. (2019). Predicting student depression with measures of general and academic anxieties. *Front. Educ.* 4:11. doi: 10.3389/feduc.2019.00011

Cassady, J. C., and Thomas, C. L. (2020). "Academic anxieties and emotional information processing: identification and interventions to support students with affective disorders," in *Handbook of Educational Psychology and Students with Special Needs*, eds A. J. Martin, R. A. Sperling, and K. J. Newton (New York, NY: Routledge).

Cheslock, J. J., and Kroc, R. (2012). "Managing college enrollments," in *The Handbook for Institutional Researchers*, eds R. Howard, B. Knight, and G. McLaughlin (San Francisco, CA: Jossey-Bass), 221–236.

Cho, M. H., and Summers, J. J. (2012). Factor validity of the motivated strategies for learning questionnaire (MSLQ) in asynchronous online learning environments (AOLE). *J. Interact. Learn. Res.* 23, 5–28.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Garzón-Umerenkova, A., Vera, M. M., and Paoloni, P. (2019). Applying the SRL vs. ERL Theory to the Knowledge of Achievement Emotions in Undergraduate University Students. *Front. Psychol.* 10:2070. doi: 10.3389/fpsyg.2019.02070

Deci, E. L., and Ryan, R. M. (2012). "Self-determination theory," in *Handbook of Theories of Social Psychology*, eds P. A. M. Van Lange, A. W. Kruglanski, and E. T. Higgins (Thousand Oaks, CA: Sage Publications Ltd), 416–436. doi: 10.4135/9781446249215.n21

Duckworth, A. L., and Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychol. Sci.* 16, 939–944. doi: 10.1111/j.1467-9280.2005.01641.x

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., and Willingham, D. T. (2013). Improving students' learning with effective learning techniques: promising directions from cognitive and educational psychology. *Psychol. Sci. Public Interest* 14, 4–58. doi: 10.1177/1529100612453266

Durik, A. M., Shechter, O. G., Noh, M., Rozek, C. S., and Harackiewicz, J. M. (2015). What if I can't? Success expectancies moderate the effects of utility value information on situational interest and performance. *Motiv. Emot.* 39, 104–118. doi: 10.1007/s11031-014-9419-0

Eysenck, M. W., and Calvo, M. G. (1992). Anxiety and performance: the processing efficiency theory. *Cogn. Emot.* 6, 409–434. doi: 10.1080/02699939208409696

Eysenck, M. W., Derakshan, N., Santos, R., and Calvo, M. G. (2007). Anxiety and cognitive performance: attentional control theory. *Emotion* 7, 336–353. doi: 10.1037/1528-3542.7.2.336

Gorges, J., and Göke, T. (2015). How do I know what I can do? Anticipating expectancy of success regarding novel academic tasks. *Br. J. Educ. Psychol.* 85, 75–90. doi: 10.1111/bjep.12064

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299. doi: 10.1037/1089-2680.2.3.271

Gross, J. J. (2015). Emotion regulation: current status and future prospects. *Psychol. Inq.* 26, 1–15.

Hastie, T. J., and Tibshirani, R. J. (1990). *Generalized Additive Models*. Orange: Chapman & Hall/CRC.

Heller, M. L., and Cassady, J. C. (2017). The impact of perceived barriers, academic anxiety and resource management strategies on achievement in first year community college students. *J. First Year Exp. Stud. Trans.* 29, 9–32.

Hembree, R. (1988). Correlates, causes, effects and treatment of test anxiety. *Rev. Educ. Res.* 58, 47–77. doi: 10.3102/00346543058001047

Kalechstein, P., Hocevar, D., Zimmer, J. W., and Kalechstein, M. (1989). "Procrastination over test preparation and test anxiety," in *Advances in Test*

*Anxiety Research*, Vol. 6, eds R. Schwarzer, H. M. van der Ploeg, and G. D. Spielberger (Lisse: 63–76).

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., and Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Arch. Gen. Psychiatry* 62, 617–627. doi: 10.1001/archpsyc.62.6.617

Kitsantas, A., and Zimmerman, B. J. (2009). College students' homework and academic achievement: the mediating role of self-regulatory beliefs. *Metacogn. Learn.* 4, 97–110. doi: 10.1007/s11409-008-9028-y

Lazarus, R., and Folkman, S. (1987). Transactional theory and research on emotions and coping. *Eur. J. Pers.* 1, 141–169. doi: 10.1002/per.2410010304

Liebert, R. M., and Morris, L. W. (1967). Cognitive and emotional components of test anxiety: a distinction and some initial data. *Psychol. Rep.* 20, 975–978. doi: 10.1108/eb026408

Lowe, P., Lee, S., Witteburg, K., Prichard, K., Luhr, M., Cullinan, C., et al. (2008). The test anxiety inventory for children and adolescents (TAICA): evaluation of the psychometric properties of a new multidimentional measure of test anxiety among elementary and secondary school students. *J. Psychometr. Assess.* 26, 215–230. doi: 10.1177/0734282907303760

Mattarella-Micke, A., Mateo, J., Kozak, M. N., Foster, K., and Beilock, S. L. (2011). Choke or thrive? The relation between salivary cortisol and math performance depends on individual differences in working memory and math anxiety. *Emotion* 11, 1000–1005. doi: 10.1037/a0023224

Mayer, R. E. (2014). "Cognitive theory of multimedia learning," in *Cambridge Handbooks in Psychology. The Cambridge Handbook of Multimedia Learning*, ed. R. E. Mayer (Cambridge: Cambridge University Press), 43–71. doi: 10.1017/CBO9781139547369.005

Mowbray, T. (2012). Working memory, test anxiety and effective interventions: a review. *Aust. Educ. Dev. Psychol.* 29, 141–156. doi: 10.1017/edp.2012.16

Naveh-Benjamin, M., McKeachie, W. J., and Lin, Y. (1987). Two types of test-anxious students: support for an information processing model. *J. Educ. Psychol.* 79, 131–136. doi: 10.1037/0022-0663.79.2.131

O'Carroll, P. J., and Fisher, P. (2013). Metacognitions, worry and attentional control in predicting OSCE performance test anxiety. *Med. Educ.* 47, 562–568. doi: 10.1111/medu.12125

Owens, M., Stevenson, J., Hadwin, J. A., and Norgate, R. (2012). When does anxiety help or hinder cognitive test performance? The role of working memory capacity. *Br. J. Psychol.* 105, 92–101. doi: 10.1111/bjop.12009

Pekrun, R. (2006). The control-value theory of achievement emotions: assumptions, corollaries, and implications for educational research and practice. *Educ. Psychol. Rev.* 18, 315–341. doi: 10.1007/s10648-006-9029-9

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educ. Psychol. Rev.* 16, 385–407. doi: 10.1007/s10648-004-0006-x

Pintrich, P. R., Smith, D. A. F., Garcia, T. G., and McKeachie, W. J. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching.

Putwain, D. W. (2007). Test anxiety in UK schoolchildren: prevalence and demographic patterns. *Br. J. Educ. Psychol.* 77, 579–593. doi: 10.1348/000709906X161704

Putwain, D. W. (2019). An examination of the self-referent executive processing model of test anxiety: control, emotional regulation, self-handicapping, and examination performance. *Eur. J. Psychol. Educ.* 34, 341–358. doi: 10.1007/s10212-018-0383-z

Putwain, D. W., and Aveyard, B. (2018). Is perceived control a critical factor in understanding the negative relationship between cognitive test anxiety and examination performance? *Sch. Psychol. Q.* 33, 65–74. doi: 10.1037/spq0000183

Putwain, D. W., Daly, T., Chamberlain, S., and Saddredini, S. (2016). "Sink or swim": buoyancy and coping in the test anxiety and academic performance relationship. *Educ. Psychol.* 36, 1807–1825. doi: 10.1080/01443410.2015.1066493

Putwain, D. W., and Prescod, M. (2018). Is reducing uncertain control the key to successful test anxiety for Secondary school students? Findings from a randomized control trial. *Sch. Psychol. Q.* 33, 283–292. doi: 10.1037/spq0000228

R Core Team (2019). *R: A Language and Environment for Statistical Computing*. Vienna: R Foundation for Statistical Computing.

Raffety, B. D., Smith, R. E., and Ptacek, J. T. (1997). Facilitating and debilitating trait anxiety, situational anxiety, and coping with an anticipated stressor: a process analysis. *J. Pers. Soc. Psychol.* 72, 892–906. doi: 10.1037/0022-3514.72.4.892

Rojas, J. S., and Furlan, L. A. (2017). Achievement emotions and achievement goals in support of the convergent, divergent, and criterion validity of the Spanish-Cognitive Test Anxiety Scale. *Int. J. Educ. Psychol.* 6, 67–92.

Sarason, I. G. (1986). "Test anxiety, worry, and cognitive interference," in *Self-Related Cognitions in Anxiety and Motivation*, ed. R. Schwarzer (Hillsdale, NJ: Lawrence Erlbaum), 19–34.

Schunk, D. H. (1990). Goal setting and self-efficacy during self-regulated learning. *Educ. Psychol.* 26, 207–231.

Schunk, D. H., and Zimmerman, B. J. (2003). "Self-regulation and learning," in *Handbook of Psychology*, Vol. 7, eds W. M. Reynolds and G. E. Miller (Hoboken, NJ: Wiley), 59–78.

Shim, S. S., Ryan, A. M., and Cassady, J. C. (2011). Self-esteem change during the first year of college: the role of achievement goals. *Educ. Psychol.* 32, 149–167. doi: 10.1080/01443410.2011.627837

Stowell, J. R., Tumminaro, T., and Attarwala, M. (2008). Moderating effects of coping on the relationship between test anxiety and negative mood. *Stress Health* 24, 313–324. doi: 10.1002/smi.1186

Thomas, C. L., Cassady, J. C., and Finch, W. H. (2017a). Identifying severity standards on the cognitive test anxiety scale using Latent class and cluster analysis. *J. Psychoeduc. Assess.* 36, 492–508. doi: 10.1177/0734282916686004

Thomas, C. L., Cassady, J. C., and Heller, M. L. (2017b). The influence of emotional intelligence, cognitive test anxiety, and coping strategies on undergraduate academic performance. *Learn. Individ. Differ.* 55, 40–48. doi: 10.1016/j.lindif.2017.03.001

von der Embse, N. P., Jester, D., Roy, D., and Post, J. (2018). Test anxiety effects, predictors, and correlates: a 30-year meta-analytic review. *J. Affect. Disord.* 227, 483–493. doi: 10.1016/j.jad.2017.11.048

Weiner, B. (2018). The legacy of an attribution approach to motivation and emotion: a no-crisis zone. *Motiv. Sci.* 4, 4–14. doi: 10.1037/mot0000082

Wells, A., and Matthews, G. (1996). Modelling cognition in emotional disorder: The S-REF model. *Behav. Res. Ther.* 34, 881–888. doi: 10.1016/s0005-7967(96)00050-2

Wigfield, A., and Eccles, J. S. (2002). "The development of competence beliefs, expectancies for success, and achievement values from childhood through adolescence," in *A Volume in the Educational Psychology Series. Development of Achievement Motivation*, eds A. Wigfield and J. S. Eccles (Cambridge, MA: Academic Press), 91–120. doi: 10.1016/B978-012750053-9/50006-1

Wong, I., Mahar, D., Titchener, K., and Freeman, J. (2013). The impact of anxiety on processing efficiency: implications for the Attentional Control Theory. *Open Behav. Sci. J.* 7, 7–15. doi: 10.2174/1874230001307010007

Yerkes, R. M., and Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *J. Comp. Neurol. Psychol.* 18, 459–482. doi: 10.1002/cne.920180503

Zeidner, M., and Matthews, G. (2005). "Evaluation anxiety," in *Handbook of Competence and Motivation*, eds A. J. Elliot and C. S. Dweck (London: Guildford Press), 141–163.

Zeidner, M., and Saklofske, D. (1996). "Adaptive and maladaptive coping," in *Handbook of Coping: Theory, Research, Applications*, eds M. Zeidner and N. S. Endler (Hoboken, NJ: John Wiley & Sons), 505–531.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: an overview. *Theor. Pract.* 41, 64–72. doi: 10.1207/s15430421tip4102_2

Zohar, D. (1998). An additive model of test anxiety: role of exam-specific expectations. *J. Educ. Psychol.* 90, 330–340. doi: 10.1037/0022-0663.90.2.330

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Education

ORIGINAL RESEARCH
published: 24 June 2020
doi: 10.3389/feduc.2020.00094

# Preventing Stress Among Undergraduate Learners: The Importance of Emotional Intelligence, Resilience, and Emotion Regulation

*Christopher Thomas* and Staci Zolkoski*

*School of Education, University of Texas at Tyler, Tyler, TX, United States*

In the current investigation, we examined the association among emotional intelligence, emotional regulation tendencies, resilience, and perceived stress within a sample of undergraduate students. Participants ($N$ = 277, 71% Female, 55% White) completed the Brief Emotional Intelligence Scale, Emotion Regulation Questionnaire, Brief Resilience Scale, and Perceived Stress Scale. Using path analysis techniques, we demonstrated that resilience was a negative predictor of perceived stress. Additionally, our results indicated that the use of cognitive reappraisal exerted an indirect influence on perceived stress through resilience. Finally, the current investigation provided evidence that emotional intelligence exerts an indirect influence on stress through both cognitive reappraisal and resilience. We believe the results of the current understanding expand our understanding of the determinants of effective emotional information processing and have implications for intervention efforts designed to reduce perceived stress within university-based samples.

**Keywords: perceived stress, emotional intellegence, resilience, emotion regulation, path analysis**

OPEN ACCESS

***Edited by:***
*Jesus de la Fuente,*
*University of Navarra, Spain*

***Reviewed by:***
*Fareed Bordbar,*
*University of Alabama, United States*
*Eva M. Romera,*
*Universidad de Córdoba, Spain*

****Correspondence:***
*Christopher Thomas*
*cthomas@uttyler.edu*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Education*

***Received:*** *28 October 2019*
***Accepted:*** *25 May 2020*
***Published:*** *24 June 2020*

***Citation:***
*Thomas C and Zolkoski S (2020) Preventing Stress Among Undergraduate Learners: The Importance of Emotional Intelligence, Resilience, and Emotion Regulation. Front. Educ. 5:94. doi: 10.3389/feduc.2020.00094*

## INTRODUCTION

There is little disagreement that individuals are often required to cope with feelings of stress following maladaptive appraisals of internal and external stimuli (Lazarus and Folkman, 1984; Folkman and Moskowitz, 2004). The prevailing view of coping views stress as a specific misbalance between an individuals' assessment of situational demands and the resources—both external and internal—available to manage the demands (Hodzic et al., 2016). Stated another way, stress occurs when individuals appraise situations as having the potential to overload coping resources and interfere with the attainment of goals of high personal importance (Lazarus and Folkman, 1984). Generally speaking, exposure to stress is associated with various negative outcomes including increased anxiety and depression, post-traumatic stress disorder, and decreased well-being (Troy and Mauss, 2011). More relevant to the current investigation is evidence suggesting stress shares a strong negative association with important academic outcomes including overall academic achievement and persistence (e.g., Hartley, 2011; Beiter et al., 2015). Interestingly, a review of the available literature highlights that not all university students who must work to navigate prolonged periods of stress experience negative outcomes. Instead, some empirical research indicates that a subset of university students experience positive academic outcomes despite considerable adversity in their lives—or demonstrate resilience despite exposure to stressful events (e.g., Luthar et al., 2000; DeRosier et al., 2013).

## RESILIENCE, STRESS, AND HIGHER EDUCATION

Individuals are considered to be resilient when positive outcomes occur despite challenges they face (Masten, 2011). Dominant theoretical frameworks describing the determinants of resilience emphasize the importance of risk and protective factors in the successful management of environmental stressors (Alvord and Grados, 2005; Benzies and Mychasiuk, 2009; Martinez-Torteya et al., 2009). Risk factors can include biological (e.g., congenital defects) or environmental [e.g., poverty, education level of parents; (Zolkoski and Bullock, 2012)] factors with the potential to interfere with optimal functioning. It is important to note that individuals encounter "risk factors" throughout life, but the severity of risk is the result of a complex interplay between personal, environmental, and behavioral occurring at a particular time and place. Moreover, available evidence highlights the influence of risk factors is additive in nature such that the accumulation of risk is associated with poor outcomes across the developmental trajectory (e.g., mental health disorders, school dropout; Brooks, 2006). Protective factors are conceptualized within the literature as factors altering a person's response to environmental risks commonly resulting in the experience of negative outcomes (Ahern and Norris, 2011). Critically, a large body of empirical evidence has demonstrated various individual-level characteristics (e.g., self-regulation), family conditions (e.g., support), and community supports (e.g., relevant support services; Benzies and Mychasiuk, 2009) can reduce the impact of risk factors allowing individuals to achieve success and thrive when confronted with adverse conditions.

Within the field of higher education, one of the most prominent risk factors contributing to negative life outcomes is the prolonged experience of elevated levels of stress (Beiter et al., 2015). For instance, available evidence suggests that university students experiencing high-stress report an increased incidence of problematic levels of anxiety and depression, significant impairments in academic functioning, and lower likelihood of degree completion (Felsten and Wilcox, 1992; Shields, 2001; Ahern and Norris, 2011; Hartley, 2011; Beiter et al., 2015). However, research in the domain of higher education has identified that students who possess certain individual differences are characterized as "resilient" and are able to manage everyday academic stressors. Although investigations have identified numerous mechanisms contributing to resilience in children (e.g., Werner, 1993) and at-risk adolescents (e.g., Zolkoski et al., 2016), much less is known about factors that promote resilience and protect against the experience of stress among college students (Ahern and Norris, 2011).

## EMOTIONAL INTELLIGENCE, RESILIENCE, AND STRESS

The concept of emotional intelligence has guided numerous investigations over the past 25 years. The outcomes of these empirical inquiries have resulted in the formulation of distinct theoretical perspectives detailing mechanisms that contribute to variation in the ability to process emotional information (i.e., trait models Petrides et al., 2016; ability models; Mayer and Salovey, 1997). Although numerous theoretical orientations exist, we endorse an ability-based orientation and suggest that emotional intelligence consists of a constellation of abilities allowing individuals to process and use emotional-laden information in a manner that facilitates effective problem-solving (Mayer and Salovey, 1997; Mayer et al., 2008, 2016). Logically, the ability to appraise, process, and utilize emotional information is associated with numerous adaptive outcomes among students within higher education settings. For instance, a review of the literature highlights that learners with higher levels of emotional intelligence often experience increased psychological well-being (Salami, 2011), persistence and retention (Qualter et al., 2009), and academic achievement (MacCann et al., 2011; Fernandez et al., 2012). Most important to the current investigation; however, is a large body of literature suggesting emotional intelligence influences individuals' responses to stress and contributes to resilience when confronted with adverse life events. Given that stress response fundamentally involves the processing of emotional information, investigations have demonstrated the ability to implement executive control processes, supporting emotion interpretation and regulation when confronted with stress supports resilience (Armstrong et al., 2011; Schneider et al., 2013). The association between emotional intelligence and resilience is established in the literature; however, the causal pathway through which emotional intelligence supports resilience is not well understood. However, recent work has provided preliminary evidence suggesting emotion regulation preferences—which are often fundamentally tied to overall levels of emotional intelligence –often have a dramatic influence on resilience. As suggested above, the term emotional intelligence refers to a person's ability to monitor his/her own and other's feelings, to differentiate between them, and use the information to guide thoughts and actions (Salovey and Mayer, 1990). On the other hand, emotional regulation refers to a person's ability to influence which emotions they have, when they have them, and how the emotions are expressed (Gross, 1998). Emotional intelligence appears to account for variability in why some individuals are able to regulate their emotions (Mikolajczak et al., 2008). Logically, the use of adaptive emotion regulation strategies—such as cognitive reappraisal—has been linked to the ability to better manage stressful situations (Carlson et al., 2012). Although the impact of emotional intelligence, emotion regulation, and resilience on perceived stress is well-established, few empirical investigations have examined the collective influence of these variables on the stress response of undergraduate students.

## THE CURRENT STUDY

Undergraduate students are routinely confronted with situations both within and outside traditional learning environments that contribute to the experience of prolonged stress. It is critical that empirical investigations attempt to identify factors that can protect learners from stress given that students who experience

an extended period of stress often are at an increased risk for academic underperformance and emotional distress (Ahern and Norris, 2011; Beiter et al., 2015). Therefore, the current study was designed to systematically examine how emotional intelligence, emotional regulation tendencies, and resilience influence stress perceptions among a sample of undergraduate students.

## HYPOTHESES

**H1:** Prior investigations have demonstrated that "resilient" learners are better able to manage common academic stressors (e.g., Wilks and Spivey, 2010; Ahern and Norris, 2011). Therefore, it is predicted that resilience will be negatively associated with perceived stress among undergraduate learners.

**H2:** Recent work in the domain of emotion regulation has suggested that the use of effective emotion regulation strategies (i.e., cognitive reappraisal) supports resilience (Armstrong et al., 2011; Schneider et al., 2013). As such, it is predicted that the use of cognitive reappraisal will be positively associated with resilience.

**H3:** Emotional intelligence has been identified as an individual difference variable that supports adaptive emotional information processing and influences attempts to alter emotional experience (MacCann et al., 2020). Specifically, the available literature provides converging evidence that emotional intelligence is associated with the increased use of adaptive emotional regulation strategies and decreased reliance on maladaptive emotion regulation strategies. Therefore, it is predicted that emotional intelligence will be positively associated with the use of cognitive reappraisal and will be negatively associated with the use of suppression.

**H4:** Relatively little is known about the combined influence of emotional intelligence, emotion regulation, and resilience on perceived stress. However, dominant theoretical orientations highlight the influence of dispositional constructs (e.g., cognitive-emotional processing abilities) on "downstream" processes (i.e., emotion regulation) that are fundamentally tied to stress and academic outcomes (Matthews et al., 2006). Therefore, it is predicted that the relationship between emotional intelligence, cognitive reappraisal, suppression, and perceived stress will be fully mediated by resilience.

## METHOD

### Participants

Participants ($N$ = 277, 71% Female, 55% White) were undergraduate students attending a small regional university located in the Southern United States. A portion of the participants were recruited through a standard undergraduate research pool and received partial course credit in exchange for their participation in the current study. The remaining participants were recruited through campus-wide solicitation and were entered into a drawing for a $20 Amazon gift card following the completion of the experimental materials. Of those participants who opened the Qualtrics link and viewed the informed consent document, four chose not to complete the study materials. A series of independent samples $t$-tests—with the Bonferroni correction—were used to determine if there were significant differences in the constructs of interest between participants recruited using the two methods. These analyses indicated that participants did not differ in terms of emotional intelligence [$t_{(242)} = -0.16, p > 0.05$], resilience [$t_{(247)} = -0.31, p > 0.05$], perceived stress [$t_{(242)} = -0.18, p > 0.05$], use of suppression [$t_{(243)} = 0.01, p > 0.05$], or use of cognitive reappraisal [$t_{(247)} = -0.81, p > 0.05$].

### Measures

#### Emotional Intelligence

We measured undergraduate students' emotional intelligence using the Brief Emotional Intelligence Scale (BEIS; Davies et al., 2010). The BEIS is a 10-item instrument designed to assess individuals' ability to appraise internal and external emotional cues, regulate emotional states, and use emotional information to solve problems (Davies et al., 2010). Participants reported their level of agreement with each item on the instrument using a 5-point Likert Tyler scale *(1 = Strongly disagree, 5 = strongly agree).* Sample items include: "I know why my emotions change," "I have control over my emotions." Prior investigations have provided evidence of the factorial validity of the instrument when applied to undergraduate samples, and the BEIS exhibited acceptable internal consistency in the current examination (Cronbach's $\alpha = 0.81$, McDonald's $\omega = 0.82$).

#### Emotion Regulation

In the current study, participants' emotion regulation capabilities were assessed using the Emotion Regulation Questionnaire (Gross and John, 2003). The ERQ is a 10-item instrument designed to measure the extent to which individuals rely on cognitive reappraisal and suppression techniques to modulate their emotional experiences. Within process models of emotion regulation, cognitive reappraisal refers to efforts to manage emotional experience by altering ones' interpretation of internal and external cues while suppression refers to efforts to inhibit behavioral responses that follow from specific emotion states (Gross, 2015). Participants reported their level of agreement with each of the presented items using a 7-point Likert-type scale (*1 = strongly disagree, 7 = strongly agree*). Prior research has established the factorial and convergent validity of the instrument when applied to university students. Further, reliability analyses indicated that the reappraisal (Cronbach's $\alpha = 0.84$, McDonald's $\omega = 0.85$) and suppression (Cronbach's $\alpha = 0.78$, McDonald's $\omega = 0.78$) subscales of the ERQ demonstrated acceptable levels of internal consistency in the current investigation.

#### Resilience

Undergraduate students' resilience or ability to recover from stressful life events was assessed using the 6-item Brief Resilience Scale (BRS; Smith et al., 2008). Participants reported their level of agreement with each of the presented statements using a 5-point Likert-type scale (*1 = strongly disagree, 5 = strongly agree*). Sample items include: "I tend to bounce back quickly after hard times," "It does take me long to recover from a stressful event." Results of a reliability analysis indicated that

the BRS demonstrated acceptable levels of internal consistency when applied to our university sample (Cronbach's $\alpha = 0.84$, McDonald's $\omega = 0.84$).

### Perceived Stress

We assessed undergraduate students' perceptions of life stress using the 10-item Perceived Stress Scale (PSS; Cohen et al., 1983). Participants indicated how often they have experienced the situations described in the items within the last month using a 5-point Likert-type scale (*0 = Never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often*). Sample PSS items include: "In the last month, how often have you been upset because of something that happened unexpectedly?," "In the last month, how often have you felt that you were on top of things?" The PSS was shown to demonstrate acceptable levels of internal consistency in the current examination (Cronbach's $\alpha = 0.82$, McDonald's $\omega = 0.81$).

## Procedure

All materials were completed using the Qualtrics online survey management platform. Participants could choose to complete the experimental materials at a time and location of their choosing, but the entire battery of instruments was required to be completed in a single session. The presentation of the questionnaires was counterbalanced to eliminate the potential for order effects. Additionally, all participants provided informed consent before completing the experimental materials. The University of Texas at Tyler Institutional Review Board approved the study materials and procedure.

## Analytic Strategy

The association among emotional intelligence, emotion regulation, resilience, and perceived stress was investigated through the estimation of an a priori path analysis model. We assumed the influence of emotional intelligence, suppression, and reappraisal on perceived stress was fully mediated by resilience. A visual representation of the path analysis model is presented in **Figure 1**.

The specification of this model was guided by research suggesting resilience is a mediator between environmental and personal characteristics and stress related outcomes (e.g., DeRosier et al., 2013; Maidaniuc-Chirilă, 2015; Crane and Searle, 2016). The path analysis model was estimated using Diagonally Weighted Least Squares estimation. Our decision to use this robust alternative was guided by prior research suggesting Diagonally Weighted Least Squares is robust to issues with normality and as a result provides more accurate parameter estimates compared to traditional Maximum Likelihood estimation (Mîndrila, 2010). We determined the appropriateness of the fully and partially mediated models through the examination of model fit indices including the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), Comparative Fit Index (CFI; Bentler, 1990), Tucker-Lewis Index (TLI; Tucker and Lewis, 1973), and Standardized Root Mean Square Residual (SRMR). Consistent with best practices, a good fitting path analysis model was indicated by CFI $\geq 0.95$, TLI $\geq 0.95$, RMSEA $\leq 0.06$, and SRMR $\leq 0.08$ (Hu and Bentler, 1999).

# RESULTS

## Descriptive Statistics and Correlational Analyses

Review of our correlational analyses highlights several interesting patterns. For instance, our results revealed emotional intelligence shared a positive association with both reappraisal ($r = 0.33$, $p < 0.05$) and resilience ($r = 0.30$, $p < 0.05$). Further, our findings demonstrated that the use of reappraisal was associated with increased resilience ($r = 0.35$, $p < 0.05$) and reduced perceived stress ($r = -0.25$, $p < 0.05$). Correlational results also indicated that resilience shared a strong association with perceived stress ($r = -0.57$, $p < 0.05$) such that increased ability to bounce back from sources of stress was associated with reduced perceived stress. Notably, our results suggested there were not significant associations between emotional intelligence and suppression, emotional intelligence and perceived stress, suppression and

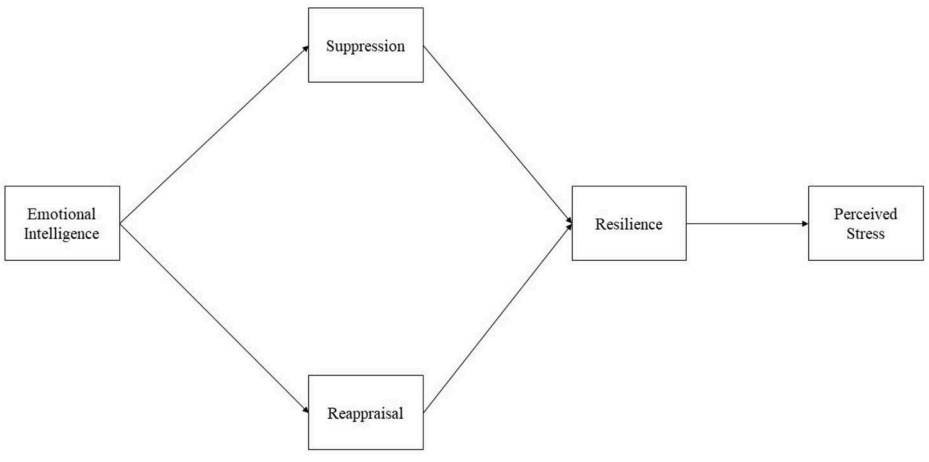


**FIGURE 1 |** Overview of the fully mediated a priori path model.

**TABLE 1 |** Correlation coefficients for emotional intelligence, reappraisal, suppression, resilience, and perceived stress.

| Variable | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 - Emotional intelligence | 1 | - | - | - | - |
| 2 - Reappraisal | 0.33* | 1 | - | - | - |
| 3 - Suppression | −0.06 | 0.01 | 1 | - | - |
| 4 - Resilience | 0.30* | 0.35* | 0.10 | 1 | - |
| 5 - Perceived Stress | −0.10 | −0.25* | 0.02 | −0.57* | 1 |

*$p < 0.05$.

**TABLE 2 |** Descriptive statistics for emotional intelligence, reappraisal, suppression, resilience, and perceived stress.

| Variable | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|
| Emotional intelligence | 3.94 | 0.59 | −1.04 | 3.18 |
| Reappraisal | 5.04 | 1.16 | −0.35 | 0.00 |
| Suppression | 3.99 | 1.39 | −0.19 | −0.30 |
| Resilience | 3.34 | 0.76 | 0.02 | −0.03 |
| Perceived stress | 22.25 | 5.65 | −0.22 | −0.17 |

resilience, and suppression and perceived stress. Correlational coefficients are presented in **Table 1**.

Following the correlational analysis, we reviewed descriptive information for each of the constructs of interest to ensure there were no issues with the potential to bias the results of the primary analysis. Specifically, we reviewed skewness and kurtosis values to determine if the data were approximately normally distributed as certain latent variable modeling techniques are not robust to the incorporation of variables that violate the assumption of normality (Kline, 2015). Our review indicated that skewness and kurtosis values for the reappraisal, suppression, resilience, and perceived stress constructs fell within acceptable limits. However, the emotional intelligence variable was found to demonstrate a high level of skewness and a high level of kurtosis—suggesting emotional intelligence scores were not normally distributed. Descriptive information for the variables of interest in presented in **Table 2**.

### Path Analysis

The path analysis results indicated that the a priori path analysis model provided an excellent fit to the observed data, CFI = 0.99, TLI = 0.98, RMSEA = 0.03 [0.00, 0.10], SRMR = 0.04. Our review of the standardized path coefficients for the fully mediated a priori model indicated that increases in students' level of resilience was associated (ß = −0.57, $p < 0.05$) with reductions in perceived stress. Further, our results indicated that the increased use of reappraisal techniques (ß = 0.40, $p < 0.05$) was associated with increased resilience. Examination of indirect effects indicated reappraisal (ß = −0.23, $p < 0.05$) influenced perceived stress through resilience. Perhaps most notability, our results indicated that emotional intelligence exerted a small—but statistically significant—influence on undergraduates' perceptions of stress that was mediated by both reappraisal and resilience (ß = −0.08, $p < 0.05$). A visual representation of the final path analysis model is presented in **Figure 2**.

## DISCUSSION

The current study investigated the influence of emotional intelligence, emotion regulation preferences and resilience on perceived stress. In support of H2, the results of our study indicated that the use of cognitive reappraisal techniques was associated with increased resilience within a group of university learners. This pattern replicates past work noting that the ability to alter ones' interpretation of internal and environmental cues in a manner that supports the down-regulation of negative affective states promotes resilience to adverse events (Troy and Mauss, 2011; Carlson et al., 2012). From a process-orientated perspective of stress and coping, the current work supports the well-established notion that the ability to alter the meaning of situational cues often contributes to adaptive responses to stress (Gross, 1998; Folkman and Moskowitz, 2000, 2004; Memedovic et al., 2010)—a facilitative influence identified in the protective factor model of resilience (Steinhardt and Dolbier, 2008; Zolkoski and Bullock, 2012).

In support of our H1, we found that levels of resilience shared a negative association with perceived stress. This finding is consistent with prior literature noting that "resilient" individuals are often better able to manage environmental stressors. Further, and in partial support of our H3, the results indicated that participants high in emotional intelligence were more likely to use cognitive reappraisal during attempts to regulate their emotions. This finding is consistent with a large body of literature noting emotional intelligence supports the implementation of adaptive coping responses (MacCann et al., 2011, 2020). Interestingly, our results demonstrated that levels of emotional intelligence were not associated with the use of suppression-focused strategies during emotion modulation efforts. That finding is largely inconsistent with past work noting that emotional intelligence often reduces the use of maladaptive coping responses—such as suppression (Zeidner and Matthews, 2018). Although these findings are inconsistent with our predictions, recent work has identified a host of individual difference factors that moderate the relationship between emotional intelligence and emotion regulation efforts. For instance, Nozaki (2018) found that levels of emotional intelligence was predictive of suppression in a group of European Americans. However, this association was not detected in a group of Japanese individuals highlighting the importance of culture in emotion regulation efforts. Therefore, it is possible that we did not account for variables with the potential to moderate the association among study constructs.

Further, the results of the current investigation highlight that emotional intelligence contributes indirectly to lower perceived stress through its influence on the use of cognitive reappraisal techniques and resilience. This finding supports our H4 and the broad expectation that emotional intelligence facilitates the use of effective emotion regulation practices (Mikolajczak et al., 2008) and the ability to recover from sources of environmental

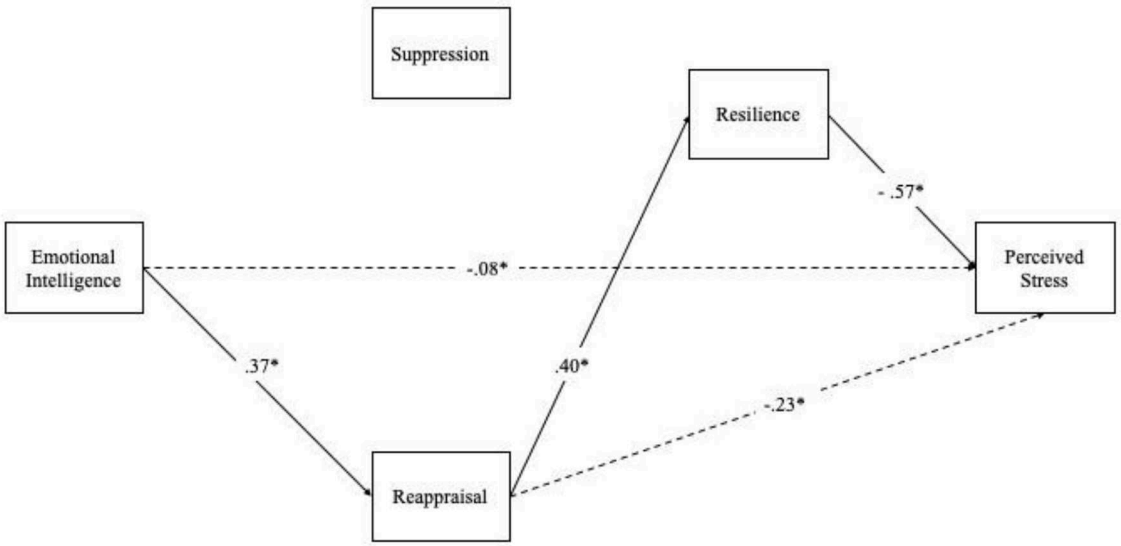


**FIGURE 2 |** Overview of the fully mediated path model. * < 0.05; only significant paths are shown; dashed lines indicate indirect effect.

stress (Armstrong et al., 2011). But more importantly, we believe this finding further reinforces key propositions of theoretical orientations emphasizing the cascading influence of emotional intelligence on mediating processes contributing directly to individuals' responses to stress (Matthews et al., 2006; Joseph and Newman, 2010). In their articulation of the Emotional Information Processing framework, Cassady and Boseck (2008) highlight effective emotion regulation requires the implementation of specific competencies that support the interpretation of internal and external cues, the articulation of goals, and the ability to implement strategies with the potential to support goal attainment. Logically, the Emotional Information Processing framework suggests that goal articulation and strategy implementation is more effective when learners are able to effectively appraise their emotional states and evaluate the availability of coping resources—a key component of emotional intelligence identified within ability perspectives of the emotional intelligence construct (Mayer and Salovey, 1997; Mayer et al., 2016). Therefore, we believe these findings expanding our understanding of the factors that protect students from the debilitating effects of stress by providing a more nuanced understanding of how emotional intelligence contributes to positive emotional outcomes. Further, we believe our study further solidifies the importance of adopting a multivariate approach in educational research as the impact of key constructs (such as emotional intelligence) can only be attained by considering the influence of numerous factors working in unison to impact student performance.

## Practical Implications

Importantly, we believe the results of the current investigation have important implications for those interested in designing interventions with the explicit goal of enhancing resilience and lessening the impact of perceived stress on undergraduate students. Returning to the Emotional Information Processing framework detailed above, the effectiveness of emotional regulation efforts is fundamentally tied to the content of the learners' existing knowledge base. That is, learners who possess a repertoire of effective emotional regulation strategies and an understanding of when to implement appropriate regulation approaches are often more able to respond in an adaptive manner when confronted with sources of stress. Given evidence suggesting self and emotional regulation strategies can be taught (Bandura, 2005; Boyle et al., 2017; Wimmer et al., 2019), we believe intervention efforts should incorporate explicit training (e.g., direct instruction, modeling of how to respond to emotional stimuli) to help learners accumulate knowledge of effective coping and emotion regulation strategies. Although accumulated knowledge certainly plays an important role in emotion regulation, it is not sufficient to ensure learners will engage with emotional information in an appropriate manner (Hodzic et al., 2018). Therefore, we encourage educators and other practitioners to incorporate structured opportunities to practice modeled strategies to support the transfer of accumulated knowledge regarding effective emotional information processing to new situations.

## Limitations

We believe the current study possessed several limitations needing to be addressed. First, the primary constructs of interest in the current investigation were measured solely using self-report instruments. Given that self-report measures rely on individuals' subjective evaluation and are subject to bias, it is possible we did not collect accurate estimates of emotional intelligence, emotional regulation, resilience, and perceived stress. We believe future work could overcome this potential limitation through the use of ability-focused measures (such as the Mayer-Salovey-Caruso Emotional Intelligence Test; Mayer

et al., 2002, 2003) or experiential sampling to identify emotion regulation preferences over an extended period of time. Further, it is important to note that the sample was recruited from a single institution in the Southern United States and is limited in terms of gender and ethnic diversity. Therefore, it is not clear how well the results of the current investigation will generalize to other contexts. Finally, it is important to note that we utilized a cross-sectional design in this investigation which limits our ability to make statements regarding causality. Future work could overcome this limitation through the use of longitudinal data that would better allow researchers to investigate the causal relations among emotional intelligence, emotion regulation, resilience, and perceived stress.

## CONCLUSION

Available evidence highlights undergraduate students often report experiencing periods of time that are characterized by high levels of perceived stress. The continued experience of stress has been shown to contribute to a variety of negative outcomes that interfere with optimal academic performance (Shields, 2001; Beiter et al., 2015). However, the association between perceived stress and negative academic outcomes is not universal—suggesting some learners possess factors that protect them from the debilitative influence of stress. As such, we developed the current study to investigate the combined influence of emotional intelligence, emotional regulation, and resilience on perceived stress. Our results indicate that emotional intelligence and the use of reappraisal contribute to reductions in perceived stress through their influence on resilience. We believe our results highlight the importance of fostering resilience in undergraduate students and suggest resilience-based interventions should focus on increasing the use of cognitive reappraisal and fostering learners' ability to use emotional information processing capabilities.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The University of Texas at Tyler Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

## REFERENCES


Ahern, N. R., and Norris, A. E. (2011). Examining factors that increase and decrease stress in adolescent community college students. *J. Pediatr. Nurs.* 26, 530–540. doi: 10.1016/j.pedn.2010.07.011

Alvord, M. K., and Grados, J. J. (2005). Enhancing resilience in children: a proactive approach. *Prof. Psychol. Res. Pract.* 36, 238–245. doi: 10.1037/0735-7028.36.3.238

Armstrong, A. R., Galligan, R. F., and Critchley, C. R. (2011). Emotional intelligence and psychological resilience to negative life events. *Pers. Individ. Dif.* 51, 331–336. doi: 10.1016/j.paid.2011.03.025

Bandura, A. (2005). "The evolution of social cognitive theory." in *Great Minds in Management*, eds K. G. Smith and M. A. Hitt (Oxford: University Press), 9–35.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi: 10.1016/j.jad.2014.10.054

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol. Bull.* 107, 238. doi: 10.1037/0033-2909.107.2.238

Benzies, K., and Mychasiuk, R. (2009). Fostering family resiliency: a review of the key protective factors. *Child Fam. Soc. Work* 14, 103–114. doi: 10.1111/j.1365-2206.2008.00586.x

Boyle, C. C., Stanton, A. L., Ganz, P. A., Crespi, C. M., and Bower, J. E. (2017). Improvements in emotion regulation following mindfulness meditation: effects on depressive symptoms and perceived stress in younger breast cancer survivors. *J. Consult. Clin. Psychol.* 85:397. doi: 10.1037/ccp0000186

Brooks, J. E. (2006). Strengthening resilience in children and youths: maximizing opportunities in the schools. *Child Schools* 28, 69–76. doi: 10.1093/cs/28.2.69

Carlson, E. B., Dalenberg, C., and McDade-Montez, E. (2012). Dissociation in posttraumatic stress disorder part 1: definitions and review of research. *Psychol. Trauma* 4, 479–489. doi: 10.1037/a0027748

Cassady, J. C., and Boseck, J. J. (2008). "Educational psychology and emotional intelligence: Toward a functional model for emotional information processing in schools," in *Emotional Intelligence: Perspectives of Educational and Positive Psychology*, eds J. C. Cassady and M. A. Eissa (New York, NY: Cassady, J. C), 3–24.

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *J. Health Soc. Behav.* 24, 386–396. doi: 10.2307/2136404

Crane, M. F., and Searle, B. J. (2016). Building resilience through exposure to stressors: the effects of challenges versus hindrances. *J. Occup. Health Psychol.* 21:468. doi: 10.1037/a0040064

Davies, K. A., Lane, A. M., Devonport, T. J., and Scott, J. A. (2010). Validity and reliability of a brief emotional intelligence scale (BEIS-10). *J. Individ. Diff.* 34, 198–208. doi: 10.1027/1614-0001/a000028

DeRosier, M. E., Frank, E., Schwartz, V., and Leary, K. A. (2013). The potential role of resilience education for preventing mental health problems for college students. *Psychiatr. Ann.* 43, 538–544. doi: 10.3928/00485713-20131206-05

Felsten, G., and Wilcox, K. (1992). Influences of stress and situation-specific mastery beliefs and satisfaction with social support on well-being and academic performance. *Psychol. Rep.* 70, 291–303. doi: 10.2466/pr0.1992.70.1.291

Fernandez, R., Salamonson, Y., and Griffiths, R. (2012). Emotional intelligence as a predictor of academic performance in first-year accelerated graduate entry nursing students. *J. Clin. Nurs.* 21, 3485–3492 doi: 10.1111/j.1365-2702.2012.04199.x

Folkman, S., and Moskowitz, J. T. (2000). Stress, positive emotion, and coping. *Curr. Dir. Psychol. Sci.* 9, 115–118. doi: 10.1111/1467-8721.00073

Folkman, S., and Moskowitz, J. T. (2004). Coping: pitfalls and promise. *Annu. Rev. Psychol.* 55, 745–774. doi: 10.1146/annurev.psych.55.090902.141456

Gross, J. J. (1998). Antecedent-and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 74:224. doi: 10.1037/0022-3514.74.1.224

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychol. Inq.* 26, 1–26 doi: 10.1080/1047840X.2014.940781

Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362. doi: 10.1037/0022-3514.85.2.348

Hartley, M. T. (2011). Examining the relationships between resilience, mental health, and academic persistence in undergraduate college students. *J. Am. Coll. Health* 59, 596–604. doi: 10.1080/07448481.2010.515632

Hodzic, S., Ripoll, P., Costa, H., and Zenasni, F. (2016). Emotionally intelligent students more resilient to stress? *the moderating effect of emotional attention, clarity and repair. Behav. Psychol.* 24, 253–272. doi: 10.3389/fpsyg.2018.02653

Hodzic, S., Scharfen, J., Ripoll, P., Holling, H., and Zenasni, F. (2018). How efficient are emotional intelligence trainings: a meta-analysis. *Emot. Rev.* 10, 138–148. doi: 10.1177/1754073917708613

Hu, L. T., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55. doi: 10.1080/10705519909540118

Joseph, D. L., and Newman, D. A. (2010). Emotional intelligence: an integrative meta-analysis and cascading model. *J. Appl. Psychol.* 95:54. doi: 10.1037/a0017286

Kline, R. B. (2015). *Principles and Practice of Structural Equation Modeling, 4th Edn.* London: The Guilford Press.

Lazarus, R. S., and Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York, NY: Springer.

Luthar, S. S., Cicchetti, D., and Becker, B. (2000). The construct of resilience: a critical evaluation and guidelines for future work. *Child Dev.* 71, 543–562. doi: 10.1111/1467-8624.00164

Mîndrila, D. (2010). Maximum likelihood (ML) and diagonally weighted least squares (DWLS) estimation procedures: a comparison of estimation bias with ordinal and multivariate non-normal data. *Int. J. Digit. Soc.* 1, 60–66. doi: 10.20533/ijds.2040.2570.2010.0010

MacCann, C., Fogarty, G. J., Zeidner, M., and Roberts, R. D. (2011). Coping mediates the relationship between emotional intelligence (EI) and academic achievement. *Contemp. Educ. Psychol.* 36, 60–70. doi: 10.1016/j.cedpsych.2010.11.002

MacCann, C., Jiang, Y., Brown, L. E., Double, K. S., Bucich, M., and Minbashian, A. (2020). Emotional intelligence predicts academic performance: a meta-analysis. *Psychol. Bull.* 146, 150–186. doi: 10.1037/bul0000219

Maidaniuc-Chirilă, T. (2015). The mediation role of resilience on the relationship between workplace bullying and Romanian employees' strain. *Revista de Cercetare și Interventie Socială. 24*, 120–133.

Martinez-Torteya, C., Anne Bogat, G., Von Eye, A., and Levendosky, A. A. (2009). Resilience among children exposed to domestic violence: the role of risk and protective factors. *Child Dev.* 80, 562–577. doi: 10.1111/j.1467-8624.2009.01279.x

Masten, A. S. (2011). Resilience in children threatened by extreme adversity: framework for research, practice, and translational synergy. *Dev. Psychopathol.* 23, 493–506. doi: 10.1017/S0954579411000198

Matthews, G., Zeidner, M., and Roberts, R. D. (2006). "Models of personality and affect for education: a review and synthesis," in *Handbook of Educational Psychology, 2nd Edn,* eds P. Alexander, and P. H. Winne (New York, NY: Routledge), 163–186.

Mayer, J. D., Caruso, D. R., and Salovey, P. (2016). The ability model of emotional intelligence: principles and updates. *Emot. Rev.* 8, 290–300. doi: 10.1177/1754073916639667

Mayer, J. D., Roberts, R. D., and Barsade, S. G. (2008). Human abilities: emotional intelligence. *Annu. Rev. Psychol.* 59, 507–536. doi: 10.1146/annurev.psych.59.103006.093646

Mayer, J. D., and Salovey, P. (1997). "What is emotional intelligence?," in *Emotional Development and Emotional Intelligence: Implications for Educators,* eds. P. Salovey, and D. Sluyter (New York, NY: Basic Books), 3–31.

Mayer, J. D., Salovey, P., and Caruso, D. R. (2002). *Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT) Users Manual*. Toronto: Multi-Health Systems.

Mayer, J. D., Salovey, P., Caruso, D. R., and Sitarenios, G. (2003). Measuring emotional intelligence with the MSCEIT V2. 0. *Emotion* 3, 97–105. doi: 10.1037/1528-3542.3.1.97

Memedovic, S., Grisham, J. R., Denson, T. F., and Moulds, M. L. (2010). The effects of trait reappraisal and suppression on anger and blood pressure in response to provocation. *J. Res. Pers.* 44, 540–543. doi: 10.1016/j.jrp.2010.05.002

Mikolajczak, M., Nelis, D., Hansenne, M., and Quoidbach, J. (2008). If you can regulate sadness, you can probably regulate shame: Associations between trait emotional intelligence, emotion regulation and coping efficiency across discrete emotions. *Pers. Individ. Dif.* 44, 1356–1368. doi: 10.1016/j.paid.2007.12.004

Nozaki, Y. (2018). Cross-cultural comparison of the association between trait emotional intelligence and emotion regulation in European-American and Japanese populations. *Pers. Ind. Diff.* 130, 150–155. doi: 10.1016/j.paid.2018.04.013

Petrides, K. V., Mikolajczak, M., Mavroveli, S., Sanchez-Ruiz, M. J., Furnham, A., and Pérez-González, J. C. (2016). Developments in trait emotional intelligence research. *Emot. Rev.* 8, 335–341. doi: 10.1177/1754073916650493

Qualter, P., Whiteley, H., Morley, A., and Dudiak, H. (2009). The role of emotional intelligence in the decision to persist with academic studies in HE. *Res. Post Compul. Educ.* 14, 219–231 doi: 10.1080/13596740903139255

Salami, S. O. (2011). Personality and psychological well-being of adolescents: the moderating role of emotional intelligence. *Soc. Behav. Pers.* 39, 785–794. doi: 10.2224/sbp.2011.39.6.785

Salovey, P., and Mayer, J. D. (1990). Emotional intelligence. *Imagin. Cogn. Pers.* 9, 185–211. doi: 10.2190/DUGG-P24E-52WK-6CDG

Schneider, T. R., Lyons, J. B., and Khazon, S. (2013). Emotional intelligence and resilience. *Pers. Individ. Dif.* 55, 909–914. doi: 10.1016/j.paid.2013.07.460

Shields, N. (2001). Stress, active coping, and academic performance among persisting and nonpersisting college students. *J. Appl. Biobehav. Res.* 6, 65–81. doi: 10.1111/j.1751-9861.2001.tb00107.x

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., and Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *Int. J. Behav. Med.* 15, 194–200. doi: 10.1080/10705500802222972

Steiger, J. H. (1990). Structural model evaluation and modification: an interval estimation approach. *Multivariate Behav. Res.* 25, 173–180. doi: 10.1207/s15327906mbr2502_4

Steinhardt, M., and Dolbier, C. (2008). Evaluation of a resilience intervention to enhance coping strategies and protective factors and decrease symptomatology. *J. Am. College Health* 56, 445–453 doi: 10.3200/JACH.56.44.445-454

Troy, A. S., and Mauss, I. B. (2011). "Resilience in the face of stress: Emotion regulation ability as a protective factor," in *Resilience to Stress,* eds S. Southwick, D. Charney, M. Friedman, and B. Litz (Cambridge: Cambridge University Press), 30–44.

Tucker, L. R., and Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika* 38, 1–10. doi: 10.1007/BF02291170

Werner, E. E. (1993). Risk, resilience, and recovery: perspectives from the Kauai longitudinal study. *Dev. Psychopathol.* 5, 503–515. doi: 10.1017/S095457940000612X

Wilks, S. E., and Spivey, C. A. (2010). Resilience in undergraduate social work students: social support and adjustment to academic stress. *Soc. Work Educ.* 29, 276–288. doi: 10.1080/02615470902912243

Wimmer, L., von Stockhausen, L., and Bellingrath, S. (2019). Improving emotion regulation and mood in teacher trainees: effectiveness of two mindfulness trainings. *Brain Behav.* 2019:e01390. doi: 10.1002/brb3.1390

Zeidner, M., and Matthews, G. (2018). "Grace under pressure in educational contexts: emotional intelligence, stress, and coping," in *Emotional Intelligence in Education* (Cham: Springer), 83–110.

Zolkoski, S. M., and Bullock, L. M. (2012). Resilience in children and youth: a review. *Child. Youth Serv. Rev.* 34, 2295–2303. doi: 10.1016/j.childyouth.2012.08.009

Zolkoski, S. M., Bullock, L. M., and Gable, R. A. (2016). Factors associated with student resilience: perspectives from graduates of alternative education programs. *Prevent. School Fail.* 60, 231–243. doi: 10.1080/1045988X.2015.1101677

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 26 August 2020
doi: 10.3389/fpsyg.2020.01773

# Effects of Self-Regulation vs. External Regulation on the Factors and Symptoms of Academic Stress in Undergraduate Students

*Jesús de la Fuente[1,2]*, Francisco Javier Peralta-Sánchez[2], Jose Manuel Martínez-Vicente[2], Paul Sander[3], Angélica Garzón-Umerenkova[4] and Lucía Zapata[5]*

*[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] School of Psychology, University of Almería, Almería, Spain, [3] School of Psychology, Teesside University, Middlesbrough, United Kingdom, [4] School of Psychology, Fundación Universitaria Konrad Lorenz, Bogotá, Colombia, [5] Educational Psychologist, Cardiff Council, Cardiff, United Kingdom*

OPEN ACCESS

***Edited by:***
*Pablo Fernández-Berrocal, University of Malaga, Spain*

***Reviewed by:***
*José Carlos Núñez, Universidad de Oviedo, Spain*
*Nora Maria Foerst, University of Vienna, Austria*

****Correspondence:***
*Jesús de la Fuente*
*jdlfuente@unav.es;*
*jfuente@ual.es*

***Specialty section:***
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

***Received:*** *02 February 2020*
***Accepted:*** *26 June 2020*
***Published:*** *26 August 2020*

***Citation:***
*de la Fuente J, Peralta-Sánchez FJ, Martínez-Vicente JM, Sander P, Garzón-Umerenkova A and Zapata L (2020) Effects of Self-Regulation vs. External Regulation on the Factors and Symptoms of Academic Stress in Undergraduate Students. Front. Psychol. 11:1773. doi: 10.3389/fpsyg.2020.01773*

The SRL vs. ERL theory has shown that the combination of levels of student self-regulation and regulation from the teaching context produces linear effects on achievement emotions and coping strategies. However, a similar effect on stress factors and symptoms of university students has not yet been demonstrated. The aim of this study was to test this prediction. It was hypothesized that the level of student self-regulation (low/medium/high), in interaction with the level of external regulation from teaching (low/medium/high), would also produce a linear effect on stress factors and symptoms of university students. A total of 527 undergraduate students completed validated questionnaires about self-regulation, regulatory teaching, stress factors, and symptoms. Using an *ex post* facto design by selection, ANOVAs and MANOVAs (3 × 3; 5 × 1; 5 × 2) were carried out. The results confirmed that the level of self-regulation and the level of regulatory teaching jointly determined the level of stress factors and symptoms of university students. Once again, a five-level heuristic of possible combinations was configured to jointly determine university students' level of academic stress. We concluded that the combination of different levels of student regulation and regulation from the teaching process jointly determines university students' level of academic stress. The implications for university students' emotional health, stress prevention, and well-being are established.

**Keywords: SRL vs. ERL theory, stress factors, stress symptoms, university, academic stress**

## INTRODUCTION

In university students, stress can be the cumulative emotional result of academic work, future uncertainty, difficulties forming interpersonal relationships, self-doubt, and so on (Chao, 2012). Adjustment to the rigors of university life can be difficult due to the social strain of attending college, along with the student's renewed independence; in fact, university-related stress has been identified as normative among the general population of college students (Brougham et al., 2009).

While stress is "normative" during this developmental period, it is often found to persist afterward, given that the period of university studies is a sensitive moment in one's lifetime. This type of stress has been analyzed from a clinical health perspective. Stress experienced at university increases one's susceptibility to mental health problems like depression (Cavazos et al., 2010; Bolin et al., 2017), which can be equally detrimental to one's satisfaction with school and with life (Jenkins et al., 2013).

## Academic Stress: Definition, Symptoms, and Factors

### Definition of Academic Stress

Academic stress, as a factor detrimental to psychological health or emotional well-being, is a highly current research topic in the university sphere (Gross, 2008, 2014, 2015a,b; Freire et al., 2018). Many recent studies reveal that academic stress must be kept to an adequate level that allows the university experience to be rewarding for students (Freire et al., 2018). Excessive, repeated stress experiences may place a strain on the student's emotional well-being during the teaching–learning process (D'Mello, 2013; Shannon et al., 2019). However, this reality has been primarily analyzed from the perspective of clinical and health psychology (Murphy et al., 2005; Reyes-Rodríguez et al., 2013; Lardier et al., 2020; Páramo et al., 2020), and less so from the standpoint of educational psychology. Even university training and intervention programs have traditionally been focused on improving stress management from the student's perspective (California Polytechnic State University Academic Skills Center, 2020). This report aims to provide a new theoretical approach, as well as associated empirical evidence, to analyze the reality of university stress within the framework of how university teaching and learning processes are carried out.

Academic stress in particular is considered to be the process whereby students view themselves as overwhelmed by academic tasks, hard-pressed to meet academic demands and the requirements for adequate achievement (Frenzel et al., 2016, 2018; Karaman et al., 2017). Some researchers have already highlighted a relationship between general stress and academic stress in activities such as test taking, homework, and class participation (Goetz et al., 2014; Gentsch et al., 2018; Pozos-Radillo et al., 2014).

### Symptoms of Academic Stress

Previous literature has clearly enumerated the physical and psychological dimensions of stress experiences (Schat et al., 2005). There is plentiful evidence that links stress to negative health conditions (Shaw et al., 2017). Also reported recently is the role of rumination and negative affect, after stressful experiences, in the process of finding meaning (Kamijo and Yukawa, 2018). However, stress as a *response* refers to the physiological, emotional, or behavioral manifestations caused by stressors (Selye, 1978). Similarly, when examining the effects of stress, evidence has shown how stress relates to emotional, behavioral, and cognitive symptoms (Scharp and Dorrance, 2017; Berry, 2020; Di Benedetto et al., 2020).

The *academic stress response* refers to the physiological, emotional, or behavioral manifestations prompted by stressors (Fimian et al., 1989). An acute stressor can trigger various physiological responses (rapid cardiovascular activation, raised blood pressure, increased respiratory rate and corticosteroid levels, sweating, tremor, headaches, weight loss or gain, body aches, and sleep quality). It also prompts a subjective experience related to cognitive reactions (perceived stress, negative thoughts, worry, and feeling of uncontrollability) and negative affect (irritability, agitation, fear, anxiety, and guilt) and can generate behavioral responses [crying, abuse of self and others, smoking (Garett et al., 2017)].

### Factors of Academic Stress in the Teaching–Learning Process

From the perspective of *educational psychology*, it seems reasonable to assume that academic stress factors at university may originate either in the student or in the context. Stress can be conceptualized in various ways.

It is well known that *stress factors* in the sphere of education are multidimensional, whereas research has tended to address *student-centered factors*, such as personality (Saklofske et al., 2012), ways of coping (Chartier et al., 2011; Freire et al., 2018), student anxiety (Putwain, 2018; Cassady et al., 2019), and student goals (Cabanach et al., 2008; Rusk et al., 2011). Recent research has established consistent *student factors* in this process, such as self-beliefs (Lazarus, 1999), temperament (Hirvonena et al., 2019), test anxiety level (Putwain and Pescod, 2018), and self-regulation behavior (Boyraz et al., 2016; de la Fuente et al., 2020). Stress factors in the *learning process* have also been considered, such as presentations in class, overload of assigned work, team-based assignments, and testing situations (Cabanach et al., 2008; Pozos-Radillo et al., 2014).

The analysis of *context-centered factors*, however, has been more limited, despite certain partial attempts to approach this phenomenon. Stress as a *stimulus* refers to the event or circumstance that has the capacity to trigger emotional reactions in the subject. This is usually external to the subject and can alter the physiological and psychological balance. In reference to the teaching process in particular, factors such as the teacher's behavior or well-organized teaching have appeared as predictors of emotional well-being and student engagement, reducing the level of stress (Frenzel et al., 2018; Lekwa et al., 2018; Krijgsman et al., 2019; Shannon et al., 2019).

Among academic stressors, three main groups can be distinguished: (1) those related to evaluation processes, (2) those related to work overload, and (3) other conditions of the teaching–learning process, such as social relationships (teacher–student and peer relationships), teaching methodology, and various organizational components (inadequate study plans, scheduling problems, overlapping programs, low student participation in organization and decision making, overcrowding, etc.) (González-Cabanach et al., 2016, 2017, 2018). Denovan and Macaskill (2013), in a study that lists 11 potential situations that generate stress and stress symptoms, found that the situations predictive of chronic stress were class participation, required assignments, and test taking. Bob et al. (2014), in a sample of medical students, found that the top stressors were exams, falling behind in the learning schedule, the

large amount of content to be learned, heavy workload, and lack of time to review what has been covered.

## SRL vs. ERL Theory as a Heuristic for Analyzing Stress in the Teaching–Learning Process

Stress factors and effects can also be conceptualized from an *interactive approach*, which speaks of the joint, combined effect of student factors and of factors pertaining to the teaching process that the student is exposed to. Previous research has reported effects from the learning context, referring to factors such as regulation carried out through the teaching process (Vermunt, 1989, 2007). This is the approach taken in the present study. This view is important because it allows academic stress to be addressed from two directions, from the subject and the context, in combination. The theory of *self-regulated learning vs. externally regulated learning* (de la Fuente, 2017) can serve as a research heuristic for analyzing this interaction. It is based on certain assumptions:

(1) University students can have prior *personal* characteristics that make them less susceptible to suffering stress experiences. *Self-regulation* behavior, as a meta-behavioral variable (de la Fuente, 2015; Craig et al., 2020), can be considered a *personal protective factor* against stress. Previous evidence has shown that behavioral self-regulation is positively associated with greater resilience (Artuch-Garde et al., 2017), a higher level of positive emotionality, and less negative emotionality (de la Fuente et al., 2017), as well as greater use of problem-focused strategies and less use of emotion-focused strategies (de la Fuente et al., 2015c). Also, Self-regulation is negatively associated with the surface learning approach, negative emotionality, and emotion-focused strategies for coping with stress (de la Fuente et al., 2020). The presence of self-regulation behavior can be classed as *high* (good *self-regulatory behavior*), leading to a lower perception of stress factors and symptoms; *middle* (*non-regulatory behavior*), leading to their perception at a medium level; and *low* (*dysregulatory behavior*), which leads to a high perception of stress factors and symptoms. Consequently, a high level of self-regulation operates as a protective factor and a low level of self-regulation as a risk factor for stress.

(2) Similarly, an adequate teaching process (*effective teaching*) can be considered a *contextual protective factor* against stress because it favors the student's perception of control over the learning process (Azevedo et al., 2008; Goe et al., 2008; Roehrig et al., 2012). Previous evidence has shown that *high regulatory teaching* (effective teaching) is a *protective factor* against stress, because it is positively associated with a higher level of positive emotionality and lower negative emotionality (de la Fuente et al., 2017), as well as with greater use of problem-focused strategies and less use of emotion-focused strategies (de la Fuente et al., 2017). Similarly, *low regulatory teaching* is a risk factor for stress because is positively associated with surface learning, negative emotionality, and emotion-focused coping with stress (de la Fuente et al., 2020). The *low/medium/high level of external regulation from the teaching context* will function as a contextual protective or risk factor for stress. If the teaching includes a high level of external regulation (*good external regulation*), it will predispose to low stress, since the teaching–learning process is designed and developed in a way that offers protection from stress. By contrast, if external regulation is absent (*external non-regulation*), this mid-level option will allow a medium level of stress factors and symptoms to appear, originating from the teaching and learning process. Finally, if the teaching produces *external dysregulation*, this lowest level of external regulation would predispose to the appearance of a high level of stress factors and symptoms.

(3) It is therefore possible to analyze the combination of the two preceding factors (personal × contextual) in order to determine the probable level of protection or risk for stress that results. The *combination of personal and contextual* factors, whether they are *protective or risk factors*, can help determine university students' perceived level of stress factors and symptoms. Thus, for example, the combination of low student self-regulation with low regulation from teaching (risk factors in both cases) would predispose to a high level of stress factors and symptoms in students. However, high student self-regulation combined with high regulation from teaching, both protection factors, would predispose to a low level of stress factors and symptoms. The possible combinations have been established in a *five-level heuristic* that calculates the regulation level that exists in the student–teacher interaction (de la Fuente et al., 2019b, p. 12; de la Fuente et al., 2020, p. 5).

The five-level heuristic was created through a process of several steps. First, students' low/medium/high levels of self-regulation were determined. Second, low/medium/high levels of regulatory teaching were established. Third, a combined regulation level was calculated by averaging these two regulation levels (each with values of 1–3); these averages were then assigned ranks from 1 to 5 (for the averages 1.0, 1.5, 2.0, 2.5, 3.0). Fourth, each rank was given a descriptive name according to its combination values, ranging from high dysregulation to high regulation. Fifth, each rank was also labeled with its corresponding value as a risk or protection factor against stress. See **Table 1**.

## Aims and Hypothesis

Based on our previous research and findings, our research team sought to validate the combination of different types of regulation, assuming that no linear models previously found would be applicable to the factors and symptoms of stress. This line of research has provided prior empirical evidence that the *five heuristic levels* derived from SRL vs. ERL theory have the potential to explain other differences. For example, these levels have been used to explain university students' experience of positive versus negative achievement emotions (de la Fuente et al., 2017); the type of stress-coping strategies they use, whether emotion- or problem-focused (de la Fuente et al., 2020); their

**TABLE 1 |** Combinations between the model parameters hypothesized by SRL vs. ERL theory (de la Fuente et al., 2019b, 2020, p. 5).

| Combination level | | Regulation | | Regulation tendency | Stress protection | Stress risk |
|---|---|---|---|---|---|---|
| SR level (range) | RT level (range) | Average/rank | | | | |
| **3** (3.85–5.00) **H** | **3** (2.84–5.00) **H** | 3.0 | **5** | **High–High:** *High-regulation* | *High protector* | *Low risk* |
| **2** (3.10–3.84) **M** | **3** (2.84–5.00) **H** | 2.5 | **4** | **Medium–High**: *Regulation* | *M-H protector* | *M-L risk* |
| **3** (3.85–5.00) **H** | **2** (2.35–2.83) **M** | 2.5 | **4** | **High–Medium**: *Regulation* | *M-H protector* | *M-L risk* |
| **2** (3.10–3.84) **M** | **2** (2.35–2.83) **M** | 2.0 | **3** | **Medium:** *Non-regulation* | *Medium protector* | *M risk* |
| **2** (3.10–3.84) **M** | **1** (1.00–2.34) **L** | 1.5 | **2** | **Medium–Low**: *Dysregulation* | *M-L protector* | *M-H risk* |
| **1** (1.00–3.09) **L** | **2** (2.35–2.83) **M** | 1.5 | **2** | **Low–Medium**: *Dysregulation* | *M-L protector* | *M-H risk* |
| **1** (1.00–3.09) **L** | **1** (1.00–2.34) **L** | 1.0 | **1** | **Low–Low:** *High Dysregulation* | *Low protector* | *High risk* |

*L, low; M, medium; H, high; SR, self-regulation; RT, regulatory teaching. 1–5 (Rank of regulation).*

learning approaches; and even academic achievement[1]. It remains to be seen, therefore, whether this heuristic can be shown to determine levels of stress factors inherent in the teaching–learning process and the stress symptoms produced. This is the aim of the present study.

Consequently, our *specific objectives* were as follows: (1) to establish whether the regulation levels of the student and of the teaching process determined *academic stress factors and symptoms of stress* and (2) to determine whether the interaction of these levels, as described in SRL vs. ERL theory, were associated with levels of stress factors and symptoms. The corresponding *hypotheses* were established: (1) low/medium/high levels of regulation in students and in their teaching process will result in a corresponding low/medium/high level of academic stress factors and symptoms; (2) the lower the combination rank of student and teaching regulation, the higher the factors and symptoms of academic stress because of the greater presence of risk factors, and vice versa.

# MATERIALS AND METHODS

## Participants

The participants were 527 undergraduate students from two Spanish public universities. The sample was composed of students enrolled in psychology and primary education degree programs; 82.6% were women, and 17.4% were men. Their ages ranged from 19 to 25, with a mean of 22.15 ([$\sigma_X$] = 7.1) years. Sampling was incidental and not probabilistic, since the sample could not be randomized. The students came from nine class subjects (specific teaching–learning processes), whose teachers desired to participate and had invited them. As is common in these types of degree programs, the sample contains a large majority of women. In some cases, students did not complete all the inventories, or some instruments were only partially completed. This explains the variability in the number of participants in the different analyses.

[1]de la Fuente, J., Sander, P., Kauffman, D., and Yilmaz-Soylu, M. (2020). Differential effects of self- vs. external- regulation on learning approaches, academic achievement and satisfaction in undergraduate students. Front. Psychol. 11 (in review).

## Instruments

### Learning Process

#### *Self-regulation Behavior*

This variable was measured using the *Short Self-Regulation Questionnaire* (*SSRQ*) (Miller and Brown, 1991). It has already been validated in Spanish samples (Pichardo et al., 2014, 2018) and possesses acceptable validity and reliability values, similar to the English version (Garzón-Umerenkova et al., 2017). The Short SRQ is composed of four factors (goal setting–planning, perseverance, decision making, and learning from mistakes) and 17 items. All items have saturations greater than 0.40, with a consistent confirmatory factor structure [chi-square or CMIN = 250.83, df = 112, $p < 0.001$; relative chi-square, CMIN/df = 2,239; SRMR = 0.0420; comparative fit index (CFI) = 0.90, TLI = 0.92, normed fit index (NFI) = 0.90, root mean square error of approximation (RMSEA) = 0.05]. Internal consistency was acceptable for the total of questionnaire items ($\alpha = 0.86$) and for the factors of goal setting–planning ($\alpha = 0.79$), decision making ($\alpha = 0.72$), learning from mistakes ($\alpha = 0.72$), and perseverance ($\alpha = 0.73$).

### Teaching Process

#### *Regulatory teaching*

*The Scales for Assessment of the Teaching–Learning Process, ATLP, student version* (de la Fuente et al., 2012), was used to evaluate students' perception of the teaching process. The scale entitled *Regulatory Teaching* is Dimension 1. IATLP-D1 comprises 29 items structured along five factors: specific regulatory teaching, regulatory assessment, preparation for learning, satisfaction with the teaching, and general regulatory teaching. The ATLP is a self-report instrument to be completed by the teacher and the students, available in Spanish and English versions. It also includes a qualitative part where students can make recommendations for improving each of the processes evaluated. As for the instrument's external validity, results are consistent; there are different interdependent relationships between perceptions of variables found in the academic environment. The scale was validated in university students (de la Fuente et al., 2012) and showed a factor structure with adequate fit indices (chi-square or CMIN = 490.626, *df* = 98, $p < 0.001$; relative chi-square or CMIN/df = 5,00; SRMR = 0.0802, CFI = 0.958, TLI = 0.959, NFI = 0.950, NNFI = 0.967, RMSEA = 0.068) and adequate internal consistency (IATLP-D1:

α = 0.83; specific regulatory teaching, α = 0.897; regulatory assessment, α = 0.883; preparation for learning, α = 0.849; satisfaction with the teaching, α = 0.883; and general regulatory teaching, α = 0.883).

#### *Factors of stress*

*Academic Stress Questionnaire*, *CEA* (Cabanach et al., 2008). We analyzed the internal structure of the scale. In order to verify the second-level structure, a confirmatory factor analysis (CFA) was conducted on the whole set of data from our sample. The default model shows good fit [chi-square or CMIN = 66,457, df = 13, $p < 0.001$; relative chi-square or CMIN/df = 5,11; SRMR = 0.075, CFI = 0.935, TLI = 0.961, IFI = 0.947, RFI = 0.965, NFI = 0.947, RMSEA = 0.057, HOELTER = 0.430 ($p < 0.05$) and 0.532 ($p. < 01$)]. The model proposed for this version of the scale contains 53 items with a structure of seven factors and two dimensions, with one factor different from the original version. The resulting factors, in two dimensions, were: (1) *Dimension of Stress in Learning:* task overload (Factor 2), dif. perform. control (F3), social climate (Factor 5), and test anxiety (Factor 7) and (2) *Dimension of Stress in Teaching*: method. difficulties (Factor 1), Public speaking (Factor 4), content lacks value (Factor 6). Overall reliability = 0.961; part 1 = 0.932, part 2 = 0.946.

### Learning Product

#### *Symptoms of academic stress*

*Stress Response Questionnaire*, *CRE* (Cabanach et al., 2008). The psychometric properties of this scale were adequate in this sample of Spanish students. The factors of the Confirmatory Structural Model of the CRE were: chi-square or CMIN = 846.503, DF (375-76) = 299, $p < 0.001$; relative chi-square, CMIN/df = 2,831; SRMR = 0.0721, NFI = 0.952, RFI = 0.965, IFI = 0.953, TLI = 0.951; F1, *burnout*; F2, *sleep difficulties*; F3, *irritability;* F4, *negative thoughts*; and F5, *agitation.* The unidimensionality of the scale and metric invariance in the assessment samples were confirmed [RMSEA = 0.046; CFI = 0.922 and TLI = 0.901; HOELTER = 431 ($p < 0.05$) and 459 ($p < 0.01$)]. Cronbach's alpha was 0.920; part 1 = 0.874, and part 2 = 0.863.

## Procedure

The University Guidance department at the two universities invited teachers of different subjects to participate in the research. Once the teachers accepted, they were given full information about the research project. They in turn invited their students to participate by completing the scales. Participants voluntarily completed the scales using an online platform[2] (de la Fuente et al., 2015a). As part of their initial registration on the platform, students read and signed their informed consent. The platform then assigned a randomly generated participant code to each student, so anonymity was maintained. Students received a Certificate of Participation in the research project for completing the inventories outside of regular class hours; participation time was shown on the certificate (a total of 2 h). These certificates were unrelated to the ECTS credits for the subject. Students were required to complete all the questionnaires in order to receive the certification.

The assessments covered a total of five specific teaching–learning processes of different university subjects that occurred over two academic years. *Self-regulation behavior* was evaluated in September–October 2018 and 2019, *regulatory teaching* process variables in February–March 2018 and 2019, and *factors and symptoms of stress* in May–June 2018 and 2019. The procedure was approved by the respective Ethics Committees of the two universities, in the context of an R&D project (2018–2021) and UAL18 SEJ-DO31-A-FEDER (2018–2021).

## Data Analysis

### Research Design

An *ex post* facto, non-linear, inferential-type design was used. This design has provided evidence that aligns with SRL vs. ERL theory. A linear prediction is not intended; instead, we attempt to demonstrate inferential, interdependence relationships between levels of the different variables. The levels refer to H/M/L in self-regulation × H/M/L in regulatory teaching (3 × 3), and the combination level 1/2/3/4/5 according to the heuristic (5 × 1). This design seemed best suited to demonstrating the effect of each of the combinations hypothesized in the five-level heuristic.

### Preliminary Analysis

A preliminary *CFA* was performed on this sample as evidence of factor validity and to ensure the prior structural adjustment

[2]http://www.estres.investigacion-psicopedagogica.org/espanol/seccion.php?idseccion=10

**TABLE 2 |** Combinations between the model parameters hypothesized by SRL vs. ERL theory, for Factors and Symptoms of Academic Stress (de la Fuente et al., 2019b, 2020, p. 5).

| Regulation levels | | Regulation | | Regulation tendency | Factors of stress* | Symptoms of stress* |
|---|---|---|---|---|---|---|
| SR level (range) | RT level (range) | Average/rank | | | | |
| **3** (3.85–5.00) **H** | **3** (2.84–5.00) **H** | 3.0 | **5** | **High–High:** *High-regulation* | *Low* | *Low* |
| **2** (3.10–3.84) **M** | **3** (2.84–5.00) **H** | 2.5 | **4** | **Medium–High**: *Regulation* | *M-L* | *M-L* |
| **3** (3.85–5.00) **H** | **2** (2.35–2.83) **M** | 2.5 | **4** | **High–Medium**: *Regulation* | *M-L* | *M-L* |
| **2** (3.10–3.84) **M** | **2** (2.35–2.83) **M** | 2.0 | **3** | **Medium:** *Non-regulation* | *M* | *M* |
| **2** (3.10–3.84) **M** | **1** (1.00–2.34) **L** | 1.5 | **2** | **Medium–Low**: *Dysregulation* | *M-H* | *M-H* |
| **1** (1.00–3.09) **L** | **2** (2.35–2.83) **M** | 1.5 | **2** | **Low–Medium**: *Dysregulation* | *M-H* | *M-H* |
| **1** (1.00–3.09) **L** | **1** (1.00–2.34) **L** | 1.0 | **1** | **Low–Low:** *High Dysregulation* | *High* | *High* |

*H, high; M, medium; L, low. *Effects analyzed in this investigation. 1–5 (Rank of regulation).*

**TABLE 3 |** Combined effects (3 × 3) between the levels of *SR* with levels of *RT* in the *stress factors and symptoms* (*n* = 486).

| **SR** | **Low (*n* = 134)** | | | **Medium (*n* = 229)** | | | **High (*n* = 123)** | | | **IV** | **Effects** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RT** | **Low** | **Med** | **High** | **Low** | **Med** | **High** | **Low** | **Med** | **High** | | ***F*(Pillai's index)** | ***post hoc*** |
| ***n*=** | **28** | **76** | **30** | **55** | **110** | **64** | **75** | **45** | **63** | | | |
| **Stress factors** | | | | | | | | | | | | |
| Total | 2.95(0.70) | 2.70(0.70) | 2.46(0.80) | 2.25(0.21) | 2.26(0.59) | 2.26(0.66) | 1.99(0.72) | 1.96(0.59) | 1.93(0.72) | **SR** | $F(2,392) = 36.398^{**}\ \eta^2 = 157$ | |
| | | | | | | | | | | **RT** | $F(2,392) = 0.661.^{511}\ \eta^2 = 0.003$ | |
| Teaching process | 3.67(0.74) | 3.62(0.60) | 3.73(0.56) | 3.29(0.63) | 3.24(0.64) | 3.27(0.64) | 3.06(0.91) | 2.96(0.64) | 2.68(0.78) | **SR** | $F(4,784) = 17.385^{**}\ \eta^2 = 0.081$ | |
| Learning process | 3.28(0.60) | 2.96(0.68) | 2.87(0.80) | 2.39(0.61) | 2.64(0.64) | 2.62(0.55) | 2.33(0.73) | 2.31(0.70) | 2.22(0.82)* | **SR × RT** | $F(8,784) = 2.523^{**}\ \eta^2 = 0.025$ | |
| *Factors of teaching process* | | | | | | | | | | **SR** | $F(2,392) = 29.397^{***}\ \eta^2 = 0.130$ | 1 > 2 > 3 |
| Method. Difficulties | 3.96(0.63) | 3.75(0.65) | 3.69(0.64) | 3.57(0.79) | 3.42(0.75) | 3.72(0.79) | 3.32(1.1) | 3.19(0.74) | 3.16(0.86) | **SR** | $F(2,392) = 12.296^{***}\ \eta^2 = 0.059$ | 1 > 2 > 3 |
| Public interventions | 3.31(1.0) | 3.92(1.0) | 4.05(0.80) | 3.38(1.0) | 3.39(1.0) | 3.30(1.0) | 3.30(1.1) | 2.84(0.97) | 2.68(1.0)* | **SR** | $F(2,392) = 12.398^{***}\ \eta^2 = 0.064$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR × RT** | $F(4,392) = 2.869^{*}\ \eta^2 = 0.028$ | |
| Content lacks value | 3.74(0.93) | 3.18(0.81) | 3.46(0.76) | 2.91(0.97) | 2.92(0.95) | 2.78(0.96) | 2.54(1.1) | 2.84(1.0) | 2.19(1.1) | **SR** | $F(2,392) = 20.779^{***}\ \eta^2 = 0.096$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR × RT** | $F(4,392) = 2.932^{*}\ \eta^2 = 0.029$ | |
| *Factors of learning process* | | | | | | | | | | **SR** | $F(2,394) = 27.975^{**}\ \eta^2 = 0.130$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR × RT** | $F(4,392) = 2.463^{*}\ \eta^2 = 0.025$ | 1 > 2 > 3 |
| Task overload | 3.52(0.75) | 3.28(0.71) | 3.30(1.0) | 2.72(0.68) | 2.87(0.73) | 2.77(0.74) | 2.52(0.76) | 2.60(0.85) | 2.33(0.90) | **SR** | $F(2,392) = 28.639^{***}\ \eta^2 = 0.127$ | 1 > 2 > 3 |
| Social climate | 2.67(0.98) | 2.38(0.90) | 2.18(0.83) | 1.95(0.80) | 2.27(0.82) | 2.35(0.82) | 2.06(0.74) | 2.03(0.81) | 2.10(1.0)* | **SR** | $F(2,392) = 3.347^{*}\ \eta^2 = 0.017$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR × RT** | $F(4,392) = 2.932^{*}\ \eta^2 = 0.029$ | |
| Dif. Perf. control | 3.48(0.62) | 3.23(0.69) | 3.23(0.71) | 2.57(0.73) | 2.82(0.69) | 2.81(0.62) | 2.44(0.80) | 2.41(0.73) | 2.31(0.84) | **SR** | $F(2,392) = 36.815^{***}\ \eta^2 = 0.158$ | 1 > 2 > 3 |
| Test anxiety | 3.46(0.76) | 2.95(0.92) | 2.79(0.98) | 2.30(0.77) | 2.62(0.82) | 2.54(0.77) | 2.29(1.0) | 2.20(0.81) | 2.14(0.99)* | **SR** | $F(2,392) = 22.998^{***}\ \eta^2 = 0.105$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR × RT** | $F(4,392) = 3.054^{**}\ \eta^2 = 0.030$ | |
| **Stress symptoms** | | | | | | | | | | | | |
| Total | 2.95(0.70) | 2.70(0.70) | 2.48(0.80) | 2.52(0.71) | 2.26(59) | 2.26(0.66) | 1.99(0.72) | 1.96(0.59) | 1.93(0.72) | **SR** | $F(2,477) = 30.609^{***}\ \eta^2 = 0.114$ | 1 > 2 > 3 |
| | | | | | | | | | | **SR** | $F(10,948) = 10.312^{***}\ \eta^2 = 0.098$ | 1 > 2 > 3 |
| Burnout | 3.41(0.79) | 3.21(0.81) | 3.12(1.0) | 2.79(0.93) | 2.80(0.89) | 2.81(0.89) | 2.37(0.71) | 2.28(0.82) | 2.26(0.87) | **SR** | $F(2,477) = 27.752^{***}\ \eta^2 = 0.104$ | 1 > 2 > 3 |
| Sleep difficulties | 2.72(0.86) | 2.58(0.90) | 1.98(1.0) | 2.21(0.90) | 2.08(0.72) | 2.16(0.85) | 1.98(1.0) | 2.08(0.08) | 1.98(0.90) | **SR** | $F(2,477) = 9.361^{***}\ \eta^2 = 0.138$ | 1 > 2 > 3 |
| Irritability | 2.72(1.0) | 2.32(0.92) | 2.12(0.86) | 2.00(0.87) | 2.00(0.72) | 1.97(0.73) | 1.68(0.64) | 1.76(0.73) | 1.72(0.82) | **SR** | $F(2,477) = 17.760^{***}\ \eta^2 = 0.087$ | 1 > 2 > 3 |
| Negative thoughts | 3.31(1.0) | 2.94(1.0) | 2.75(1.0) | 2.18(0.90) | 2.33(0.86) | 2.14(0.76) | 1.96(0.82) | 1.82(0.75) | 1.83(0.84) | **SR** | $F(2,477) = 43.362^{***}\ \eta^2 = 0.164$ | 1 > 2 > 3 |
| Agitation | 2.61(0.92) | 2.37(0.88) | 2.12(0.94) | 2.07(0.93) | 2.11(0.74) | 2.22(0.77) | 1.95(0.96) | 1.88(0.96) | 1.89(0.90) | **SR** | $F(2,477) = 7.739^{***}\ \eta^2 = 0.030$ | 1 > 2 > 3 |

*Statistical effect in the interaction of variables: SR, personal self-regulation levels, or RT, regulatory teaching levels. SR, self-regulation effect; RT, regulatory teaching effect. 1 = low level; 2 = medium level; 3 = high level. ***p < 0.001, **p < 0.01, p < 0.05.*

of each inventory using the AMOS statistical program (v. 22). Reliability (Cronbach's alpha) was also estimated using SPSS (v. 25). The following were used for analysis of the CFA model:

(1) Discrepancy functions, such as the chi-square test (or CMIN in the AMOS program), relative chi-square (CMIN/df less than 5; Schumacker and Lomax, 2004). SRMR should be less than 0.08 (Browne and Cudeck, 1993), and ideally less than 0.05. Alternatively, the SRMR's upper confidence interval should not exceed 0.08 (Hu and Bentler, 1995).
(2) Tests that compare the target model with the null model, such as the CFI, NFI, TFI, and IFI. The NFI should exceed 0.90 (Byrne, 1994) or 0.95 (Schumacker and Lomax, 2004), the goodness of fit index (GFI) should exceed 0.90 (Byrne, 1994), and the CFI should exceed 0.93 (Byrne, 1994). In general, index values equal to or greater than 0.90 and 0.95, respectively, were taken to indicate acceptable and close fit to the data (McDonald and Marsh, 1990). In addition, the RMSEA was used. RMSEA values equal to or less than 0.08 and 0.05 were also taken to indicate acceptable and close levels of fit (Jöreskog and Sörbom, 1993).

## Typology of Five Combinations According to the Heuristic

The procedure for forming the low/medium/high groups has already been presented in previous work (de la Fuente et al., 2019b, 2020). Basically, it consisted of a cluster analysis followed by simple and multiple ANOVAs to delimit the significant differences between the different levels of regulation. The exact cutoff points are shown in **Table 2**.

The multivariate analyses (MANOVAs) showed a statistically significant main effect of the five interaction types on low/medium/high levels of self-regulation (SR) and of regulatory teaching (RT) (see: de la Fuente et al., 2020, p. 5, and **Table 1**):

*Combination 1* presented a statistically significant low level in *SR* and low level in *RT* (*1 and 1*). The average regulation level is 1.0, and the rank is 1. The effects are a *high level of stress factors and symptoms*.
*Combination 2* had a statistically significant low level in *SR* and medium level in *RT*, or vice versa (*1 and 2*, *or 2 and 1*). The average regulation level is 1.5, and the rank is 2. The effects are a *medium-high level of stress factors and symptoms*.
*Combination 3* presented a statistically significant medium SR level (*2*) and medium RT level (*2 and 2*). The average regulation level is 2.0, and the rank is 3. The effects are a *medium level of stress factors and symptoms*.
*Combination 4* had statistically significant medium SR and high RT, or vice versa (*2 and 3*, *or 3 and 2*). The average regulation level is 2.5, and the rank is 4. The effects are a *medium-low level of stress factors and symptoms*.
*Combination 5* presented a statistically significant high SR and high RT (*3 and 3*). The average regulation level is 3.0, and the rank is 5. The effects are a *low level of stress factors and symptoms*.

## Statistical Analyses

First, after checking the sample for adequacy assumptions, simple and multiple multivariate analyses were conducted (ANOVAs and MANOVAs; Pillai's Trace, partial eta squared, and power) to establish the effect of low/medium/high levels of SR and of RT (IVs) on the factors and symptoms of stress (DVs). To ensure that gender did not have a significant effect, it was initially inserted as an IV in the analyses. As gender did not appear as an independent

**TABLE 4 |** Effects of types of combination in the factors of stress ($n$ = 401).

| DVs | Type of Combination in Groups (IVs) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Effects *post hoc* |
| | (*n* = 26) | (*n* = 101) | (*n* = 135) | (*n* = 87) | (*n* = 52) | |
| **Stress factors** | | | | | | |
| Total | 3.45(0.52) | 3.10(0.53) | 2.97(0.61) | 2.81(0.57) | 2.47(0.75) | $F(4,396) = 15.207$ (Pillay), $p < 0.001$, $\eta^2 = 0.133$;5,4 > 3 > 2,1** $F(8,792) = 9,124$ (Pillay), $p < 0.001$, $\eta^2 = 0.085$ |
| Teaching factors | 3.67(0.64) | 3.47(0.63) | 3.29(0.70) | 3.12(0.65) | 2.68(0.78) | $F(4,396) = 15.108$, $p < 0.001$, $\eta^2 = 132$; 5 < 4,3 < 2,1** |
| Learning factors | 3.28(0.70) | 2.71(0.71) | 2.64(0.69) | 2.47(0.74) | 2.22(0.82) | $F(4,396) = 11.420$, $p < 0.001$, $\eta^2 = 103$; 5,4 < 3,2 < 1** $F(28,1572) = 3,869$ (Pillay), $p < 0.001$, $\eta^2 = 0.064$ |
| Method. difficulties | 3.96(0.63)* | 3.67(0.71) | 3.45(0.80) | 3.47(0.81) | 3.16(0.86) | $F(4,396) = 6.089$, $p < 0.001$, $\eta^2 = 0.058$, 5 < 2,1**; 4,3 < 1** |
| Public interventions | 3.31(0.98) | 3.68(0.99) | 3.48(0.99) | 3.08(0.97) | 2.68(0.96) | $F(4,396) = 9.425$, $p < 0.001$, $\eta^2 = 0.087$, 5,4 < 3,2,1** |
| Content lacks value | 3.74(0.93)* | 3.06(0.89) | 2.95(0.98) | 2.81(0.99) | 2.19(0.99) | $F(4,396) = 12.518$, $p < 0.001$, $\eta^2 = 0.112$ 5,4 < 3 < 2,1** |
| Work overload | 3.52(0.75)* | 3.04(0.78) | 2.89(0.80) | 2.69(0.79) | 2.33(.90) | $F(4,396) = 12.004$, $p < 0.001$, $\eta^2 = 0.108$, 5,4,3 < 2,1** |
| Social climate | 2.67(0.98) | 2.19(0.88) | 2.23(0.81) | 2.20(0.82) | 2.10(0.99) | $F(4,396) = 1.949$, $p < 0.001$, $\eta^2 = 0.019$n.s. |
| Dif. Perf. control | 3.48(0.62)* | 2.95(0.78) | 2.84(0.75) | 2.62(0.70) | 2.10(0.99) | $F(4,396) = 12.290$, $p < 0.001$, $\eta^2 = 0.115$, 5,4 < 3 < 2,1** |
| Test anxiety | 3.46(0.76)* | 2.67(0.91) | 2.60(0.88) | 2.38(0.80) | 2.14(0.99) | $F(4,396) = 11.191$, $p < 0.001$, $\eta^2 = 0.102$, 5,4 < 3,2 < 1** |

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

**TABLE 5 |** Effects of types of combination in symptoms of stress ($n$ = 401).

| | 1 | 2 | 3 | 4 | 5 | Effects *post hoc* |
|---|---|---|---|---|---|---|
| | (*n* = 28) | (*n* = 131) | (*n* = 155) | (*n* = 109) | (*n* = 63) | |
| **Stress Symptoms** | | | | | | |
| Total | 2.95(0.70) | 2.51(0.73) | 2.28(0.65) | 2.14(0.64) | 1.93(0.72) | $F(4,481) = 15.253$, $p < 0.001$, $\eta^2 = 0.113$, 5,4 < 3 < 2,1** $F(20,1920) = 4.696$, $p < 0.001$, $\eta^2 = 0.053$ |
| Burnout | 3.41(0.72)* | 3.03(0.89) | 2.81(0.92) | 2.59(0.90) | 2.26(0.87) | $F(4,481) = 12.649$, $p < 0.001$, $\eta^2 = 0.095$, 5,4 < 3 < 2,1** |
| Sleep difficulties | 2.72(0.56)* | 2.42(0.92) | 2.10(0.80) | 2.13(0.81) | 1.98(0.90) | $F(4,481) = 6.675$, $p < 0.001$, $\eta^2 = 0.063$, 5,4,3 < 2,1** |
| Irritability | 2.72(0.99)* | 2.22(0.91) | 1.99(0.75) | 1.99(0.75) | 1.71(0.82) | $F(4,481) = 9.735$, $p < 0.001$, $\eta^2 = 0.075$, 5 < 4,3 < 2,1** |
| Negative thoughts | 3.31(1.0)* | 2.62(1.0) | 2.37(0.92) | 2.01(0.77) | 1.83(0.84) | $F(4,481) = 19.068$, $p < 0.001$, $\eta^2 = 0.137$, 5,4 < 3,2 < 1** |
| Agitation | 2.61(0.92)* | 2.24(0.91) | 2.10(0.80) | 2.08(0.71) | 1.89(0.90) | $F(4,481) = 4.367$, $p < 0.001$, $\eta^2 = 0.075$, 5,4,3 < 2,1** |

*Type 1 (low personal self-regulation, and low regulatory teaching); Type 2 (low personal self-regulation and high regulatory teaching); Type 3 (medium personal self-regulation and medium regulatory teaching); Type 4 (high personal self-regulation and low regulatory teaching); Type 5 (high personal self-regulation and high regulatory teaching). *Statistical relevant effect; **$p < 0.01$.*

variable with any significant effect, it was eliminated from the analyses performed. Second, the five-level heuristic was taken as an IV to establish its potential for determining factors and symptoms of stress.

# RESULTS

## Combined Effects of Levels of SR and Levels of RT

### Effects in Academic Stress Factors

A statistically significant main effect of the *IV SR* H/M/L was noted on the total of *academic stress factors*. No significant statistical effect appeared of the *IV RT* H/M/L on *total academic stress*. No statistical effect of the interaction SR × RT appeared.

Complementarily, a statistically significant main effect of the *IV SR* H/M/L, and an interaction *SR* × *RT* statistically significant effect, was noted in the dimensions of academic stress factors. The statistically significant partial effect was maintained for the *IV SR* H/M/L for both *stress factors of teaching* and *stress factors of learning*. Also, a statistically significant partial effect was maintained for the interaction *SR* × *RT* H/M/L for both *stress factors of learning*. There were no significant interaction effects SR × RT for stress factors in the stress factors of teaching.

A statistically significant partial effect was maintained for the *IV SR* H/M/L for both factors of stress: method difficulties, public intervention, content lacks value, task overload, social climate, difficulties of performance control, and for test anxiety. No significant statistical effect appeared of the *IV RT* H/M/L. Complementarily, a statistically significant partial effect was maintained for the interaction *SR* × *RT* H/M/L for *public intervention*, *content lacks value*, *social climate*, and *test anxiety*. See **Table 3**.

### Effects in Academic Stress Symptoms

A statistically significant main effect of the *SR IV levels* was noted on the total of *academic stress symptoms*. Also, the statistically significant partial effect was maintained for the *IV SR levels* for all *stress symptoms*: burnout, sleep difficulties, irritability, negative thoughts, and agitation. No significant effects appeared for regulatory teaching or for the SR × RT interaction. See **Table 3**.

## Combination Typology for Understanding Academic Stressors and Stress Symptoms

### Effects in Academic Stress Factors

A statistically significant main effect of the *five combinations of SR and RT* was noted on total *academic stress factors* (5,4 < 3 < 2,1). The statistically significant partial effect was maintained in the *five combinations*, for both teaching factors and learning factors. In the case of *teaching factors*, a significant statistical effect appeared in favor of low levels (5 < 4,3 < 2,1), similarly to the *learning factors* (5,4 < 3,2 < 1). The statistically significant partial effect was maintained for each factor of the teaching process (*method difficulties*, *public interventions*, and *content lacks value*) and for the learning process (work *overload*, *differences in performance control*, and *test anxiety*). See **Table 4**. The graphic representation of the differential progressive effect of the combination between SR and RT levels is shown in **Figure 1**. Thus, academic stress factors progressively decrease through the five levels of interaction. Overall, the clearest effect that appears is that a higher interaction level leads to a decreasing level of stress factors.

### Effects in Academic Stress Symptoms

A statistically significant main effect of the *five combinations of SR and RT* was noted on the total *symptoms of academic stress* (5,4 < 3 < 2,1). The statistically significant partial effect was maintained for each factor (*burnout*, *sleep difficulty*, *irritability*, *negative thoughts*, and *agitation*). Thus, factors of academic stress symptoms progressively decrease through the five levels of combination. Overall, the clearest effect that appears is that a higher combination level leads to a decreasing level of stress symptoms. See **Table 5**. The graphic representation of the differential progressive effect of the combination between SR and RT levels is shown in **Figure 2**.

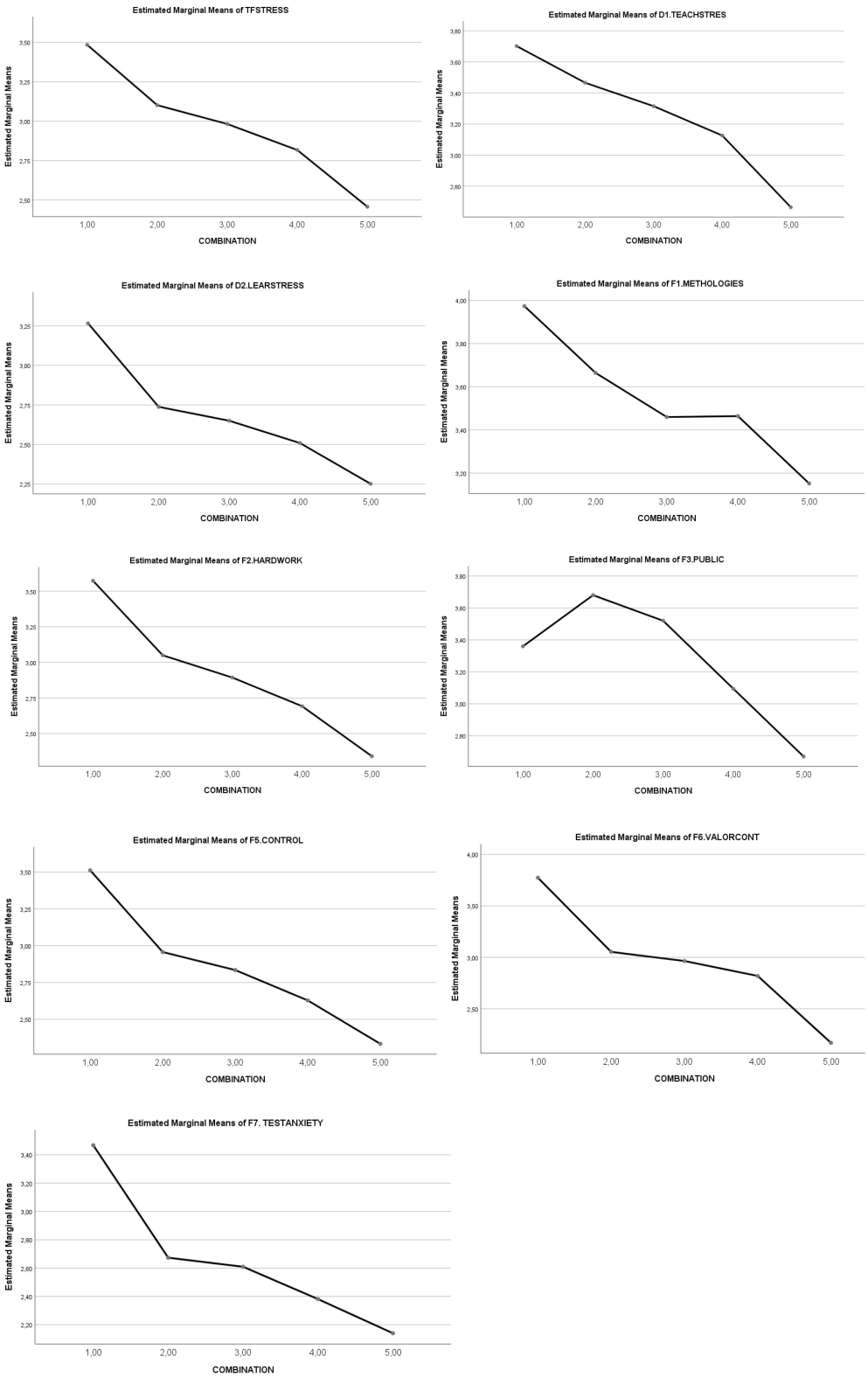


**FIGURE 1 |** Graphical representation of the effects of the types of combinations (levels 1–5) on *academic stress factors and:* (1) TFSTRESS = total stressors; (2) D1. TEACHSTRESS = stressors of teaching process; (3) D2. LEARSTRESS = stressors of learning process; (4) F1. METHODOLOGIES = method. difficulties; (5) F2. HARDWORK = work overload; (6). F3. PUBLIC = public interventions; (7) F5. CONTROL = dif. performance control; (8) F6. VALORCONT = content lacks value; (9) F7. TESTANXIETY = test anxiety.

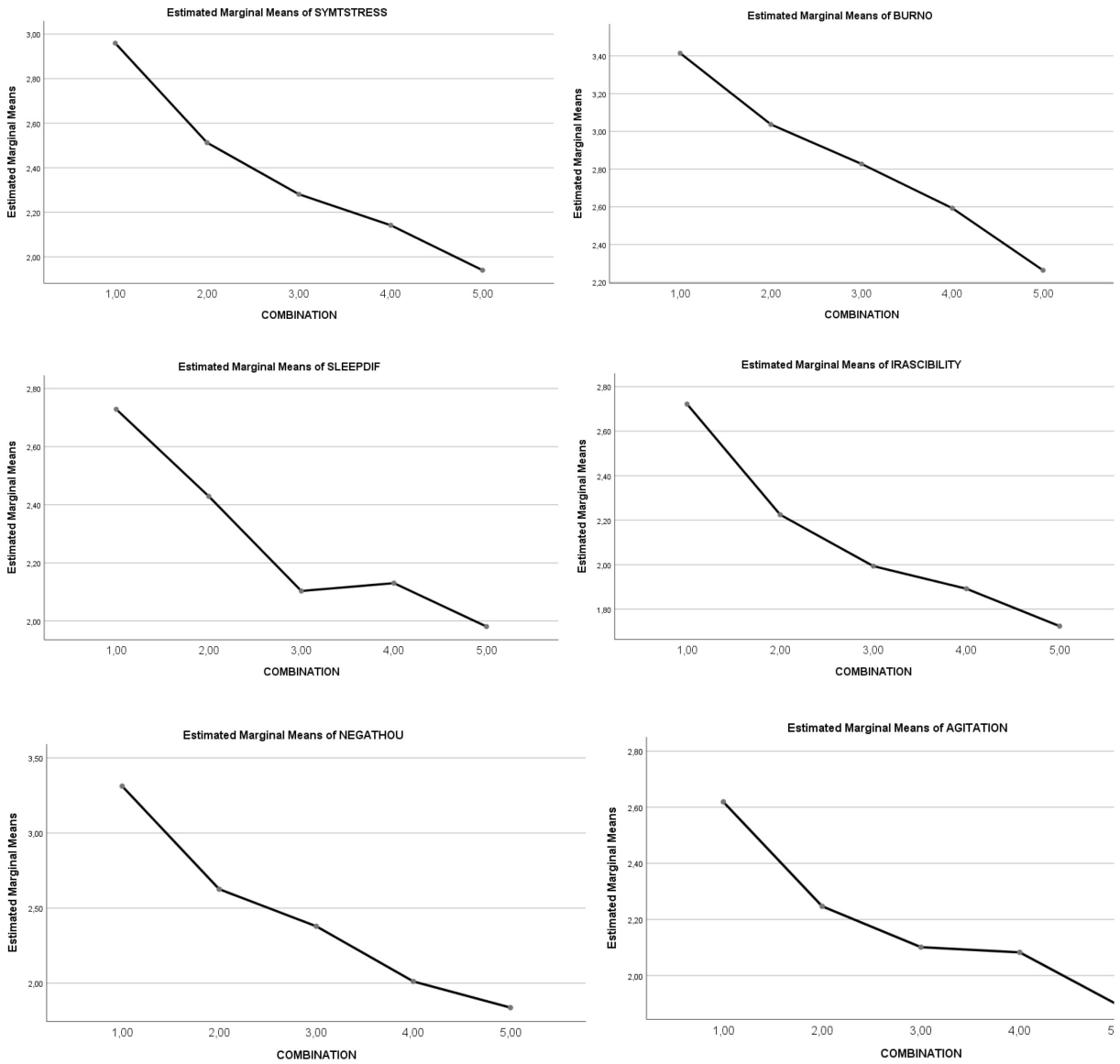


**FIGURE 2 |** Graphical representation of the effects of the types of combinations (levels 1–5) on *academic stress symptoms:* (1) SYMTSTRESS = total stress symptoms; (2) BURNOU = burnout; (3) SLEEPDIF = sleep difficulties; (4) IRASCIBILITY = irritability; (5) NEGATHOU = negative thoughts; (6) AGITATION = agitation.

## DISCUSSION AND CONCLUSION

The SRL vs. ERL theory (de la Fuente, 2017) predicted that the level of student self-regulation (personal) and the level of external regulation from the teaching process (context) would jointly predict stress factors and symptoms. In addition, this type of interaction could be understood as the combination of low/medium/high levels of both factors, as supported by previous evidence in this direction (de la Fuente et al., 2015b, 2017, 2019b, 2020). Complementary, the directionality of the proposed hypothesis stated that a gradual decrease in the level of regulation (internal and external) would result in a proportional increase in (1) stress factors and (2) stress symptoms. By contrast, the higher the level of internal and external regulation, the lower the level of stress factors and symptoms in undergraduate students.

The results supported the prediction of the *first hypothesis*. The evidence confirmed the differential presence of stress factors. The level of self-regulation behavior was shown to negatively predict the level of stress factors and symptoms, while the level of regulatory teaching (external regulation) also did so, though to a lesser degree.

(1) This result, showing the importance of *students' self-regulation level* in determining the level of stress factors and symptoms, is consistent with evidence reported previously (Durand-Bush et al., 2015; Bingen et al., 2019; de la Fuente et al., 2019b). This result confirms the idea that

self-regulation is a meta-behavioral variable that, due to its nature of behavior oversight, offers *protection* against academic stress and is associated with meta-affective variables like coping strategies (de la Fuente et al., 2015c) or meta-motivational variables like resilience (Artuch-Garde et al., 2017). Complementarily, this finding also shows that a lack of student self-regulation acts as a factor of *vulnerability*, predisposing to a higher level of stress factors and symptoms.

(2) As for the effect of *regulatory teaching level* on these stress factors and symptoms, results are also consistent with previous findings (de la Fuente et al., 2017, 2019b, 2020). *Regulatory teaching* is confirmed as a protective factor against factors of stress. Effective teaching decreases potential stress factors pertaining to the teaching process (inadequate methodology, lack of interesting course content, disorganization) and to the learning process (anxiety, perceived lack of control, and excessive workload), just as it predisposes to low levels of stress symptoms. By contrast, a *low level of regulatory teaching* brings with it higher levels of stress factors in the teaching process (inadequate methodology, unscheduled changes, and less meaningful content) and in the learning process (more anxiety, task overload): this is why it is considered *dysregulatory*. This is the context where greater stress symptoms appear (Khan et al., 2020). It has therefore been demonstrated, in a precise manner, that factors of the teaching process can constitute either protective or risk factors during the period of university learning (Vermunt, 2007). These results indicate a course of action for alleviating the stress factors associated with the teaching–learning context, usually present in university environments (Moffa et al., 2016; Shaw et al., 2017; Mainhard et al., 2018).

Results from testing the *second hypothesis* are very consistent with the idea that a higher combination of the two types of regulation (subject and context) significantly predicts a decrease in stress factors and symptoms. This finding is very important for the theoretical model, offering consistency with levels of negative emotionality reported in previous studies (de la Fuente et al., 2019b, 2020); empirical evidence supports the idea that the *combined levels* of individual and contextual regulation are what delimit the level of stress. Students with a lower level of self-regulation (non-regulation or dysregulation), who are also exposed to non-regulatory teaching processes (no external regulation or dysregulation), are quite consistently shown to experience the greatest factors and symptoms of stress. The opposite occurs in the case of students with high self-regulation who are exposed to teaching that is high in external regulation. These results allow us to analyze academic stress from an interactive approach, taking into consideration the combination of *stress factors* pertaining to the student and to the teaching process, whether they are factors of *protection* or of *vulnerability* to symptoms of *academic stress.* This is a step forward from analyzing these aspects independently, as has been done traditionally (Karaman et al., 2017). The five-level heuristic presented here allows for precise analysis and prediction at each level, from the most protective levels to the levels of most vulnerability.

This evidence, in addition to supporting the proposed hypotheses, constitutes progress in the conceptualization of academic stress, by taking an educational psychology approach. These results offer solid backing for contextualized, molar, psycho-educational models in real settings, taking us beyond a molecular-level understanding (de la Fuente et al., 2019a) of how personal variables affect stress factors and symptoms. This contribution should make us move toward a more precise, interactive conception of academic stress in the university. Indeed, self-regulation is a personal protective factor against academic stress in the university setting, and the lack of self-regulation is a risk factor for it. However, the lack of external regulation, likewise, is a contextual risk factor for academic stress, while external regulation is a contextual protective factor for stress. It therefore makes little sense to evaluate only one part of this binomial. If students with a low level of self-regulation perceive more stress factors inherent in the teaching process and, consequently, experience more stress symptoms, any innovation in teaching design must take into account the teaching process itself as a *protective* or *risk* factor.

## Limitations and Future Directions

Despite the evidence offered, the present study has several limitations which must be addressed in future research:

(1) Variability of the sample is limited because the participants included only undergraduate students taking subjects in degree programs that we were able to assess. Courses with other profiles are also offered at the university and should be the object of this evaluation in the future, in order for conclusions to be generalized. Sample size and variability can be increased by including university students majoring in different fields of study. There is also a sample limitation referring to the large majority of female participants.

(2) A methodological limitation of this study is its reliance on collecting student data by means of self-report systems. Collecting data that are based only on student perceptions can lead to limitations and biases. In the future, other assessments could be incorporated, including the perspective of the teacher giving the course, in order to compare student and teacher perceptions of the process under assessment. The instrument used here offers assessment options for both teachers and students to evaluate the same teaching–learning processes (de la Fuente et al., 2012).

(3) Finally, another aspect to be considered is the research design. Although the existing design addressed the stated objectives and is ecologically valid, in the future, other types of complementary designs for analyzing this area need to be considered, thereby obtaining other important information. A multi-method,

multi-technique evaluation system always improves research on psychological problems.

### Practical Implications for Educational Psychology

When implementing improvements in the university teaching process, we should consider what kind of context is being designed, within the framework of SRL vs. ERL theory (de la Fuente, 2017). The concept of regulatory teaching is characteristic of high levels of effective teaching (protective factor against stress), while non-regulatory or dysregulatory teaching would be typical of ineffective teaching (risk factor for stress). When the teaching context does not help regulate the student's learning, or is even dysregulatory, the student's learning process is inadequately supported, especially if students have low self-regulation. In the absence of external regulation, students must exercise even more effort to self-regulate, in order to compensate for the lack of external help. Some previous evidence has reported results consistent with this idea (Bingen et al., 2019). This view of *academic stress* is quite novel compared to the typical view where classical stress models (Folkman and Lazarus, 1984) are merely applied in a linear way to the university context. Such a linear application attempts to explain stress at university without entering into the academic processes of teaching and learning. This is nothing other than a decontextualization of the problem of academic stress. The educational psychology point of view, offered in this study, seeks to overcome this limitation.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comite de Ética University of Navarra (Spain). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JF: conceptualization, design, and data analysis. FP-S and JM-V: foundation and initial writing. PS and LZ: English revision and final writing. AG-U: revision of the general structure of the manuscript. All authors contributed to the article and approved the submitted version.

## FUNDING

This work was supported by R&D project PGC2018-094672-B-I00 (Ministry of Science and Education, Spain), UAL18 SEJ-DO31-A-FEDER (University of Almería, Spain), and the European Social Fund.

## REFERENCES

Artuch-Garde, R., González-Torres, M. D. C., de la Fuente, J., Vera, M. M., Fernández-Cabezas, M., and López-García, M. (2017). Relationship between resilience and self-regulation: a study of Spanish youth at risk of social exclusion. *Front. Psychol.* 8:612. doi: 10.3389/fpsyg.2017.00612

Azevedo, R., Moos, D. C., Greene, J. A., Winters, F. I., and Cromley, J. G. (2008). Why is externally-facilitated regulated learning more effective than self-regulated learning with hypermedia? *Educ. Technol. Res. Dev.* 56, 45–72. doi: 10.1007/s11423-007-9067-0

Berry, S. (2020). *An Assessment of Acne, Stress, and Psychological Symptoms in College Students: A Daily Diary Study*. Honors Theses, University of Mississippi, Mississippi.

Bingen, H. M., Steindal, S. A., Krumsvik, R., and Tveit, B. (2019). Nursing students studying physiology within a flipped classroom, self-regulation and off-campus activities. *Nurse Educ. Pract.* 35, 55–62. doi: 10.1016/j.nepr.2019.01.004

Bob, M. H., Popescu, C. A., Pîrlog, R., and Buzoianu, A. D. (2014). Personality factors associated with academic stress in first year medical students. *Hum. Vet. Med. Bioflux* 6, 40–44.

Bolin, R. M., Pate, M., and McClintock, J. (2017). The impact of alcohol and marijuana use on academic achievement among college students. *Soc. Sci. J.* 54, 430–437. doi: 10.1016/j.soscij.2017.08.003

Boyraz, G., Granda, R., Baker, C. N., Tidwell, L. L., and Waits, J. B. (2016). Posttraumatic stress, effort regulation, and academic outcomes among college students: a longitudinal study. *J. Counsel. Psychol.* 63, 475–486. doi: 10.1037/cou0000102

Brougham, R. R., Zail, C. M., Mendoza, C. M., and Miller, J. R. (2009). Stress, sex differences, and coping strategies among college students. *Curr. Psychol.* 28, 85–97. doi: 10.1007/s12144-009-9047-0

Browne, M. W., and Cudeck, R. (1993). "Alternative ways of assessing model fit," in *Testing Structural Equation Models*, eds K. A. Bollen, and J. S. Long (Newsbury Park, CA: Sage), 136–162.

Byrne, B. M. (1994). *Structural Equation Modeling with EQS and EQS/Windows*. Thousand Oaks, CA: Sage Publications.

Cabanach, R. G., Rodríguez, S., Valle, A., Piñeiro, I., and Millán, P. G. (2008). Metas académicas y vulnerabilidad al estrés en contextos académicos [Academic goals and vulnerability to stress in academic contexts]. *Aula abierta* 36, 3–16.

California Polytechnic State University Academic Skills Center (2020). *Stress Management*. Available at: https://asc.calpoly.edu/ssl/stressmanagement

Cassady, J. C., Pierson, E. E., and Starling, J. M. (2019). Predicting student depression with measures of general and academic anxieties. *Front. Educ.* 4:11. doi: 10.3389/feduc.2019.00011

Cavazos, J. Jr., Johnson, M. B., and Sparrow, G. S. (2010). Overcoming personal and academic challenges: perspectives from Latina/o college students. *J. Hispanic High. Educ.* 9, 304–316. doi: 10.1177/1538192710380744

Chao, R. C. L. (2012). Managing perceived stress among college students: the roles of social support and dysfunctional coping. *J. College Counsel.* 15, 5–21. doi: 10.1002/j.2161-1882.2012.00002.x

Chartier, I. S., Gaudreau, P., and Fecteau, M. (2011). From dispositional affect to academic goal attainment: the mediating role of coping. *Anxiety Stress Coping* 24, 43–58. doi: 10.1080/10615801003725360

Craig, K., Hale, D., Grainger, C., and Stewart, M. E. (2020). Evaluating metacognitive self-reports: systematic reviews of the value of self-report in metacognitive research. *Metacogn. Learn.* 1–59. doi: 10.1007/s11409-020-09222-y

de la Fuente, J. (2015). *Competence for Studying, Learning and Performance Under Stress: Self-Help Guide for University Students, Graduates and Professional Examination Candidades*. Almería: Education & Psychology I+D+I, e-Publishing Series I+D+I.

de la Fuente, J. (2017). Theory of self- vs. externally- regulated learningtm: fundamentals, evidence, and applicability. *Front. Psychol.* 8:1675. doi: 10.3389/fpsyg.2017.01675

de la Fuente, J., Amate, J., González-Torres, M. C., Artuch, R., García-Torrecillas, J. M., and Fadda, S. (2020). Effects of levels of self-regulation and regulatory

teaching on strategies for coping with academic stress in undergraduate students. *Front. Psychol.* 11:22. doi: 10.3389/fpsyg.2020.00022

de la Fuente, J., González-Torres, M. C., Aznárez-Sanado, M., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., and Vera, M. M. (2019a). Implications of unconnected micro, molecular, and molar level research in psychology: the case of executive functions, self-regulation, and external regulation. *Front. Psychol.* 10:1919. doi: 10.3389/fpsyg.2019.01919

de la Fuente, J., López, M., Zapata, L., Sollinas, G., and Fadda, S. (2015a). "Improving mental health trough and online self-assessment and self-help e-Utility in university students," in *Progress in Education*, Vol. 33, ed. R. V. Nata (New York, NY: Nova Publisher), 63–74.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Garzón-Umerenkova, A., Vera, M. M., and Paoloni, P. (2019b). Applying the SRL vs. ERL theory to the knowledge of achievement emotions in undergraduate university students. *Front. Psychol.* 10:2070. doi: 10.3389/fpsyg.2019.02070

de la Fuente, J., Sander, P., Martínez-Vicente, J. M., Vera, M. M., Garzón, A., and Fadda, S. (2017). Combined effect of levels in personal self-regulation and regulatory teaching on meta-cognitive, on meta-motivational, and on academic achievement variables in undergraduate students. *Front. Psychol.* 8:232. doi: 10.3389/fpsyg.2017.00232

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Cardelle-Elawar, M., Sander, P., Justicia, F., et al. (2012). Regulatory teaching and self-regulated learning in college students: confirmatory validation study of the IATLP scales. *Electron. J. Res. Educ. Psychol.* 10, 839–866.

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Sander, P., and Cardelle-Elawar, M. (2015b). The role of personal self-regulation and regulatory teaching to predict motivational-affective variables, achievement, and satisfaction: a structural model. *Front. Psychol.* 6:399. doi: 10.3389/fpsyg.2015.00399

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Sander, P., and Putwain, D. (2015c). "Personal self-regulation, self-regulated learning and coping strategies, in university context with stress," in *Metacognition: Fundaments, Applications, and Trends*, Vol. 76, eds A. Pena-Ayala, and L. Cardenas (London: Springer), 39–72.

Denovan, A., and Macaskill, A. (2013). An interpretive phenomenological analysis of stress and coping in first year undergraduates. *Br. Educ. Res. J.* 39, 1002–1024. doi: 10.1002/berj.3019

Di Benedetto, M., Towt, C. J., and Jackson, M. L. (2020). A cluster analysis of sleep quality, self-care behaviors, and mental health risk in australian university students. *Behav. Sleep Med.* 18, 309–320. doi: 10.1080/15402002.2019.1580194

D'Mello, S. (2013). A selective meta-analysis on the relative incidence of discrete affective states during learning with technology. *J. Educ. Psychol.* 105, 1082–1099. doi: 10.1037/a0032674

Durand-Bush, N., McNeill, K., Harding, M., and Dobransky, J. (2015). Investigating stress, psychological well-being, mental heatlh functioning, and self-regulation capacity among university undergraduates stufdents: it this population optimal functioning? *Can. J. Counsel. Psychoter.* 49, 253–274.

Fimian, M. J., Fastenau, P. A., Tashner, J. H., and Cross, A. H. (1989). The measure of classroom stress and burnout among gifted and talented students. *Psychol. Sch.* 26, 139–153. doi: 10.1002/1520-6807(198904)26:2<139::aid-pits2310260205>3.0.co;2-e

Folkman, S., and Lazarus, R. S. (1984). *Stress, Appraisal, and Coping*. New York, NY: Springer Publishing Company, 150–153.

Freire, C., Ferradás, M. M., Núñez, J. C., Valle, A., and Vallejo, G. (2018). Eudaimonic well-being and coping with stress in university students: the mediating/moderating role of self-efficacy. *Int. J. Environ. Res. Public Health* 16:48. doi: 10.3390/ijerph16010048

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., and Lüdtke, O. (2018). Emotion transmission in the classroom revisited: a reciprocal effects model of teacher and student enjoyment. *J. Educ. Psychol.* 110, 628–639. doi: 10.1037/edu0000228

Frenzel, A. C., Pekrun, R., Goetz, T., Daniels, L. M., Durksen, T. L., Becker-Kurz, B., et al. (2016). Measuring enjoyment, anger, and anxiety during teaching: the teacher emotions scales (TES). *Contemp. Educ. Psychol.* 46, 148–163. doi: 10.1016/j.cedpsych.2016.05.003

Garett, R., Liu, S., and Young, S. D. (2017). A longitudinal analysis of stress among incoming college freshmen. *J. Am. Coll. Health* 65, 331–338. doi: 10.1080/07448481.2017.1312413

Garzón-Umerenkova, A., de la Fuente, J., Martínez-Vicente, J. M., Zapata, Sevillano L, Pichardo, M. C., and García-Berbén, A. B. (2017). Validation of the spanish short self-regulation questionnaire (SSSRQ) through rasch analysis. *Front. Psychol.* 8:276. doi: 10.3389/fpsyg.2017.00276

Gentsch, K., Loderer, K., Soriano, C., Fontaine, J. R., Eid, M., Pekrun, R., et al. (2018). Effects of achievement contexts on the meaning structure of emotion words. *Cogn. Emot.* 32, 379–388. doi: 10.1080/02699931.2017.1287668

Goe, L., Bell, C., and Little, O. (2008). *Approaches to Evaluating Teacher Effectiveness: A Research Synthesis*. Washington, DC: National Comprehensive Center for Teacher Quality.

Goetz, T., Frenzel, A. C., Hall, N. C., Nett, U. E., Pekrun, R., and Lipnevich, A. A. (2014). Types of boredom: an experience sampling approach. *Motiv. Emot.* 38, 401–419. doi: 10.1007/s11031-013-9385-y

González-Cabanach, R., Souto-Gestal, A., and Fernández-Cervantes, R. (2017). Perfiles de regulación emocional y estrés académico en estudiantes de fisioterapia [Profiles of emotional regulation and academic stress in physiotherapy students]. *Eur. J. Educ. Psychol.* 10, 57–61.

González-Cabanach, R., Souto-Gestal, A., and Franco, V. (2016). Escala de Estresores Académicos para la evaluación de los estresores académicos en estudiantes universitarios [Stressor Academic Scale for the evaluation of academic stressors in undergraduates]. *Rev. Iberoamericana Psicol. Salud* 7, 41–50. doi: 10.1016/j.rips.2016.05.001

González-Cabanach, R., Souto-Gestal, A., González-Doniz, L., and Franco-Taboada, V. (2018). Perfiles de afrontamiento y estrés académico en estudiantes universitarios [Coping and academic stress profiles in university students]. *Rev. Investig. Educ.* 36, 421–433. doi: 10.6018/rie.36.2.290901

Gross, J. J. (ed.) (2008). *Handbook of Emotion Regulation*. New York, NY: Guilford.

Gross, J. J. (2014). *Handbook of Emotion Regulation*, 2nd Edn. New York, NY: Guilford.

Gross, J. J. (2015a). Emotion regulation: current status and future prospects. *Psychol. Inq.* 26, 1–26. doi: 10.1080/1047840X.2014.940781

Gross, J. J. (2015b). The extended process model of emotion regulation: elaborations, applications, and future directions. *Psychol. Inq.* 26, 130–137. doi: 10.1080/1047840X.2015.989751

Hirvonena, R., Yli-Kivistöa, L., Putwain, D. W., Ahonena, T., and Kiuru, N. (2019). School-related stress among sixth-grade students – Associations with academic buoyancy and temperament. *Learn. Individ. Diff.* 70, 100–108. doi: 10.1016/j.lindif.2019.01.012

Hu, L. T., and Bentler, P. M. (1995). "Evaluating model fit," in *Structural Equation Modeling: Concepts, Issues, and Applications*, ed. R. H. Hoyle (Thousand Oaks, CA: Sage), 76–99.

Jenkins, S. R., Belanger, A., Connally, M. L., Boals, A., and Durón, K. M. (2013). Firstgeneration undergraduate students' social support, depression, and life satisfaction. *J. College Counsel.* 16, 129–142. doi: 10.1002/j.2161-1882.2013.00032.x

Jöreskog, K. G., and Sörbom, D. (1993). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Chicago, IL: Scientific Software International.

Kamijo, N., and Yukawa, S. (2018). The role of rumination and negative affect in meaning making following stressful experiences in a japanese sample. *Front. Psychol.* 9:2404. doi: 10.3389/fpsyg.2018.02404

Karaman, M. A., Lerma, E., Cavazos, J., and Watson, J. C. (2017). Predictors of academic stress among college students. *J. College Counsel.* 22, 41–55. doi: 10.1002/jocc.12113

Khan, K. W., Ramzan, M., Zia, Y., Zafar, Y., Khan, M., and Saeed, H. (2020). Factors affecting academic performance of medical students. *Life Sci.* 1, 7–10.

Krijgsman, C., Mainhard, T., van Tartwijk, J., Borghouts, L., Vansteenkiste, M., Aelterman, N., et al. (2019). Where to go and how to get there: Goal clarification, process feedback and students' need satisfaction and frustration from lesson to lesson. *Learn. Instr.* 61, 1–11. doi: 10.1016/j.learninstruc.2018.12.005

Lardier, D. T. Jr., Lee, C. Y. S., Rodas, J. M., Garcia-Reid, P., and Reid, R. J. (2020). The effect of perceived college-related stress on depression, life satisfaction, and school satisfaction: the coping strategies of hispanic college students from a hispanic serving Institution. *Educ. Urban Soc.* 1–19. doi: 10.1177/0013124519896845

Lazarus, R. S. (1999). "The cognition-emotion debate: A bit of history," in *Book of Cognition and Emotion*, eds T. Dalgleish and M. Power (New York, NY: Whiley), 3–19.

Lekwa, A. J., Reddy, L. A., and Shernoff, E. S. (2018). Measuring teacher practices and student academic engagement: a convergent validity study. *Sch. Psychol. Q.* 34, 109–118. doi: 10.1037/spq0000268

Mainhard, T., Oudman, S., Hornstra, L., Bosker, R. J., and Goetz, T. (2018). Student emotions in class: the relative importance of teachers and their interpersonal relations with students. *Learn. Instr.* 53, 109–119. doi: 10.1016/j.learninstruc.2017.07.011

McDonald, R. P., and Marsh, H. W. (1990). Choosing a multivariate model: noncentrality and goodness of fit. *Psychol. Bull.* 107, 247–255. doi: 10.1037/0033-2909.107.2.247

Miller, W. R., and Brown, J. M. (1991). "Self-regulation as a conceptual basis for the prevention and treatment of addictive behaviours," in *Self-Control and The Addictive Behaviours*, eds N. Heather, W. R. Miller, and J. Greeley (Sydney: Maxwell Macmillan Publishing Australia), 3–79.

Moffa, K., Dowdy, E., and Furlong, M. J. (2016). Exploring the contributions of school belonging to complete mental health screening. *Educ. Dev. Psychol.* 33, 16–32. doi: 10.1017/edp.2016.8

Murphy, J. G., McDevitt-Murphy, M. E., and Barnett, N. P. (2005). Drink and be merry? Gender, life satisfaction, and alcohol consumption among college students. *Psychol. Addict. Behav.* 19, 184–191. doi: 10.1037/0893-164x.19.2.184

Páramo, M. F., Cadaveira, F., Tinajero, C., and Rodríguez, M. S. (2020). Binge drinking, cannabis co-consumption and academic achievement in first year university students in spain: academic adjustment as a mediator. *Int. J. Environ. Res. Public Health* 17:542. doi: 10.3390/ijerph17020542

Pichardo, M. C., Cano, F., Garzón-Umerenkova, A., de la Fuente, J., Peralta-Sánchez, F. J., and Amate-Romera, J. (2018). Self-regulation questionnaire (SRQ) in spanish adolescents: factor structure and rasch analysis. *Front. Psychol.* 9:1370. doi: 10.3389/fpsyg.2018.01370

Pichardo, M. C., Justicia, F., de la Fuente, J., Martínez-Vicente, J. M. Y., and García-Berbén, A. B. (2014). Factor structure of the self-regulation questionnaire (SRQ) at spanish Universities. *Span. J. Psychol.* 17:e62. doi: 10.1080/02699931.2016.1204989

Pozos-Radillo, B., Preciado-Serrano, M. D. L., Acosta-Fernandez, M., Aguilera-Velasco, M. D. L. A., and Delgado-Garcia, D. D. (2014). Academic stress as a predictor of chronic stress in university students. *Psicol. Educ.* 20, 47–52. doi: 10.1016/j.pse.2014.05.006

Putwain, D. W. (2018). An examination of the self-referent executive processing model of test anxiety: control, emotional regulation, self-handicapping, and examination performance. *Eur. J. Psychol. Educ.* 34, 341–358. doi: 10.1007/s10212-018-0383-z

Putwain, D. W., and Pescod, M. (2018). Is reducing uncertain control the key to successful test anxiety intervention for secondary school students? Findings from a randomized control trial. *Sch. Psychol. Q.* 33, 283–292. doi: 10.1037/spq0000228

Reyes-Rodríguez, M. L., Rivera-Medina, C. L., Cámara-Fuentes, L., Suárez-Torres, A., and Bernal, G. (2013). Depression symptoms and stressful life events among college students in Puerto Rico. *J. Affect. Disord.* 145, 324–330. doi: 10.1016/j.jad.2012.08.010

Roehrig, A. D., Turner, J. E., Arrastia, M. C., Chistesen, E., McElhaney, S., and Jakiel, L. M. (2012). "Effective teachers and teaching: characteristics and practices related to positive students outcomes," in *APA Educational Psychology Handbook*, Vol. 2, eds K. R. Harris, S. Graham, and T. Urdam (Washington, DC: American Psychological Association).

Rusk, R., Tamir, M., and Rothbaum, F. (2011). Performance and learning goals for emotional regulation. *Motiv. Emot.* 35, 444–460. doi: 10.1007/s11031-011-9229-6

Saklofske, D. H., Austin, E. J., Mastoras, S. M., Beaton, L., and Osborne, S. E. (2012). Relationships of personality, affect, emotional inteligence and coping with student stress and academic success: different patterns of association for stress and success. *Learn. Individ. Diff.* 22, 251–257. doi: 10.1016/j.lindif.2011.02.010

Scharp, K. M., and Dorrance, E. (2017). Examining the relationship between undergraduate student parent social support-seeking factors, stress, and somatic symptoms: a two-model comparison of direct and indirect effects. *Health Commun.* 34, 54–64. doi: 10.1080/10410236.2017.1384427

Schat, E., Kelloway, E. K., and Desmarais, S. (2005). The physical health questionnaire (PHQ): construct validation of a self-report scale of somatic symptoms. *J. Occup. Health Psychol.* 10, 363–338. doi: 10.1037/1076-8998.10.4.363

Schumacker, R. E., and Lomax, R. G. (2004). *A Beginner's Guide to Structural Equation Modeling, Second edition*. Mahwah, NJ: Lawrence Erlbaum Associates.

Selye, H. (1978). *The Stress of Life*. New York, NY: McGraw Hill.

Shannon, M., Suldo, S. M., Storey, L. D., O'Brennan, L. M., Shaunessy-Dedrick, E., Ferron, J. M., et al. (2019). Identifying high school freshmen with signs of emotional or academic risk: screening methods appropriate for students in accelerated courses. *Sch. Mental Health* 11, 210–227. doi: 10.1007/s12310-018-9297-9

Shaw, M. P., Peart, D. J., and William, O. J. (2017). Perceived stress in university students studying in a further education college. *Res. Post Comp. Educ.* 22, 442–452. doi: 10.1080/13596748.2017.1362534

Vermunt, D. H. M. (1989). "The interplay between internal and external regulation of learning, and the design of process-oriented instruction," in *Proceedings of the Conference of the European Association of Research on Learning and Instruction*, Madrid.

Vermunt, J. D. (2007). The power of teaching-learning environments to influence student learning. *Br. J. Educ. Psychol. Monogr. Ser.* 4, 73–90.

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 07 October 2020
doi: 10.3389/fpsyg.2020.543884

# Differential Effects of Self- vs. External-Regulation on Learning Approaches, Academic Achievement, and Satisfaction in Undergraduate Students

*Jesús de la Fuente[1,2]*, Paul Sander[3], Douglas F. Kauffman[4] and Meryem Yilmaz Soylu[5]*

*[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] School of Psychology, University of Almería, Almería, Spain, [3] School of Psychology, Teesside University, Middlesborough, United Kingdom, [4] Medical University of the Americas – Nevis, Devens, MA, United States, [5] University of Nebraska-Lincoln, Lincoln, NE, United States*

OPEN ACCESS

**Edited by:**
*Sung-il Kim,*
*Korea University, South Korea*

**Reviewed by:**
*Mirjam Weis,*
*Technical University of Munich, Germany*
*Yi Jiang,*
*East China Normal University, China*

***Correspondence:**
*Jesús de la Fuente*
*jdlfuente@unav.es;*
*jfuente@ual.es*

**Specialty section:**
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

**Received:** *18 March 2020*
**Accepted:** *14 September 2020*
**Published:** *07 October 2020*

**Citation:**
*de la Fuente J, Sander P, Kauffman DF and Yilmaz Soylu M (2020) Differential Effects of Self- vs. External-Regulation on Learning Approaches, Academic Achievement, and Satisfaction in Undergraduate Students. Front. Psychol. 11:543884. doi: 10.3389/fpsyg.2020.543884*

The aim of this research was to determine the degree to which undergraduate students' learning approach, academic achievement and satisfaction were determined by the combination of an intrapersonal factor (self-regulation) and a interpersonal factor (contextual or regulatory teaching). The hypothesis proposed that greater combined regulation (internal and external) would be accompanied by more of a deep approach to learning, more satisfaction and higher achievement, while a lower level of combined regulation would determine a surface approach, less satisfaction and lower achievement. Within an *ex post* facto design by selection, 1036 university students completed validated questionnaires using an online tool. Several multivariate analyses were conducted. Results showed that the combination of self-regulation and external regulation can be ordered as levels along a five-point scale or heuristic. These levels linearly determine type of learning approach, academic achievement and satisfaction. Implications are established for quality and improvement of the teaching and learning process at university.

**Keywords: undergraduate students, satisfaction, academic achievement, learning approaches, SRL vs. ERL theory**

## INTRODUCTION

The analysis of learning approaches, academic achievement and satisfaction at university, as well as their predictive factors, has been a constant in recent research in Educational Psychology (Balloo et al., 2017; Barattucci, 2017). Every university wants its students to experience good learning processes and attain high achievement and satisfaction with the educational experience; these matters impact institutional prestige and social desirability, not to mention their frequent use as criteria for assessing teaching quality (Browne et al., 1998; Elassy, 2015). Moreover, the degree of perceived satisfaction with the university forms part of the rankings that are published annually in many national and international listings (Douglas et al., 2015).

For all of the above, the choice of one model or another to explain academic achievement and the role of learning approaches is highly important in the practice of Educational Psychology at university (Green, 2014; Hazan and Miller, 2017). The present research study seeks to offer an alternative conceptual view, as well as empirical evidence to contribute to an integrated analysis of learning approaches, achievement and academic satisfaction, considering these as variables that depend on both learning and teaching processes in the formal university context (Biggs, 2001; Biggs and Tang, 2011; Barattucci et al., 2017; Kember et al., 2020).

## SELF-REGULATION (SR) AND REGULATORY TEACHING (RT) AS VARIABLES OF THE TEACHING AND LEARNING PROCESS: A HEURISTIC FOR ANALYSIS

*Self-Regulation* (SR) has been defined as an intrapersonal (individual) variable that allows people to manage their decisions, making it possible for them to plan, exercise control over such decisions, and evaluate their effects (Brown, 1998). In psychology research on health and academic well-being, SR has been considered a variable at the molecular level (de la Fuente et al., 2019a). It is predictive of various specific regulatory behaviors, such as coping strategies (de la Fuente et al., 2019b) or achievement emotions (de la Fuente et al., 2020b,c). In the realm of educational psychology, it has been conceptualized as a meta-behavioral, student variable (presage), predictive of Self-Regulated Learning (process variable), achievement and academic satisfaction (product variables). Previous research has consistently established these relationships (Dinsmore et al., 2008; Kaplan, 2008; Antonelli et al., 2020). Thus, self-regulation (SR) as a personal variable may be considered a precursor to Self-Regulated Learning (SRL) (de la Fuente et al., 2008, 2015b).

*Regulatory teaching* (RT) has been defined as a contextual variable, referring to the degree to which the teaching process promotes and externally favors students' SRL. It has been conceptualized as a meta-instructional variable; regulatory teaching encourages self-regulation in students and is characteristic of *effective teaching*. There have been many approaches to effective teaching in the research (for a review, see Goe et al., 2008; Baeten et al., 2013; Karagiannopoulou and Milienos, 2015). Empirical research identifies high quality teachers as those who positively influence their students' engagement with learning activities, as well as students' performance in learning (self-regulation, social competencies, academic achievement). Mediating factors in student performance must be considered (Roehrig and Chistesen, 2010): (1) Organization of the content and activities; (2) Planning for the majority of the class; (3) Encouraging deep processing and self-regulation. Recent research has shown that variables of the perceived classroom learning environment were good predictors of students' self-regulation. Moreover, teacher variables (effective teaching) were found to be directly related to students' self-regulation, and there were moderate relationships between learning environment and self-regulation variables (Kossak, 2019; Yerdelen and Sungur, 2019).

The theory of *Self-Regulated vs. Externally Regulated Learning, SRL vs. ERL* (de la Fuente, 2017) has attempted to identify and organize the different real-life combinations that result from the interaction between different types of university students and teachers (Azevedo et al., 2008). Specifically, this theory suggests that during any teaching-learning process, we find different levels of student self-regulation (low-medium-high) in combination with different levels (low-medium-high) of regulatory teaching. Consequently, a heuristic with five possible combination ranks has been put forward (see **Table 1**). This heuristic of combinations has been successfully evaluated in reference to the effect of its regulation levels on university students' achievement emotions (de la Fuente et al., 2019b) and their coping strategies (de la Fuente et al., 2020b). However, its effect on learning approaches, satisfaction and achievement has yet to be reported, and this is the aim of the present research study.

The Vermunt model (Vermunt, 1998; Vermunt and van Rijswijk, 1988), similar in part to SRL vs. ERL Theory (op cit., 2017), distinguished between three different strategies of regulation: self-regulation, external regulation and lack of regulation of learning (Lindblom-Ylänne et al., 2011):

(1) *Self-Regulated Learning*: referring to what students do to plan and monitor their learning activities, diagnose the cause of any problems that occur while learning, and progress toward the learning goals they have set for themselves. This definition is similar to other definitions or theories of learning, such as Winne (1995), Winne and Hadwin (1997), or Zimmerman (1998, 2000), who defined self-regulated learning as the systematic effort to direct one's thoughts, feelings and actions toward meeting academic goals. Biggs (1985) used the term meta-learning to describe the state of being aware of and exercising self-control over one's own learning.

Self-Regulated Learning vs. ERL Theory (de la Fuente, 2017) uses an identical concept of SRL, while also assuming that a prior variable (SR) may be what determines the level of SRL during learning. Self-regulated learning is assumed to be present at three levels: adequate, non-existent and low.

(2) *External Regulation of Learning*: External regulation refers to situations where students depend on a teacher's guidance and control (or a text book, or classmates) to regulate learning processes. In this model, the teacher takes on the regulatory activities of the students.

In SRL vs. ERL Theory (2017), however, external regulatory actions are designed to assist and promote students' internal self-regulation–not to exercise external control over them. As such, this type of external regulation may be present at three levels: high or adequate, non-existent, or low. The concept identified as external regulation in Vermunt's model would be considered a dysregulatory context in the SRL vs. ERL model, because it encourages a lack of internal self-regulation.

(3) *Lack of regulation:* This refers to certain students' difficulty in regulating their own learning processes. In the SRL vs. ERL

**TABLE 1 |** Heuristic of five combinations of the *Utility Model*™ hypothesized by *SRL* vs. *ERL Theory* (de la Fuente, 2017).

| *Combination Level* | | *Regulation* | *Regulation Trend* | *Learning* Approaches* | | *Academic.* | *Satisfact.* |
|---|---|---|---|---|---|---|---|
| **SR Level (range)** | **RT Level (range)** | ***aver/rank*** | | **Deep** | **Surface** | ***Achiev.**** | ***T & L**** |
| **3** (3.85–5.00)**H** | **3** (2.84–5.00) **H** | 3.0/**5** | **High-High:** *High-Regulation* | ++ | – | *H* | *H* |
| **2** (3.10–3.84)**M** | **3** (2.84–5.00) **H** | 2.5/**4** | **Medium-High**: *Regulation* | + | – | *M-H* | *M-H* |
| **3** (3.85–5.00)**H** | **2** (2.35–2.83) **M** | 2.5/**4** | **High-Medium**: *Regulation* | + | – | *M-H* | *M-H* |
| **2** (3–10–3.84)**M** | **2** (2.35–2.83) **M** | 2.0/**3** | **Medium:** *Non-Regulation* | = | = | *M* | *M* |
| **2** (3.10–3.84)**M** | **1** (1.00–2.34) **L** | 1.5/**2** | **Medium-Low**: *Dys-Regulation* | – | + | *M-L* | *M-L* |
| **1** (1.00–3.09) **L** | **2** (2.35–2.83) **M** | 1.5/**2** | **Low-Medium**: *Dys-Regulation* | – | + | *M-L* | *M-L* |
| **1** (1.00–3.09) **L** | **1** (1.00–2.34) **L** | 1.0/**1** | **Low-Low:** *High Dys-Regulation* | – | ++ | *L* | L |

*SR Level, Self-Regulation level (1–3 range); RT Level, Regulatory Teaching level (1–3 range); H, High level; M, Medium level; L, Low level; ++high amount of this type of learning approach; – low amount of this type of learning approach; =, medium amount of this type of learning approach; Academic Achiev., Academic achievement; Satisfact. T & L, Satisfaction with Teaching and Learning process. *Effects analyzed in this investigation. Please see and analyze the differences with previously research reports (de la Fuente et al., 2019b, p. 12; de la Fuente et al., 2020a, p. 5).*

model (2017), these students' level of self-regulation would be categorized as non-regulatory or dysregulatory.

## LEARNING APPROACHES (LA) AS A VARIABLE IN THE TEACHING AND LEARNING PROCESS

The *SAL model,* Student Approaches to Learning (Marton, 1976; Biggs, 1979; Entwistle et al., 1979; Richardson, 2015; Fryer and Ginns, 2017) established the concept of *learning approaches* (deep vs. surface) as a student variable, with a great amount of empirical evidence (for a review, see Asikainen and Gijbels, 2017). Biggs (1988) defined learning approaches as learning processes that emerge from students' perceptions of academic tasks, influenced by their personal characteristics. Learning approaches are characterized by the influence of metacognitive processes as a mediating element between the students' intention or motive and the learning strategy they use in order to study. Biggs indicated two different levels of study in approaches to learning: one is more specific and directed toward a concrete task (a surface approach seen as a process used to pass exams) and the other is more general (a deep approach seen as the motivation to understand). Previous research has associated this variable of learning approaches with learning conceptions (Monroy and González-Geraldo, 2018), with motivational-affective and personal factors (Trigwell et al., 2012; de la Fuente et al., 2013b; Cetin, 2015; Karagiannopoulou et al., 2018), and even with lifelong learning (Barros et al., 2012).

Although fewer in number, other studies have reported its relationship to the teaching process (Vermunt, 1998; Marton et al., 2005; Ruohoniemi et al., 2010). Nonetheless –based on the original conceptualization of this construct– it seems plausible that students' learning approaches depend on both intra-subject (individual) factors and between-subject (contextual) factors, considering that the nature of the variable is quite subjective, sensitive to diverse influences that stem from the student's own characteristics as well as from the teacher and from the teaching context (for a review, see Vermunt and Donche, 2017). Consequently, if we assume that the teaching process –teaching approach– affects and has a determining influence on how the student learns –learning approach– (Trigwell et al., 1999), especially in formal contexts, then approaches to learning becomes a variable within the teaching-learning process, not something that pertains only to the student who is learning (Entwistle and Ramsden, 1983; Vermunt and Verloop, 1999; Entwistle et al., 2002, 2003; Vermunt, 2007; Entwistle, 2009, 2018; Parpala et al., 2010; Biggs and Tang, 2011; Baeten et al., 2015). This approach, however, has not been addressed as much as one would expect. In the words of certain authors: "Thus, the effect of the teaching-learning environment is not taken into account so much, despite the largely accepted theoretical assumption in the SAL tradition that students' approaches to learning are not stable but change as a result of the interaction between the contextual aspects of the learning environment and the characteristics of the learners" (Asikainen and Gijbels, 2017; p. 228). The present study, therefore, adopts this more comprehensive view of student approaches to learning, in the context of teaching and learning processes.

## ACADEMIC ACHIEVEMENT AND ACADEMIC SATISFACTION AS VARIABLES OF THE TEACHING AND LEARNING PROCESS

### Academic Achievement as a Variable of the Teaching and Learning Process

The classic psychological view of analyzing *academic achievement* has sought to assess the relative weight of students' individual psychological factors of different types, observing the weight of personal variables, cognitive variables, and motivational-affective variables, as well as others that are psychosocial or contextual (for a meta-analysis review, see Richardson et al., 2012). The educational psychology perspective has led researchers to establish the role of individual psychological factors within a contextualized, specific learning process. There is a great amount of recent research in this regard (Wibrowski et al., 2016; Köller

et al., 2019; Nabizadeh et al., 2019), with marked influence from the satisfaction variable, a variable of positive experience and emotionality, in the academic setting (Vanno et al., 2014).

As in the case of learning approaches (LA), there have also been efforts to contextualize achievement within the teaching and learning process (Vermunt, 1998; Biggs and Tang, 2011; Scevak et al., 2015). This approach assumed that academic achievement is determined by variables from both the teaching process and the learning process–taken in combination. In other words, it is not only a matter of the student's individual variables. Nonetheless, the prevailing view has been to emphasize student variables, assuming that the teaching process has a contextualized role with lesser weight. While this view, which leans heavily toward factors of the learner and is not interrelational with the teaching process, may be adequate in an individual context of learning, it seems unfitted to explaining phenomena in a *formal teaching-learning context*. Hence, while it is true that certain studies have analyzed the role of effective teaching factors in the process of learning and achievement (de la Fuente et al., 2017), a systematic demonstration of the possible combinations of students' learning characteristics and the teacher's teaching characteristics is yet to be established. Some prior studies have taken this direction, with encouraging results (de la Fuente et al., 2011). Fewer research studies have documented the role of the *teaching process* as a contributing factor to university students' academic achievement, despite the fact that most universities assess students' degree of satisfaction with the teaching process either explicitly or implicitly (Douglas et al., 2015).

*Academic achievement* as a variable has been conceptualized differently. Its classic conceptualization is that of grade point average. Today's model of achievement, however, is based on the concept of *competence acquisition* (Gagné, 1965) and has prompted consideration of academic achievement as a multidimensional variable that includes acquisitions that are conceptual (facts, concepts and principles), procedural (skills and meta-skills), and *attitudinal* (attitudes, values, and habits) (Roe, 2003; de la Fuente et al., 2004).

## Academic Satisfaction as a Variable of the Teaching and Learning Process

Academic satisfaction with the teaching-learning process has been conceptualized as the emotional or attitudinal element of achievement (Biggs, 2001); it addresses the degree that students' expectations are met, and how well the process responds to their needs. This variable has been repeatedly considered as an element reflecting the quality of the experience. For example, Bobe and Cooper (2017) defined the category of student *satisfaction with the experience* using five components: teaching quality, learner engagement, learning resources, student support, and skills development. In their sample, Rubin et al. (2018) found that older female students showed the most deep learning, and this effect explained their greater satisfaction with their degree program.

Increasing importance is being given to degree satisfaction (or student satisfaction) for at least two reasons. First, satisfaction predicts student persistence (for a review, see Schertzer and Schertzer, 2004); low satisfaction is an early sign of potential student attrition. Second, satisfaction is a key factor in the rankings of universities, which are commonly used in marketing and funding exercises. Previous findings have shown an association between a deep learning approach and greater satisfaction with teaching and learning environments and methods (Parpala et al., 2010; Gurpinar et al., 2013). Thus, the present study seeks to further our understanding of academic satisfaction, conceptualized as the result of a combination of personal and contextual factors pertaining to the process of teaching and learning.

# AIMS AND HYPOTHESES

Based on prior theoretical foundations and previous empirical research, the following *objectives* were identified: (1) to establish whether the university students' regulation levels (intrapersonal variable) and the regulatory levels of the teaching received (contextual variable), independently, determined their type of learning approach and their academic achievement and satisfaction; (2) to determine whether these levels taken jointly, as described in the combination model proposed by the theory, were associated with the type of learning approach used, academic achievement and satisfaction. Based on these objectives, our *hypotheses* established that: (1) a *graded increase in level of regulation* (internal and external) would give rise to an increase in deep learning approach, and a decrease in surface approach; by contrast, a *graded decrease in level of regulation* (internal and external) would give rise to an increase in surface learning approach and a decrease in deep approach; (2) a *graded increase in level of regulation* (internal and external) would give rise to an proportionate increase in total achievement and in its three subtypes (conceptual, procedural, and attitudinal), and in satisfaction; a *graded decrease in level of regulation* (internal and external) would give a proportionate decrease in total achievement and in its three subtypes (conceptual, procedural, and attitudinal) and satisfaction.

# MATERIALS AND METHODS

## Participants

A total sample of 1036 undergraduate students from two universities of Spain participated in this research. The sample was composed of students enrolled in degree programs in Psychology and Education (Primary Education); 65.7% were women and 34.3% were men. Their ages ranged from 19 to 25, with a mean age of 21.33 ($\sigma_x = 6.9$) years.

## Instruments

### Self-Regulation

This variable was measured using the *Short Self-Regulation Questionnaire* (*SSRQ*) (Brown, 1998; Brown et al., 1999). It has already been validated in Spanish samples (Pichardo et al., 2014; Garzón-Umerenkova et al., 2017). The SSRQ is composed of four factors and 17 items with a consistent confirmatory factor

structure (Chi-Square = 250.83, *df* = 112, CFI = 0.95, GFI = 0.94, AGFI = 0.96, RMSEA = 0.059). It has acceptable validity and reliability values as measured by Cronbach's alpha [total (α = 0.86; Omega = 0.843); goal setting-planning (α = 0.79; Omega = 0.784), perseverance (α = 0.78; Omega = 0.779), decision making (α = 0.72; Omega = 0.718), and learning from mistakes (α = 0.72; Omega = 0.722)], similar to the English version. Sample items include: "I usually keep track of my progress toward my goals," "When it comes to deciding about a change, I feel overwhelmed by the choice," and "I learn from my mistakes."

### Regulatory Teaching

*The Scales for Assessment of the Teaching-Learning Process, ATLP, student version* (de la Fuente et al., 2012) were used to evaluate the perception of the teaching process in students. The scale entitled *Regulatory Teaching* is Dimension 1 of the confirmatory model. IATLP-D1 comprises 29 items structured along five factors: Specific regulatory teaching, regulatory assessment, preparation for learning, satisfaction with the teaching, and general regulatory teaching. The scale showed a factor structure with adequate fit indices (Chi-Square = 590.626; *df* = 48, $p < 0.001$, CF1 = 0.958, TLI = 0.959, NFI = 0.950, NNFI = 0.967; RMSEA = 0.068) and adequate internal consistency [IATLP 1 Scale (α = 0.830; Omega = 0.821), and the subscales: Specific regulatory teaching (α = 0.897; Omega = 0.852); regulatory assessment (α = 0.883; Omega = 0.876); preparation for learning (α = 0.849; Omega = 0.835); satisfaction with the teaching, (α = 0.883; Omega = 0.861), and general regulatory teaching, (α = 0.883; Omega = 0.858)]. Sample items include: "While we are learning the teacher help us to make clear realistic learning goals," "The teacher explains the objetives of activities we are going to carry out," or "The teacher make the class enjoyable."

### Learning Approaches

This was measured with the Revised Two-Factor Study Process Questionnaire, R-SPQ-2F (Biggs et al., 2001), in its Spanish validated version (Justicia et al., 2008). It contains 20 items on four subscales (deep motive, deep strategy; surface motive, surface strategy), measuring two dimensions: deep and surface learning approaches, respectively. Students respond to these items on a 5-point Likert-type scale ranging from 1 (rarely true of me) to 5 (always true of me). In the present study Cronbach's alpha reliability coefficients were acceptable: Deep (α = 0.793; Omega = 0.782); Surface (α = 0.751; Omega = 0.721). Sample items include: "I find that at times studying gives me a feeling of deep personal satisfaction," "My aim is to pass the course while doing as little work as possible," "I find that studying academic topics can at times be as exciting as a good novel or movie."

### Academic Achievement

Assessment of achievement was based on the academic-professional competency model (Roe, 2003). Total achievement was measured as the final grade given to the student for the subject, on a scale of 1 to 10. The 10 points are a compendium of results obtained on the three levels of subcompetencies: (1) *Conceptual* scores: these include all scores obtained on exams covering the conceptual content of the subject (4 points); (2) *Procedural* scores: assessed from the student's practical work involving procedural content and skills (4 points); (3) *Attitudinal* scores: scores given for class participation, and for doing optional activities to reach a better understanding of the material (2 points). In the latter case, there were 10 class activities that were turned in at the end of class; the mean of the 10 scores obtained was converted proportionately to a score on the 0−2 point range. Since the three subcompetencies were measured on different ranges (0−4 points, 0−2 points), their scores were converted to an equivalent scale from 1 to 10 in order to perform the different analyses and compare the results.

### Satisfaction With Teaching and Learning

*The Scales for Interactive Assessment of the Teaching-Learning Process,* IATLP, student version (de la Fuente et al., 2012) were used to evaluate students' perception of the teaching process. The scale entitled *Satisfaction of teaching and Learning* is Dimension 3 of the confirmatory model (IATLP-D3). This sub-scale comprises 10 items structured along two factors. The scale was validated in university students and showed a factor structure with adequate fit indices (Chi-Square = 590.626; *df* = 48, $p < 0.001$, CF1 = 0.938, TLI = 0.939, NFI = 0.950, NNFI = 0.967; RMSEA = 0.058) and adequate internal consistency [IATLP D3 (α = 0.85; Omega = 0.831); *Satisfaction with learning process* (α = 0.86; Omega = 0.831); and *Satisfaction with teaching process* (α = 0.87; Omega = 0.861)]. Sample items include: "I am satisfied with the way my teacher has carried out the teaching" and "I am satisfied with the way I have learned."

## Procedure

Students voluntarily completed the scales using an online platform (de la Fuente et al., 2015a). A total of fifteen specific teaching-learning processes were evaluated, each pertaining to a specific university subject that was taught within a 2-year academic period. *Presage* variables (Self-regulation, SR) were evaluated in September-October of 2017 and of 2018, *Process* variable (learning approaches, LA) in February-March of 2017 and of 2018, and *Product* variables (regulatory teaching, satisfaction with teaching and learning process, and academic achievement) in May-June of 2017 and of 2018. Achievement was reported by the teacher, based on the academic grades that students obtained at the end of the school year. In all cases, scores had been assigned for the three types of subcompetencies (conceptual, procedural, and attitudinal). Cases were eliminated if any of these scores were lacking.

At each university, teachers were invited to participate in the research project; once they agreed, they in turn invited the participation of their students. Each group of students evaluated only one teacher and the teaching-learning process of one full-year academic subject. The teachers and students received a certificate acknowledging their hours of participation in the project. In no case was any academic credit given for participation. The procedure was approved by the respective

Ethics Committees at each university, in the context of the two R & D Projects (see Funding).

## Data Analysis

### Design

An *ex post* facto design was used. There was no intervention of any kind in the teaching-learning processes assessed. Only pre-existing variables were evaluated.

### Previous Analysis

Preliminary analyzes were carried out to detect different problems in the sample data. About the potential outliers in the data, univariate outliers were identified by checking standardized scores on any variables which were outside the absolute value of 3.29 (Tabachnick and Fidell, 2013). Complementary, to detect multivariate outliers, Mahalanobis distance (MD) for the predictor variables were used, which is the distance of a data point from the centroid shaped by the cloud of the majority of data points (Mahalanobis, 1930). In this process, 21 cases were eliminated. Regarding the reliability of the scales used, the omegaH index has been recalculated; for those multidimensional variables, it is essential to provide model-based reliability (for both general factor and specific sub-factors) rather than simply reporting Alpha (Reise et al., 2012).

### Operationalization of Self- vs. External- Regulation

Using cluster analysis, continuous independent variables were converted into discrete, dependent variables, producing three levels (low-medium-high) for self-regulation and regulatory teaching, respectively. The centroids of low, medium, and high scoring groups were calculated in each variable. Next, we determined the cutoff points between scores. In this way, we established the score ranges for low (L), medium (M), and high (H) (see **Table 1**, on the left, in boldface).

### Inferential Analyses

Different ANOVAs and MANOVAs were carried out, taking high/medium/low levels of SR and RT as independent variables. First, we performed 3 × 1 (simple) and 3 × 3 (cross) analyses.

### A Heuristic of Regulation Combinations for the Teaching and Learning Process

Finally, the MANOVA (5 × 1) showed statistically significant differences in the levels of variables SR and RT among the five groups, showing them to be adequately configured. This procedure was similar to that used in other previous reports (de la Fuente et al., 2019b, p. 12; de la Fuente et al., 2020a, p. 5). The multivariate analyses (MANOVAs) showed a statistically significant main effect of the five combination types on low-medium-high levels of SR and of RT (see **Table 1**):

*Combination* 1 presented a statistically significant low level in SR and low level in RT (*1 and 1 levels*). The effects are a high level of surface approach, low level of deep approach, low level of achievement, and low level of satisfaction.

*Combination* 2 had a statistically significant low level in SR and medium level in RT, or viceversa (*1 and 2, or 2 and 1 levels*). The effects are a medium-high level of surface approach, medium-low level of deep approach, medium-low level of achievement, and medium-low level of satisfaction.

*Combination* 3 presented a statistically significant medium SR level (*2*) and medium RT level (*2 and 2 levels*). The effects are a medium level of surface approach, medium level of deep approach, medium level of achievement, and medium level of satisfaction.

*Combination* 4 had a statistically significant medium level in *SR* and high level in *RT,* or viceversa (*2 and 3,* or *3 and 2 levels*). The effects are a medium-high level of deep approach, medium-low level of surface approach, medium-high level of achievement, and medium-high level of satisfaction.

*Combination* 5 presented statistically significant high SR and high RT (*3 and 3 levels*). The *average regulation level is 3.0, and its regulation rank is 5*. The effects are a high level of deep approach, low level of surface approach, high level of achievement, and high level of satisfaction.

The proposed five-combination heuristic enables us to analyze all the most common combinations found in the interactive regulation of teaching-learning processes. A *regulation average* is obtained from the student-teaching interaction by calculating the mean of the student's regulation level and the regulation level of the teaching process. For example, if the student has a low level of regulation (1 point), and the teaching offers a medium level of regulation (2 points), the resulting regulation average will be 1.5 points (2 + 1 = 3/2 = 1.5 point average). Inversely, a student with medium regulation (2 points) and a teaching process low in regulation (1 point) would result in the same regulation average (2 + 1 = 3/2 = 1.5 average points). In another case, if a student has a high level of regulation (3 points) and interacts with teaching that is low in regulation (1 point), the regulation average will be 2 points (3 + 1 = 4/2 = 2 points). The student-teaching interaction increases from the least favorable to the most favorable: the minimum combination of low student regulation (1 point) with teaching low in regulation (1 point), to a maximum combination of high student regulation (3 points) with highly regulatory teaching (3 points). The heuristic then orders all the possible combinations according to their regulation average, assigning to them a *regulation rank* (regulation average of 1 = rank 1; regulation average of 1.5 = rank 2; regulation average of 2 = rank 3; regulation average of 2.5 = rank 4; regulation average of 3 = rank 5).

# RESULTS

## Interdependent Effects of Levels of Personal Self-Regulation (SR) and Levels of Regulatory Teaching (RT) on Learning Approaches, Academic Achievement, and Satisfaction

### Effects on Dimensions and Factors of Learning Approaches (LA)

There was a statistically significant main effect of *Self-Regulation* (SR) on the two dimensions of learning approach (LA):

Deep Approach and Surface Approach. The effect of SR (low-medium-high levels) was statistically significant for both deep approach and surface approach. A higher level of SR determined a higher level of deep approach and a lower level of surface approach. Complementarily, a lower level of SR determined a lower level of deep approach and a higher level of surface approach. See **Table 2** (first part of the table, on the left).

Complementarily, there was a statistically significant main effect of SR (low-medium levels) on learning approach factors. The partial effect of SR (low-medium-high levels) was statistically significant for the factors of deep motivation, deep strategy, surface motivation, and surface strategy. A higher level of SR determined a higher level of the factors deep motivation and deep strategy, and a lower level of surface motivation and surface strategy. A lower level of SR determined the opposite case, that is, a lower level of deep motivation and deep strategy, and a higher level of surface motivation and surface strategy. See **Table 2** (first part of the table, on the left) and **Table 3**.

There was a statistically significant main effect of *Regulatory Teaching* (RT) (low-medium-levels) on Learning Approach dimensions. The partial effect of RT (low-medium-high levels) was statistically significant for both deep approach (DA) and surface approach (SA). Thus, a higher level in regulatory teaching determined a higher level in DA and a lower level in SA; by contrast, a lower level in RT determined a higher level in SA and lower level in DA. Complementarily, there was a statistically significant main effect of RT (low-medium levels) on learning approach factors. The partial effect of RT (low-medium-high levels) was statistically significant for the factors of deep motivation (DM), deep strategy (DS), surface motivation (SM), and surface strategy (SS). Accordingly, a higher level of RT determined a higher level of DM and DS, and lower levels of SM and SS. By contrast, lower levels of RT determined higher levels of SM and SS and lower levels of DM and DS. See **Table 2** (first part of the table, on the right) and **Table 3**.

### Effects on Academic Achievement (ACH) and Satisfaction (SAT)

There was a statistically significant main effect of SR (low-medium levels) on total academic achievement (ACH). A higher level of SR determined a higher total achievement score, and a lower level did the opposite. Complementarily, there was a statistically significant main effect of SR (low-medium levels) on the ACH factors. The partial effect of SR (low-medium-high levels) was statistically significant for the factors of *conceptual achievement, procedural achievement*, and *attitudinal achievement*. In other words, a higher score in SR determined a higher level in the three types of achievement. Complementarily, there was a statistically significant effect of SR (*low-medium levels*) on *academic satisfaction* (*SAT*). In similar fashion, a higher level of SR determined a higher level of SAT, and a lower level did the opposite. See **Table 2** (second part, on the left), **Table 3**, and **Figures 1**, **2**.

There was a statistically significant main effect of RT (low-medium levels) on total ACH. A higher level in RT determined a higher level in ACH. Complementarily, there was a statistically significant main effect of RT (low-medium levels) on the ACH factors. The partial effect of RT (low-medium-high levels) was statistically significant for the factors of *conceptual achievement*, *procedural achievement*, and *attitudinal achievement*. A high level of RT, therefore, was a determinant of higher levels in all three types of achievement. Complementarily, a statistically significant effect of RT (low-medium-levels) was noted in *academic satisfaction*. Thus, a higher level of RT determined a higher level of SAT. See **Table 2** (second part), **Table 3**, and **Figures 1**, **2**.

It is important to emphasize that interaction effects between SR and RT were not produced, but main effects from each variable independently, making an additive effect. The following section documents this summative effect using the combination heuristic.

## Combination Heuristic of SR vs. ER: Understanding Its Effect on Learning Approaches, Academic Achievement, and Satisfaction

### Effects of the Combination Heuristic on Learning Approaches

A statistically significant main effect of the *five combinations of SR and RT* was observed in learning approaches (LA). In the dimensions of deep approach (DA) [5 > 4 > 3 > 2,1] and surface approach (SA) [1,2 > 3 > 4,5], a significant statistical effect also appeared, but in opposing directions. These results show that higher levels of the heuristic combination determined higher levels of DA and lower levels of SA; by contrast, lower levels of the combination heuristic determined lower levels of DA and higher levels of SA. See **Figure 1** and **Table 4**.

The statistically significant partial effect was maintained for each factor: deep motivation (DM) [5,4 > 3,2 > 1] and deep strategies (DS) [5,4 > 3,2 > 1], surface motivation (SM) [1,2 > 3 > 4,5], and surface strategies (SS) [1,2 > 3 > 4,5]. High levels of the heuristic determined high levels in DM and DS, as well as low levels in SM and SS; however, low levels of the heuristic determined low levels in DM and DS, as well as high levels in SM and SS. See **Figure 3** and **Table 4**. A graphic representation of the differential progressive effect of the combinations of SR and RT levels is shown in **Figure 3**.

## Effects of the Combination Heuristic on Academic Achievement and Satisfaction

A statistically significant main effect of the five *combinations of IVs SR and RT* was noted on *total achievement* [5 > 4, 3 > 2,1]. The statistically significant partial effect was maintained for each factor: *conceptual achievement* [5,4 > 3,2 > 1], *procedural achievement* [5 > 4 > 3,2 > 1], and *attitudinal achievement* [5,4 > 3 > 2,1]. Complementarily, a statistically significant main effect of the *five combinations of the IVs SR and RT* was noted on *satisfaction* [5 > 4 > 3 > 2 > 1]. See **Figure 4** and **Table 4**.

**TABLE 2 |** Simple interdependent relations of low-medium-high levels of *Self-Regulation* (SR) and of *Regulatory Teaching* (RT), as independent variables, on *Learning Approaches* (*n* = 1209).

| ***DVs*** | ***VI Self-Regulation level (SR)*** | | | | ***F(Pillai's)*** | ***Post hoc*** | ***VI. Regulatory Teaching level (RT)*** | | | | ***F(Pillai's)*** | ***Post hoc*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1. *Low* (*n* = 321)** | **2. *Medium* (*n* = 553)** | **3. *High* (*n* = 335)** | ***Mean* (*n* = 1209)** | | | **1. *Low* (*n* = 198)** | **2. *Medium* (*n* = 495)** | **3. *High* (*n* = 343)** | **(*n* = 1036)** | | |
| *LA Dimensions* | | | | | $F(4,1926) = 31.685^{**}$, $n^2 = 0.089$, | $p = 1.0$ | | | | | $F(4, 1924) = 8.820^{**}$, $n^2 = 0.030$, | $p = 1.0$ |
| DA | 2.71 (0.54) | 2.94 (0.56) | 3.28 (0.58) | 2.97 (0.60) | $F(2, 963) = 35.611^{**}$, $n^2 = 0.123$, | 1 < 2 < 3 | 2.80 (0.58) | 2.88 (0.54) | 3.16 (0.64) | 2.94 (0.60) | $F(2, 963) = 16.381^{**}$, $n^2 = 0.050$, | 1,2 < 3 |
| SA | 2.44 (0.58) | 2.16 (0.54) | 1.89 (0.54) | 2.16 (0.59) | $F(2, 963) = 49.828^{**}$, $n^2 = 0.094$, | 1 > 2 > 3 | 2.26 (0.62) | 2.20 (0.55) | 2.06 (0.61) | 2.16 (0.59) | $F(2, 963) = 2.735^{**}$, $n^2 = 0.006$, | 1, 2 > 3 |
| *LA Factors* | | | | | $F(8,1922) = 16.594^{**}$, $n^2 = 0.065$, $p = 1.0$ | 1 > 2 > 3 | | | | | $F(8,1922) = 4,704^{**}$, $n^2 = 0.032$, | $p = 1.0$ |
| DM | 2.84 (0.60) | 3.12 (0.60) | 3.43 (0.63) | 3.13 (0.65) | $F(2, 963) = 30.524^{**}$, $n^2 = 0.060$, | 1 < 2 < 3 | 2.94 (0.65) | 3.06 (0.61) | 3.23 (0.65) | 3.12 (0.65) | $F(2, 963) = 14.957^{**}$, $n^2 = 0.030$, | 1 < 2 < 3 |
| DS | 2.59 (0.63) | 2.75 (0.64) | 3.13 (0.65) | 2.81 (0.67) | $F(2, 963) = 27.533^{**}$, $n^2 = 0.054$, | 1 < 2 < 3 | 2.66 (0.67) | 2.71 (0.62) | 3.00 (0.72) | 2.80 (0.68) | $F(2, 963) = 11.634^{**}$, $n^2 = 0.024$ | 1,2 < 3 |
| SM | 2.09 (0.64) | 1.82 (0.56) | 1.58 (0.53) | 1.83 (0.60) | $F(2, 963) = 39.925^{**}$, $n^2 = 0.077$, | 1 > 2 > 3 | 1.93 (0.66) | 1.85 (0.67) | 1.72 (0.71) | 1.82 (0.80) | $F(2, 963) = 3,345^{**}$, $n^2 = 0.024$ | 1,2 > 3 |
| SS | 2.80 (0.48) | 2.49 (0.64) | 2.20 (0.65) | 2.49 (0.48) | $F(2, 963) = 41.188^{**}$, $n^2 = 0.080$, | 1 > 2 > 3 | 2.59 (0.72) | 2.54 (0.74) | 2.40 (0.70) | 2.50 (0.66) | $F(2, 963) = 1.514^{**}$, $n^2 = 0.003$ | 1, 2 > 3 |
| ***DVs*** | ***Self-Regulation*** | | | | | | ***Regulatory Teaching*** | | | | ***F (Pillai's Trace)*** | ***Post hoc*** |
| | **1. Low (*n* = 193)** | **2. Medium (*n* = 340)** | **3. High (*n* = 257)** | **Average (*n* = 790)** | | | **1. Low (*n* = 150)** | **2. Medium (*n* = 321)** | **3. High (*n* = 216)** | **Average (*n* = 687)** | | |
| **Achievement** | | | | | | | | | | | | |
| Total | 2.91 (1.2) | 3.16 (0.1.2) | 3.60 (1.3) | 3.24 (1.2) | $F(2,632) = 7.024^{**}$, $n^2 = 0.022$, $p = 0.98$; $F(6,1262) = 4.763^{**}$, $n^2 = 0.034$, pow = 1.0 | 1 < 2 < 3 | 2.55 (1.2) | 3.20 (1.2) | 3.70 (1.2) | 3.22 (1.3) | $F(2,637) = 22.880^{**}$, $n^2 = 0.067$, pow = 1.0; $F(6,1262) = 4.470^{**}$, $n^2 = 0.021$, power = 0.98 | 1 < 2 < 3 |
| Conceptual | 2.88 (0.73) | 3.06 (0.70) | 3.32 (0.69) | 3.10 (0.72) | $F(2, 787) = 22.101^{**}$, $n^2 = 0.053$, | 1 < 2 < 3 | 2.86 (0.76) | 3.08 (0.65) | 3.31 (0.62) | 3.10 (0.74) | $F(2,632) = 8.498^{**}$, $n^2 = 0.026$, | 1 < 2 < 3 |
| Procedural | 2.87 (0.77) | 3.10 (0.71) | 3.35 (0.69) | 3.12 (0.73) | $F(2, 787) = 24.612^{**}$, $n^2 = 0.059$, | 1 < 2 < 3 | 2.83 (0.82) | 3.10 (0.69) | 3.33 (0.64) | 3.11 (0.73) | $F(2,632) = 12.784^{**}$, $n^2 = 0.039$, | 1 < 2 < 3 |
| Attitudinal | 1.82 (0.34) | 1.87 (0.39) | 1.91 (0.53) | 1.87 (0.33) | $F(2, 787) = 3.357^{**}$, $n^2 = 0.035$, | 1 < 2 < 3 | 1.79 (0.41) | 1.87 (0.34) | 1.92 (0.27) | 1.87 (0.34) | $F(2, 632) = 3.209^{**}$, $n^2 = 0.010$, | 1 < 2 < 3 |
| *Satisfaction* | 3.48 (0.66) | 3.80 (0.57) | 4.17 (0.54) | 3.82 (0.64) | $F(2, 1129) = 47.441^{**}$, $n^2 = 0.154$, pow = 1.0; | 1 < 2 < 3 | 3.32 (0.68) | 3.71 (0.53) | 4.25 (0.46) | 3.82 (0.62) | $F(2,942) = 142.903^{**}$, $n^2 = 0.233$, pow = 1.0; | 1 < 2 < 3 |

*$^{**}p < 0.001$. DA, deep approach; SA, surface approach; DM, deep motivation; SM, surface motivation; DS, deep strategy; SS, surface strategy.*

**TABLE 3 |** Combined effects (3 × 3) between levels of Self-Regulation (SR) and levels of Regulatory *Teaching* (*RT*) on *Learning Approches* (*n* = 972).

| ***SR*** | ***Low*** | ***(n = 257)*** | | ***Medium*** | ***(n = 451)*** | | ***High*** | ***(n = 264)*** | | ***Total*** | | ***F (Pillais)*** | ***Post hoc*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***RT*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | | | | |
| ***n =*** | **62** | **140** | **55** | **84** | **227** | **240** | **32** | **103** | **129** | **(*n* = 972)** | | | |
| *LA Dimensions* | | | | | | | | | | | GrupSR | $F$ (4,1926) = 31,685**, $r^2$ = 0.062 | |
| | | | | | | | | | | | GrupRT | $F$ (4,1926) = 8,820**, $r^2$ = 0.062 | |
| DA | 2.56 (0.53) | 2.67 (0.48) | 2.94 (0.59) | 2.88 (0.57) | 2.90 (0.53) | 3.06 (0.63) | 3.10 (0.53) | 3.13 (0.54) | 3.36 (0.61) | 2.96 (0.60) | GrupSR | $F$ (2,963) = 35,611**, $r^2$ = 0.069 | 3 > 2 > 1** |
| | | | | | | | | | | | GrupRT | $F$ (2,963) = 16,381**, $r^2$ = 0.033 | 3,2 > 1** |
| SA | 2.59 (0.58) | 2.45 (0.55) | 2.34 (0.58) | 2.18 (0.60) | 2.16 (0.62) | 2.08 (0.58) | 1.94 (0.55) | 1.90 (0.50) | 1.89 (0.60) | 1.91 (0.55) | GrupSR | $F$ (2,963) = 49,828**, $r^2$ = 0.094 | 1 > 2 > 3** |
| | | | | | | | | | | | Grup RT | $F$ (2,963) = 2,735*, $r^2$ = 0.003 | 1 > 2,3** |
| *LA Factors* | | | | | | | | | | | GrupSR | $F$ (8,1992) = 16,594**, $r^2$ = 0.065 | |
| | | | | | | | | | | | Grup RT | $F$ (8,1992) = 4,704**, $r^2$ = 0.019 | |
| DM | 2.68 (0.63) | 2.80 (0.58) | 3.09 (0.59) | 3.05 (0.65) | 3.10 (0.57) | 3.24 (0.65) | 3.21 (0.60) | 3.28 (0.61) | 3.51 (0.64) | 3.12 (0.65) | GrupSR | $F$ (2,963) = 30,542**, $r^2$ = 0.060 | 3 > 2 > 1** |
| | | | | | | | | | | | Grup RT | $F$ (2,963) = 14,957**, $r^2$ = 0.030 | 3 > 2,1** |
| DS | 2.44 (0.59) | 2.54 (0.55) | 2.79 (0.72) | 2.72 (0.64) | 2.69 (0.62) | 2.89 (0.70) | 2.98 (0.67) | 3.00 (0.58) | 3.20 (0.71) | 2.80 (0.67) | GrupSR | $F$ (2,963) = 27,533**, $r^2$ = 0.077 | 1 > 2 > 3** |
| | | | | | | | | | | | Grup RT | $F$ (2,963) = 11,634**, $r^2$ = 0.024 | 3 > 2,1** |
| SM | 2.26 (0.67) | 2.10 (0.60) | 1.94 (0.62) | 1.86 (0.65) | 1.82 (0.52) | 1.74 (0.60) | 1.60 (0.49) | 1.58 (0.59) | 1.58 (0.51) | 1.83 (0.61) | GrupSR | $F$ (2,963) = 39,925**, $r^2$ = 0.062 | 1,2 > 3** |
| | | | | | | | | | | | Grup RT | $F$ (2,963) = 3,445* , $r^2$ = 0.007 | |
| SS | 2.92 (0.69) | 2.80 (0.62) | 2.74 (0.64) | 2.49 (0.69) | 2.54 (0.60) | 2.43 (0.67) | 2.21 (0.68) | 2.50 (0.66) | 2.20 (0.70) | 2.51 (0.68) | GrupSR | $F$ (2,963) = 41,778**, $r^2$ = 0.080 | 1 > 2 > 3** |
| | | | | | | | | | | | GrupRT | $F$ (2,963) = 1,514$^{ns}$ , $r^2$ = 0.080 | |

*(Continued)*

**TABLE 3 |** Continued

| ***SR*** | ***Low*** | ***(n = 257)*** | | ***Medium*** | ***(n = 451)*** | | ***High*** | ***(n = 264)*** | | ***Total*** | | ***F (Pillais)*** | ***Post hoc*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***RT*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | ***Low*** | ***Med*** | ***High*** | | | | |
| ***n =*** | **62** | **140** | **55** | **84** | **227** | **240** | **32** | **103** | **129** | **(*n* = 972)** | | | |
| *Academic Achievement Total* | 2.38 (1.1) | 2.91 (1.7) | 3.37 (1.3) | 2.147 (1.2) | 3.20 (1.2) | 3.59 (1.1) | 3.04 (1.4) | 3.33 (1.0) | 3.91 (1.9) | 3.21 (1.3) | GrupSR | $F$ (2,637) = 7,0345**, $r^2$ = 0.034; pow = 0.98 | 3,2 > 1** |
| | | | | | | | | | | | GrupRT | $F$ (2,637) = 22,880**, $r^2$ = 0.067; pow = 1,0 | 3 > 2 > 1** |
| | | | | | | | | | | | GrupSR | $F$ (6,1646) = 4,763**, $r^2$ = 0.022; pow = 0.91 | |
| | | | | | | | | | | | GrupRT | $F$ (6,1262) = 4,470**, $r^2$ = 0.021; pow = 0.986 | |
| *Conceptual (4p)* | 2.72 (0.70) | 2.91 (0.71) | 2.97 (0.79) | 2.86 (0.79) | 3.06 (0.76) | 3.26 (0.60) | 3.08 (0.90) | 3.24 (0.54) | 3.46 (0.63) | 3.10 (0.73) | GrupSR | $F$ (2,632) = 11,663**, $r^2$ = 0.036; pow = 0.994 | 3 > 2 > 1* |
| | | | | | | | | | | | GrupRT | $F$ (2,632) = 8,848**, $r^2$ = 0.026; pow = 0.966 | 3,2 > 1** |
| *Procedural (4p)* | 2.54 (0.75) | 2.91 (0.78) | 3.13 (0.86) | 2.95 (0.82) | 3.10 (0.63) | 3.26 (0.58) | 3.08 (0.90) | 3.26 (0.69) | 3.48 (0.60) | 3.12 (0.73) | GrupSR | $F$ (2,632) = 12,238**, $r^2$ = 0.037; pow = 0.996 | 3 > 2 > 1** |
| | | | | | | | | | | | GrupRT | $F$ (2,632) = 12,748**, $r^2$ = 0.039; pow = 0.997 | 3,2 > 1** |
| *Attitudinal (2p)* | 1.78 (0.47) | 1.82 (0.38) | 1.81 (0.40) | 1.75 (0.43) | 1.87 (0.33) | 1.94 (0.24) | 1.84 (0.37) | 1.91 (0.29) | 1.93 (0.29) | 1.86 (0.34) | GrupSR | $F$ (2,632) = 2,528*, $r^2$ = 0.008; pow = 0.506 | 3 > 2 > 1* |
| | | | | | | | | | | | GrupRT | $F$ (2,632) = 3,209*, $r^2$ = 0.010; pow = 0.613 | 3,2 > 1** |
| *Satisfaction* | 3.03 (0.61) | 3.52 (0.51) | 3.96 (0.46) | 3.38 (0.59) | 3.73 (0.49) | 4.19 (0.43) | 3.63 (0.64) | 3.95 (0.43) | 4.40 (0.40) | 3.82 (0.63) | GrupSR | $F$ (2,972) = 53,406**, $r^2$ = 0.099; pow = 1.0 | 3 > 2 > 1** |
| | | | | | | | | | | | GrupRT | $F$ (2,972) = 222,876**, $r^2$ = 0.350; pow = 1.0 | 3 > 2 > 1** |

*GrupSR, Effect of IV level in Self-Regulation; GrupRT, Effect of IV level in Regulatory Teaching; *p < 0.05, **p < 0.001, ns, non-significant statistical effect. DA, deep approach; SA, surface approach; DM, deep motivation; SM, surface motivation; DS, deep strategy; SS, surface strategy.*

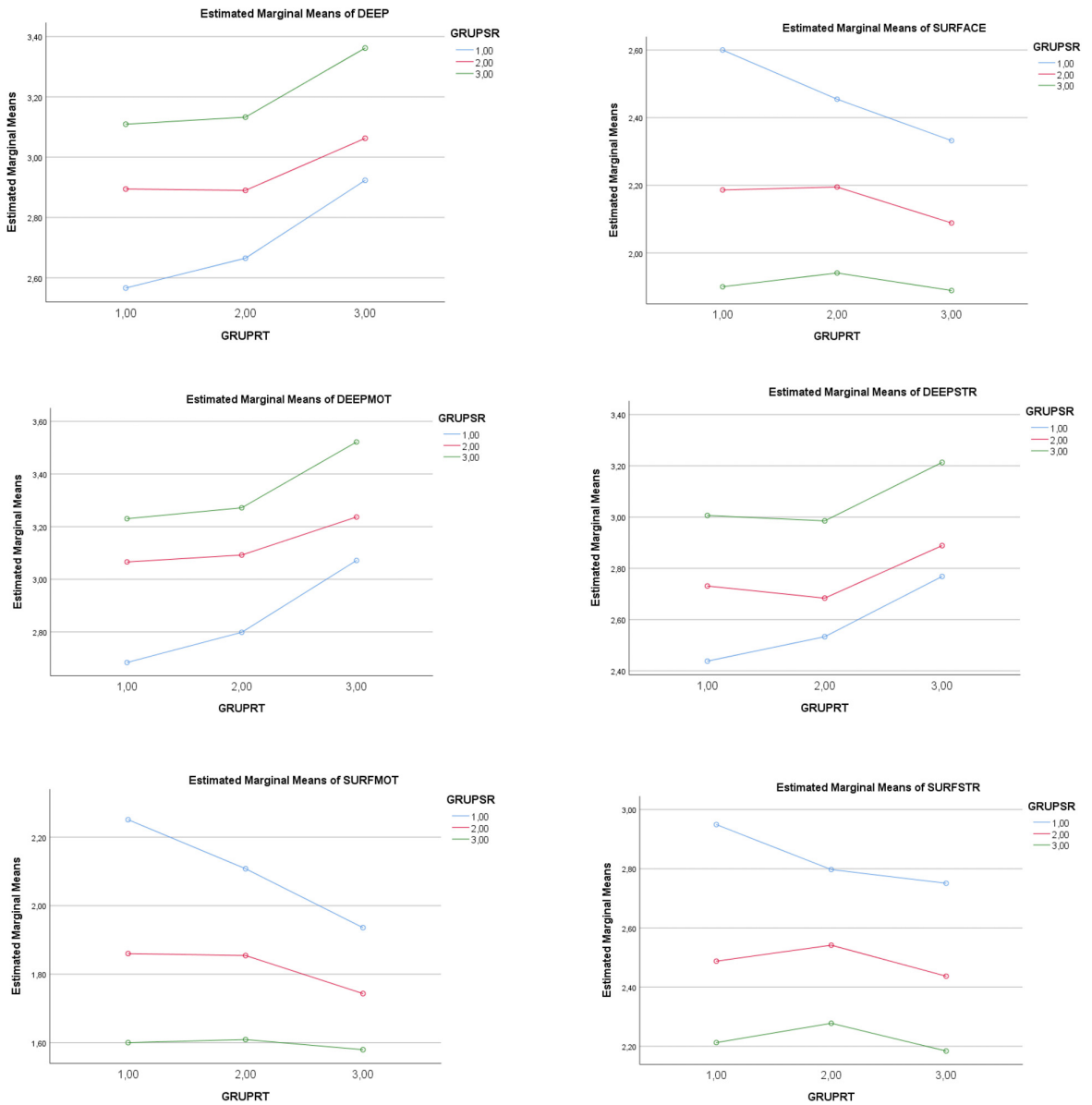


**FIGURE 1 |** Graphic representation of the effect of levels in the IV *Self-Regulation* (GRUPSR: Low = 1; Medium = 2; High = 3) and level in the IV *Regulatory Teaching* (GRUPRT: Low = 1; Medium = 2; High = 3) on *Learning Approaches* (LA). DEEP, Deep approach; SURFACE, Surface approach; DEEPMOT, Deep motivation; DEEPSTRAT, Deep strategies; SURFMOT, Surface motivation; SURFSTRAT, Surface strategies.

A graphic representation of the differential progressive effect of the combinations of SR and RT levels is shown in **Figure 4**.

# DISCUSSION

## Implications for the Knowledge of This Research Topic

### Effects on Learning Approaches

*Self-Regulated Learning vs. ERL Theory* (de la Fuente, 2017) predicted that university students' learning approaches, academic achievement and satisfaction could be determined, jointly, by the students' degree of *self-regulation* (SR) and by the level of contextual or *external regulation* (RT). Furthermore, this type of interaction could be understood by the combination of *low-medium-high levels* of the two factors (SR and RT), as supported by prior evidence in this direction (de la Fuente et al., 2017).

With respect to the *first hypothesis*, the evidence found upholds the theory that a surface vs. deep learning approach is a student-dependent variable, depending on the student's pre-existing level of self-regulation (Heikkilä and Lonka, 2006; de la Fuente et al., 2008). Interestingly, however, other novel data presented here have shown that a high level of SR more strongly

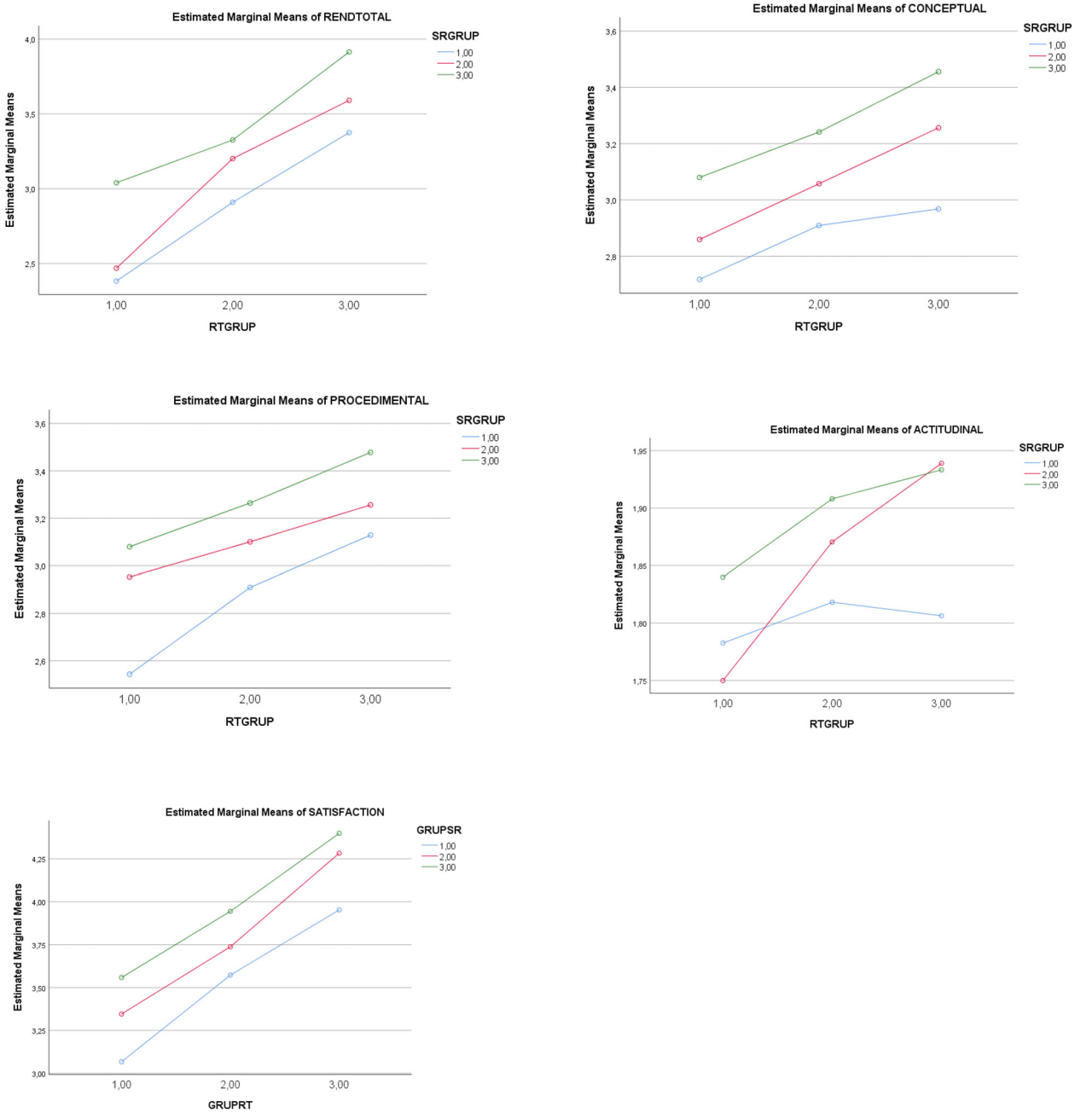


**FIGURE 2 |** Graphic representation of the effect of low(1)-medium(2)-high(3) levels in the IV *self-regulation* (GRUPSRQ) and low(1)-medium (2)-high (3) levels in the IV *regulatory teaching* (GRUPER) on *academic achievement* (*conceptual*, *procedural*, *and attitudinal*) and *satisfaction with the teaching and learning process.*

determines the level of deep motivation, but not so much the level of deep strategies, and viceversa, a *low level of SR* determines a greater number of surface strategies. These differentiating details had not been clearly established to date, and have implications for assessment and improved psychoeducational intervention – to be further discussed below. This result is consistent with the evidence showing that excellent students have a higher level of deep approach in comparison to average students (Gargallo et al., 2015).

In complementary fashion, a *high level of RT* (regulatory or effective teaching) has been shown to promote a greater degree of the deep learning approach; a *low level of RT* promotes a surface learning approach. Moreover, a differentiating effect was found, where *highly regulatory teaching* was clearly seen to have a greater effect on deep motivation than on deep strategy, while *low regulatory teaching* has more effect on surface strategy than on surface motivation. In other words, good (regulatory) teaching encourages motivation more than high-level cognitive

**TABLE 4 |** Effects of the Five Types of Combinations on *Learning Approaches* (LA) and *Academic Achievement and Satisfaction*.

| **DVs** | **Combination Types in Groups (IVs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1 (*n* = 63)** | **2 (*n* = 236)** | **3 (*n* = 338)** | **4 (*n* = 253)** | **5 (*n* = 140)** | ***F* (*Pillai's Trace*) (*n* = 972)** | ***Post hoc*** |
| *Configuration Group* | | | | | | $F$ (8,2050) = 187.65**, $n^2$ = 0.423 | |
| *Self-Regulation* | 2.65 (0.37) | 3.02 (0.42) | 3.41 (0.44) | 3.80 (0.39) | 4.23 (0.29) | $F$ (4,1025) = 302.61**, $n^2$ = 0.541 | all $p < 0.001$ |
| *Regulatory Teaching* | 2.73 (0.32) | 3.24 (0.50) | 3.63 (0.48) | 4.03 (0.44) | 4.39 (0.29) | $F$ (4,1025) = 252.64**, $n^2$ = 0.496 | all $p < 0.001$ |
| *LA Dimensions* | | | | | | $F$ (2,1934) = 22.083,**, $n^2$ = 0.084, pow = 1.0 | |
| DA | 56 (0.53) | 2.75 (0.52) | 2.92 (0.54) | 3.09 (0.59) | 3.36 (0.61) | $F$ (4,967) = 35.116**, $n^2$ = 0.127 | 5 > 4 > 3 > 2,1** |
| SA | 59 (0.58) | 2.35 (0.59) | 2.18 (0.53) | 2.02 (0.55) | 1.89 (0.60) | $F$ (4,967) = 26.109**, $n^2$ = 0.097 | 1,2 > 3 > 4,5** |
| *LA Factors* | | | | | | $F$ (16,38682) = 11,230**, $n^2$ = 0.044, pow = 1.0 | |
| DM | 2.68 (0.63) | 2.89 (0.62) | 3.11 (0.58) | 3.26 (0.63) | 3.51 (0.64) | $F$ (4,967) = 31.129**, $n^2$ = 0.114 | 5,4 > 3,2 > 1** |
| DS | 2.44 (0.59) | 2.61 (0.59) | 2.74 (0.75) | 2.93 (0.65) | 3.21 (0.71) | $F$ (4,967) = 25.681**, $n^2$ = 0.096 | 5,4 > 3,2 > 1** |
| SM | 2.26 (0.67) | 2.01 (0.63) | 1.82 (0.64) | 1.68 (0.56) | 1.58 (0.55) | $F$ (4,967) = 23.478**, $n^2$ = 0.089 | 1,2 > 3 > 4,5** |
| SS | 2.92 (0.69) | 2.68 (0.66) | 2.54 (0.63) | 2.36 (0.66) | 2.20 (0.70) | $F$ (4,967) = 20.190**, $n^2$ = 0.077 | 1,2 > 3 > 4,5** |
| | ***Combination Types in Groups (IVs)*** | | | | | | |
| **DVs** | **1 (*n* = 47)** | **2 (*n* = 141)** | **3 (*n* = 196)** | **4 (*n* = 169)** | **5 (*n* = 93)** | ***F* (*Pillai's Trace*) (*n* = 646)** | ***Post hoc*** |
| *Total Achievement* | 2.38 (1.11) | 2.71 (1.12) | 3.21 (1.2) | 3.46 (1.2) | 3.91 (1.1) | $F$ (4,641) = 20,451**, $n^2$ = 0.113, pow = 1.0 | 5 > 4,3 > 2,1** |
| Conceptual | 2.72 (0.72) | 2.89 (0.74) | 3.05 (0.72) | 3.25 (0.57) | 3.46 (0.63) | $F$ (4,636) = 15.592**, $n^2$ = 0.089 | 5,4 > 3,2 > 1** |
| Procedural | 2.54 (0.71) | 2.93 (0.79) | 3.10 (0.72) | 3.26 (0.60) | 3.48 (0.70) | $F$ (4,636) = 18.145**, $n^2$ = 0.102 | 5 > 4 > 3,2 > 1** |
| Attitudinal | 1.78 (0.41) | 1.79 (0.41) | 1.86 (0.35) | 1.92 (0.16) | 1.93 (0.25) | $F$ (4,636) = 4.723**, $n^2$ = 0.029 | 5,4 > 3 > 2,1** |
| *Satisfaction* | 3.03 (0.61) | 3.47 (0.58) | 3.76 (0.51) | 4.09 (0.44) | 4.44 (0.40) | $F$ (4,946) = 128.597**, $n^2$ = 0.352, pow = 1.0 | 5 > 4 > 3 > 2 > 1** |

*Type 1 (low self-regulation, and low regulatory teaching); Type 2 (low self-regulation and high regulatory teaching); Type 3 (medium self-regulation and medium regulatory teaching); Type 4 (high self-regulation and low regulatory teaching); Type 5 (high self-regulation and high regulatory teaching). DA, deep approach; SA, surface approach; DM, deep motivation; DS, deep strategy; SM, surface motivation; SS, surface strategy. **$p < 0.001$.*

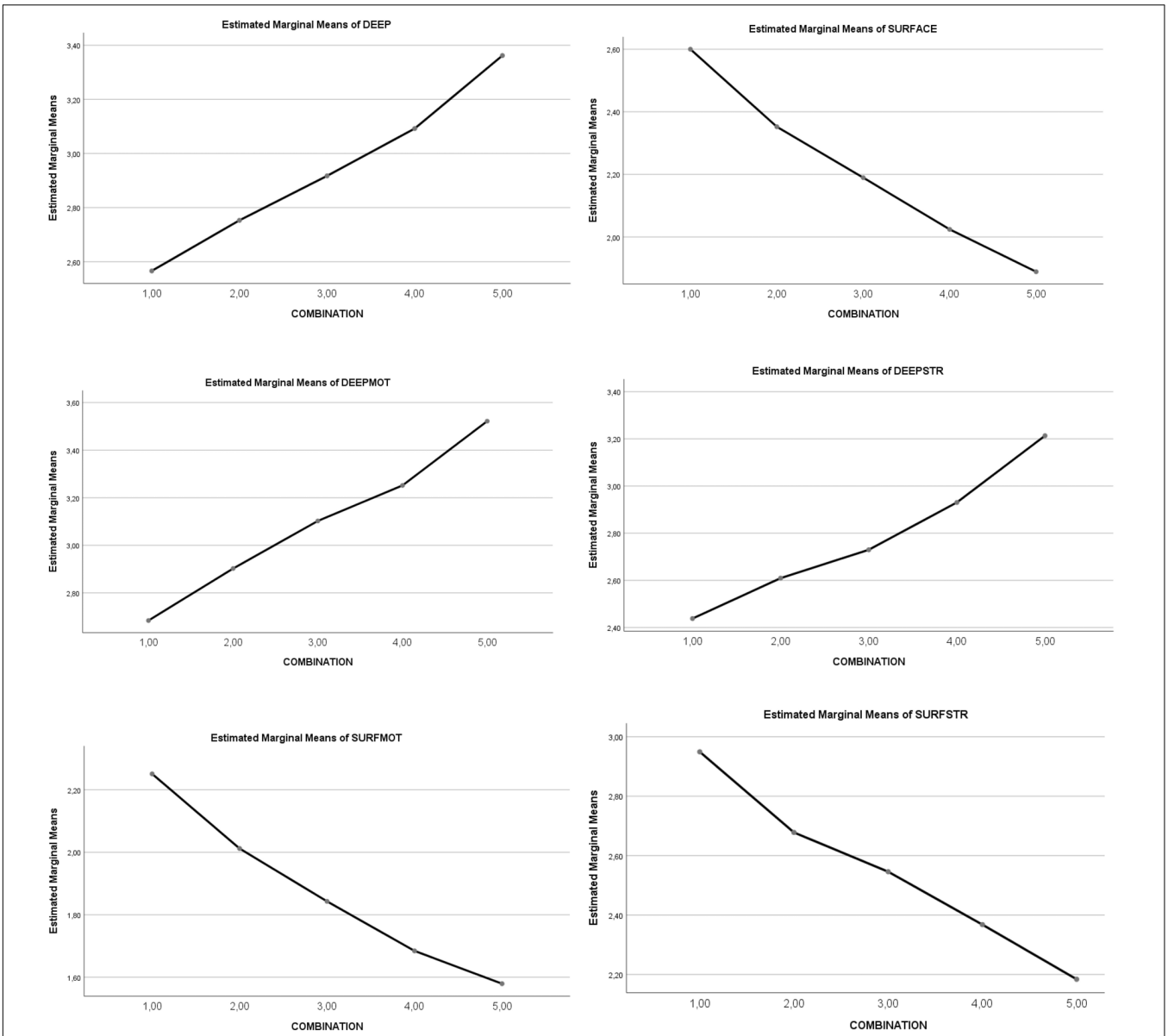


**FIGURE 3 |** Graphical representation of the effects of the combination types (heuristic levels 1–5) on *learning approaches*.

processes, while less regulatory teaching (non-regulatory or dysregulatory) seems to lead to poorer cognitive processes, and learning processes *per se*, more than it affects surface motivation. This effect is novel, and seems to allude to a differential effect of teaching on cognitive and motivational processes, which must be analyzed in greater depth.

From our point of view, however, the most interesting effect found here is the effect produced by the *combination* of student characteristics and characteristics of the teaching process, in determining university students' *learning approach*. All the cross analyses and especially the heuristic-based analyses themselves (graded combinations 1−5), have consistently supported our *combination hypothesis*, with reference to university students' *learning approaches*. In general, there are several research reports that confirm this, in the case of achievement emotions (de la Fuente et al., 2019b), and coping strategies of stress (de la Fuente et al., 2020a). Although learning approaches depend on individual characteristics, they are also fed by characteristics of the teaching process (Howie and Bagnall, 2013), especially in formal teaching-learning contexts at university, an aspect that Biggs (2001) had suggested and which has received consistent empirical support in other recent research reports (Lodewyk et al., 2009; Kember et al., 2020).

## Effects on Academic Achievement and Satisfaction

Regarding the *second hypothesis*, results allowed us to reject the null hypothesis, since both the established independent

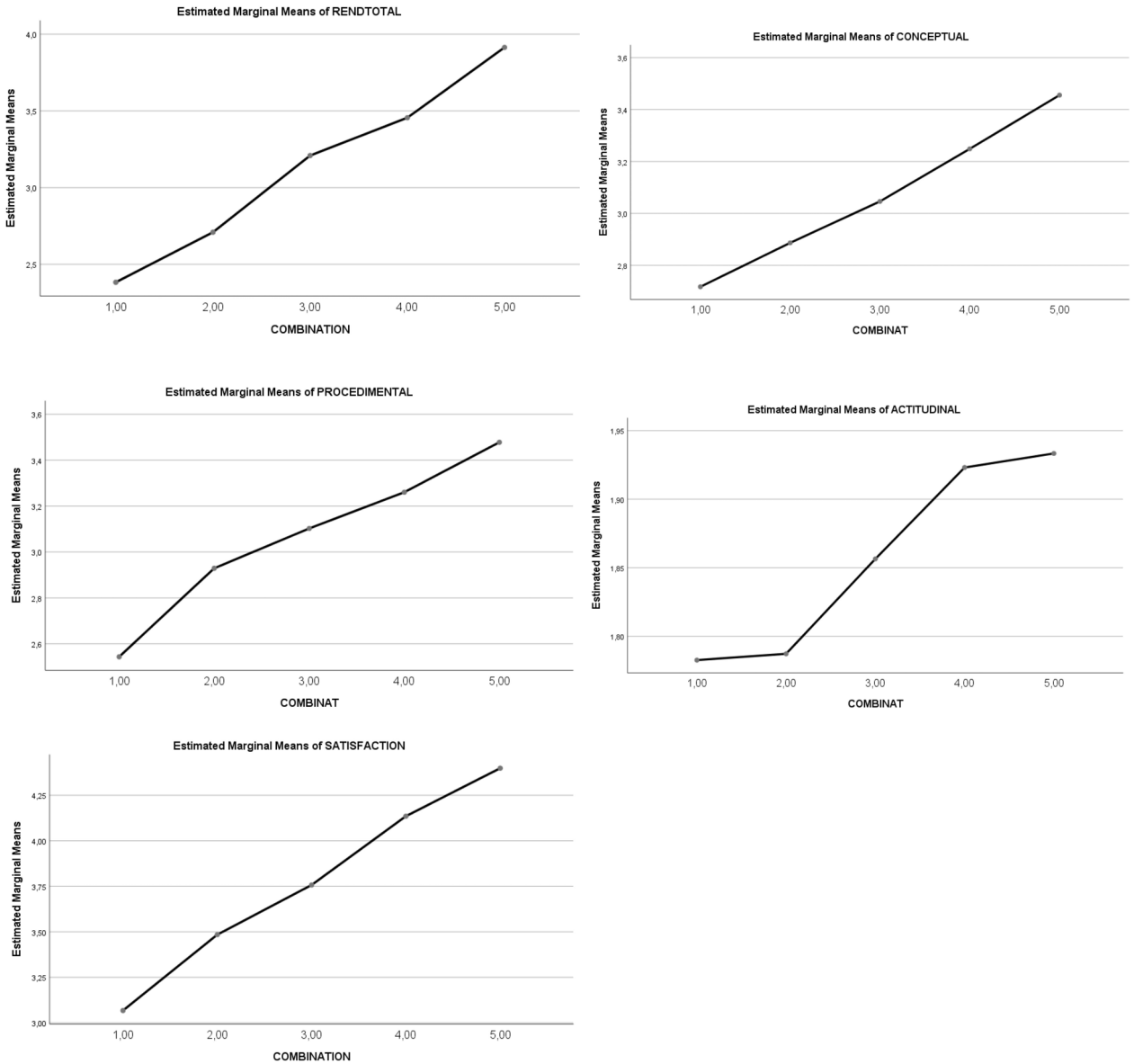


**FIGURE 4 |** Graphical representation of the effects of the combination types (heuristic levels 1–5) on *academic achievement* and *satisfaction*.

variables (SR level and ER level) and their combinations determined levels of total achievement and the subtypes of achievement, as well as determining satisfaction with the teaching-learning experience. This combination effect has already been seen in similar fashion in other previous samples (de la Fuente et al., 2017; Moghimi et al., 2020; Paloş et al., 2020), though the greater effect of the combination on procedural achievement (practical performance subcompetencies: practical problem solving) is a novel finding. By comparison, the greatest effect was seen in total and conceptual achievement, and was determined by regulatory teaching. One plausible explanation for this result is that the regulatory component (times, materiales, learning aids, strategies, meaningful assessment, etc.) is ultimately materialized in better conceptual learning. Notwithstanding, these specific aspects are worthy of further attention and should be clarified in future research.

## Limitations and Future Lines of Research

An initial limitation to this study refers to the sample. Given that the sample is not a heterogeneous group from different disciplines and degree programs, the results should be interpreted with caution. Prior research has shown that whether a teacher's approach encourages self-regulation, offers external regulation or is lacking in regulation, is dependent on the degree program and the teaching styles of different departments (Kreber et al., 2005; Lindblom-Ylänne et al., 2011). In addition, the concepts of teaching regulation presented in the *Approaches to Teaching*

*Inventory* (Trigwell and Prosser, 2004; Cao et al., 2019) and the concept used in this research on *Regulatory Teaching* are not identical. The former focuses more on an analysis of teaching style, looking at transmission and conceptual change, in order to verify the learning style that it promotes (surface vs. deep approach), while the latter seeks to evaluate whether teaching promotes self-regulation strategies in the students, and thereby affects their learning approach. Future research must accurately establish the relationship between the two concepts of regulation in teaching, as well as the relationship between the teacher's own self-regulation characteristics and his or her implementation of regulatory teaching (Randi, 2004; Capa-Aydin et al., 2009).

One important limitation of this study is that the assessment system consists exclusively of student self-reports. However, a strength of this study is that both self-assessment (self-regulation, learning approaches, satisfaction) and contextual assessment (regulatory teaching) were included. Nonetheless, future research studies should incorporate complementary assessment systems (Goe et al., 2008; Entwistle and Karagiannopoulou, 2014).

Finally, we are limited in identifying implications for different cultural contexts, because there may be cultural differences in self-regulation, regulatory teaching, and in the relationship between these two variables. Prior research has brought this factor to light, as part of understanding regulation processes (Trommsdorff, 2012; Jaramillo et al., 2017).

## Implications for the Practice of Educational Psychology

These results are of great interest to research and professional practice, allowing us to reconceptualize certain prior evidence and the evaluation of teaching and learning processes at university.

First, there are two important *implications* for *research in this topic*. On the one hand, these consistent and recurring results (some of them reported previously in this Research Topic) indicate the value of analyzing the student's level of regulation and the level of regulatory teaching in combination, for determining hypothetical levels of cognitive variables, emotional variables, coping and the emotional states of engagement-burnout at university (de la Fuente et al., 2017, 2019b, 2020a,b). These results thus provide empirical support to SRL vs. ERL Theory (de la Fuente, 2017) as a theoretical model for molar analysis, and position the model as a complementary view and a step forward from the SRL model (Zimmerman and Schunk, 2001), taking a more molecular view of analyzing university students' learning.

In reference to the topic of learning approaches, the present results confirm the strength of this construct, given that they document how learning approaches are sensitive to the effects of the teaching process, which influences the way students pursue their process of learning at university. This idea was already sufficiently recognized in the SAL model, but insufficiently demonstrated in prior research (Biggs, 2001). The prevailing SRL models (see Panadero, 2017) have encouraged research that limits its attention to the student's intrapersonal variables, leading to large quantities of research production built on the construct of *learning approaches* and its associated inventory (Asikainen and Gijbels, 2017).

The present results, however, encourage us to continue to move forward in integrating both sides into an explanatory analysis of interactive learning behavior, using the proposed combination heuristic.

A second, *practical implication* for applied professional practice has to do with having well-adjusted *conceptions* about how learning approaches are produced in the university context. If we continue to further the idea that learning approaches depend largely on individual variables, to the detriment of context, we will not recognize the important role of the teaching process, just as its authors conceptualized (Biggs, 2001). Without denying the plentiful prior evidence of associated individual characteristics that are determinants of learning approaches, we must progress toward a more interactive, contextualized view of the two processes of learning and teaching (Vermunt, 1998, 2007; Vermunt and Verloop, 1999; Vermunt and Donche, 2017).

A third, *practical implication* refers to *assessing teaching-learning processes* at university, since this is directly related to the issue we have been addressing. Students often participate in assessments of their degree of satisfaction with the teaching process at university, and quality criteria adopted by universities include students' achievement and their learning approach. If commonly used assessment models continue to focus attention on the teaching process, while overlooking the characteristics of the students who do the assessing, biases are quite likely to exist. Previous research has shown that university students with a surface learning approach, having higher likelihood of poor achievement, tend to give their teachers lower ratings, while students with a deep approach, with greater expectations of success, tend to perceive the teaching process as better in quality (de la Fuente et al., 2011). Furthermore, this assessment practice has another undesirable effect: it is not a contextualized activity for self development, given that students are not assessing themselves with regard to their own characteristics or aspects for improvement in learning, nor with regard to execution of the learning process, but they focus their attention on the teacher and on the teaching process. In this way, students are unlikely to feel that they are equal agents in the process. Using the same logic, teachers likewise are not learning to self-assess their teaching process. For both reasons, it is highly probable that the external attribution of errors and self-attribution of positive aspects adds a bias to this incomplete process.

A final *practical implication* refers to *formative processes* of university teachers (Paris and Winograd, 2003). When implementing innovations in the university teaching process, it is important to consider what type of context is being designed (de la Fuente et al., 2013a). If the context is non-regulating or dysregulating, it will probably not help students improve their learning process, especially if students are low in self-regulation. As seen in prior evidence, students with little self-regulation are the ones that require greater external regulation. Certain prior evidence has shown results that concur with this idea (Shaw et al., 2017; Bingen et al., 2019). In addition, the teacher's level of self-regulation (Capa-Aydin et al., 2009) increases the likelihood of

regulatory teaching (Randi, 2004; Monshi-Toussi et al., 2011), although this relationship has not been addressed in the present study. In an effective teaching process, or regulatory teaching, it is the teacher's responsibility to design learning environments. To implement such designs, evidence-based recommendations are needed (Roehrig et al., 2012).

## CONCLUSION

Most universities develop programs –on an intuitive basis– to attract the best students and teachers, based on the correct assumption that a combination of the two produces good learning processes, good academic outcomes, and satisfaction. The practical reality, however, is that different types of students and teachers are found at every university. The present research has offered a *conceptual model*, a *heuristic of measurement*, and consistent *empirical data* for analyzing any teaching-learning process and its most probable effects in a university context, although these can be extrapolated to other stages of education. We must acknowledge that universities admit students who execute "good and not as good" learning processes, and they can be combined with teachers who execute "good and not as good" teaching processes. We recommend that university administrators and organizational politicians, as well as educational psychologists in charge of university quality, take into account the findings presented here, in order to more precisely understand the quality of teaching-learning processes and make appropriate decisions. Not all teachers teach poorly, nor do all students learn well, and viceversa. A detailed analysis of each combination, based on the heuristic presented, should help in making evidence-based decisions in each case (Slavin, 2019).

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Comité de Ética de la Investigación (UNAV), ref. 2018.270. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JF contributed to conceptualization, design, and data analysis. PS did the initial writing. DK performed the revision of the manuscript. MY did the final revision and adjustments to the manuscript. All authors contributed to the article and approved the submitted version.

## FUNDING

This research was funded by: R&D Project PGC2018-094672-B-I00, University of Navarra (Ministry of Science and Education, Spain), and R&D Project UAL18-SEJ-DO31-A-FEDER (University of Almería, Spain), and the European Social Fund.

## REFERENCES

Antonelli, J., Jolly, S., Backscheider, S., and Hawkinset, J. (2020). Understanding the self-regulated learning characteristics of first-generation college students. *J. Coll. Stud. Dev.* 61, 67–83. doi: 10.1353/csd.2020.0004

Asikainen, H., and Gijbels, D. (2017). Do students develop towards more Deep approaches to learning during studies? A systematic review on the development of students' deep and surface approaches to learning in higher education. *Educ.Psychol. Rev.* 29, 205–234. doi: 10.1007/s10648-017-9406-6

Azevedo, R., Moos, D. C., Greene, J. A., Winters, F. I., and Cromley, J. G. (2008). Why is externally- facilitated regulated learning more effective than self-regulated learning with hypermedia? *Educ. Technol. Res. Dev.* 56, 45–72. doi: 10.1007/s11423-007-9067-0

Baeten, M., Dochy, F., and Struyven, K. (2013). The effects of different learning environments on students' motivation for learning and their achievement. *Br. J. Educ. Psychol.* 83, 484–501. doi: 10.1111/j.2044-8279.2012.02076.x

Baeten, M., Dochy, F., Struyven, K., Parmentier, E., and Vanderbruggen, A. (2015). Student-centred learning environments: an investigation into student teachers' instructional preferences and approaches to learning. *Learn. Environ. Res.* 19, 443–462.

Balloo, K., Pauli, R., and Worrell, M. (2017). Undergraduates' personal circumstances, expectations and reasons for attending university. *Stud. High. Educ.* 42, 1373–1384. doi: 10.1080/03075079.2015.1099623

Barattucci, M. (2017). Approach to study as an indicator of the quality of teaching and of learning environment: the contribution of John Biggs. *J. E Learn. Knowl. Soc.* 13, 77–88.

Barattucci, M., Pagliaro, S., Cafagna, D., and Bosetto, D. (2017). An examination of the applicability of Biggs' 3P learning process model to Italian university. *J. E Learn. Knowl. Soc.* 13, 163–180.

Barros, R., Monteiro, A., Nejmedinne, F., and Moreira, J. A. (2012). The relationship between students' approach to learning and lifelong learning. *Psychology* 4, 792–797. doi: 10.4236/psych.2013.411113

Biggs, J. (1979). Individual differences in study processes and the quality of learning outcomes. *High. Educ.* 8, 381–394. doi: 10.1007/bf01680526

Biggs, J. (1985). The role of metalearning in study processes. *Br. J. Educ. Psychol.* 55, 185–212. doi: 10.1111/j.2044-8279.1985.tb02625.x

Biggs, J. (1988). Assessing student approaches to learning. *Aust. Psychol.* 23, 197–206. doi: 10.1080/00050068808255604

Biggs, J. (2001). The reflective institution: assuring and enhancing the quality of teaching and learning. *High. Educ.* 41, 221–238.

Biggs, J., Kember, D., and Leung, D. Y. P. (2001). The revised two-factor study process questionnaire: R-SPQ-2F. *Br. J. Educ. Psychol.* 71, 133–149. doi: 10.1348/000709901158433

Biggs, J., and Tang, C. (2011). *Teaching for Quality Learning at University*. Berkshire: Open University Press.

Bingen, H. M., Steindal, S. A., Krumsvik, R., and Tveit, B. (2019). Nursing students studying physiology within a flipped classroom, self-regulation and off-campus activities. *Nurse Educ. Pract.* 35, 55–62. doi: 10.1016/j.nepr.2019.01.004

Bobe, B. J., and Cooper, B. J. (2017). The effect of language proficiency on approaches to learning and satisfaction of undergraduate accounting students. *Account. Educ.* 28, 149–171. doi: 10.1080/09639284.2017.1396481

Brown, J. M. (1998). "Self-regulation and the addictive behaviors," in *Treating Addictive Behaviors*, Vol. 2, eds W. R. Miller and N. Heather (New York, NY: Plenum Press), 61–73. doi: 10.1007/978-1-4899-1934-2_5

Brown, J. M., Miller, W. R., and Lawendowski, L. A. (1999). "The self-regulation questionnaire," in *Innovations in Clinical Practice: A Source Book*, Vol. 17, eds L. Vandecreek and T. L. Jackson (Sarasota, FL: Professional Resources Press), 281–293.

Browne, B. A., Kaldenberg, D. O., Browne, W. G., and Brown, D. J. (1998). Student as customer: factors affecting satisfaction and assessments of institutional quality. *J. Mark. High. Educ.* 8, 1–14. doi: 10.1300/j050v08n03_01

Cao, Y., Postareff, L., Lindblom-Ylanne, L., and Toom, A. (2019). Teacher educators' approaches to teaching and connections with their perceptions of the closeness of their research and teaching. *Teach. Teach. Educ.* 85, 125–136. doi: 10.1016/j.tate.2019.06.013

Capa-Aydin, Y., Sungur, S., and Uzuntiryaki, E. (2009). Teacher self-regulation: examining a multidimensional construct'. *Educ. Psychol.* 29, 345–356. doi: 10.1080/01443410902927825

Cetin, B. (2015). Academic motivation and approaches to learning in predicting college students' academic achievement: findings from Turkish and US samples. *J. Coll. Teach. Learn.* 12, 141-150.

de la Fuente, J. (2017). Theory of self- vs. externally- regulated learningTM: fundamentals, evidence, and applicability. *Front. Psychol.* 8:1675. doi: 10.3389/fpsyg.2017.01675

de la Fuente, J., Amate, J., González-Torres, M. C., Artuch, R., García-Torrecillas, J. M., and Fadda, S. (2020a). Effects of levels of self-regulation and regulatory teaching on strategies for coping with academic stress in undergraduate students. *Front. Psychol.* 11:22. doi: 10.3389/fpsyg.2020.00022

de la Fuente, J., Berbén, A. B., and Zapata, L. (2013a). How regulatory teaching impacts university students' perceptions of the teaching-learning process: the role of teacher training. *Infanc. Aprendizaje* 36, 375–385. doi: 10.1174/021037013807533016

de la Fuente, J., Cardelle-Elawar, M., Peralta, F. J., Sánchez, M. D., Martínez-Vicente, J. M., and Zapata, L. (2011). Students' factors affecting undergraduates' perceptions of their teaching and learning process within ECTS experience. *Front. Psychol.* 2:28. doi: 10.3389/fpsyg.2011.00028

de la Fuente, J., González-Torres, M. C., Aznárez-Sanado, M., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., and Vera, M. M. (2019a). Implications of unconnected micro, molecular, and molar level research in psychology: the case of executive functions, self-regulation, and external regulation. *Front. Psychol.* 10:1919. doi: 10.3389/fpsyg.2019.01919

de la Fuente, J., Justicia, F., Casanova, P., and Trianes, M. V. (2004). Perception about construction of academic and professional competences in psychologists. *Electron. J. Res. Educ. Psychol.* 3, 33–34.

de la Fuente, J., López, M., Zapata, L., Sollinas, G., and Fadda, S. (2015a). "Improving mental health trough and online self-assessment and self-help e-utility in university students," in *Progress in Education*, Vol. 33, ed. R. V. Nata (New York, NY: Nova Publisher), 63–74.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Garzón-Umerenkova, A., Vera, M. M., and Paoloni, P. (2019b). Applying the SRL vs. ERL theory to the knowledge of achievement emotions in undergraduate university students. *Front. Psychol.* 10:2070. doi: 10.3389/fpsyg.2019.02070

de la Fuente, J., Paoloni, P. V., Vera-Martínez, M. M., and Garzón-Umerenkova, A. (2020b). Effect of levels of self-regulation and situational stress on achievement emotions in undergraduate students: class, study and testing. *Int. J. Environ. Res. Public Health* 17:4293. doi: 10.3390/ijerph17124293

de la Fuente, J., Peralta-Sánchez, F. J., Martínez-Vicente, J. M. V., Sander, P., Garzón-Umerenkova, A., and Zapata, L. (2020c). Effects of self- vs external-regulation on the factors and symptoms of academic stress in undergraduate students. *Front. Psychol.* 11:22. doi: 10.3390/ijerph17124293

de la Fuente, J., Pichardo, M. C., Justicia, F., and Berbén, A. (2008). Learning approaches, self-regulation and achievement in three European universities. *Psicothema* 20, 705–711.

de la Fuente, J., Sander, P., Martínez-Vicente, J. M., Vera, M. M., Garzón, A., and Fadda, S. (2017). Combined effect of levels in personal self-regulation and regulatory teaching on meta-cognitive, on meta-motivational, and on academic achievement variables in undergraduate students. *Front. Psychol.* 8:232. doi: 10.3389/fpsyg.2017.00232

de la Fuente, J., Sander, P., and Putwain, D. (2013b). Relationship between undergraduate student confidence, approach to learning and academic performance: the role of gender. *Rev. Psicodidáctica* 18, 375–393. doi: 10.1387/RevPsicodidact.7078

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Cardelle-Ellawar, M., Sander, P., Justicia, F., et al. (2012). Regulatory teaching and self-regulated learning in college students: confirmatory validation study of the IATLP scales. *Electron. J. Res. Educ. Psychol.* 10, 839–866.

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Sander, P., and Putwain, D. (2015b). "Personal self-regulation, self-regulated learning and coping strategies, in university context with stress," in *Metacognition: Fundaments, Applications, and Trends A Profile of the Current State-Of-The-Art*, ed. E. Peña- Ayala (Cham: Springer International Publishing Switzerland), 223–250. doi: 10.1007/978-3-319-11062-2_9

Dinsmore, D. L., Alexander, P. A., and Loughlin, S. M. (2008). Focusing the conceptual lens on metacognition, self-regulation, and self-regulated learning. *Educ. Psychol. Rev.* 20, 391–409. doi: 10.1007/s10648-008-9083-6

Douglas, J. A., Douglas, A., McClelland, R. J., and Davies, J. (2015). Understanding student satisfaction and dissatisfaction: an interpretive study in the UK higher education context. *Stud. High. Educ.* 40, 329–349. doi: 10.1080/03075079.2013.842217

Elassy, N. (2015). The concepts of quality, quality assurance and quality enhancement. *Qual. Assur. Educ.* 23, 250–261. doi: 10.1108/qae-11-2012-0046

Entwistle, N., Hanley, M., and Hounsell, D. (1979). Identifying distinctive approaches to studying. *High. Educ.* 8, 365–380. doi: 10.1007/bf01680525

Entwistle, N., and Karagiannopoulou, E. (2014). "Perceptions of assessment and their influences on learning," in *Advances and Innovations in University Assessment and Feedback*, eds C. Kreber, C. Anderson, N. Entwistle, and J. McArthur (Edinburgh: Edinburgh University Press), 75–98. doi: 10.3366/edinburgh/9780748694549.003.0005

Entwistle, N., McCune, V., and Hounsell, J. (2002). *Approaches to Studying and Perceptions of University Teaching-Learning Environments: Concepts, Measures and Preliminary Findings. Enhancing Teaching and Learning Environments in Undergraduate Courses Occasional Report, 1*. Available online at: http://www.etl.tla.ed.ac.uk/docs/etlreport1.pdf (accessed September 15, 2010).

Entwistle, N., McCune, V., and Hounsell, J. (2003). "Investigating ways of enhancing university teaching-learning environments: measuring students' approaches to studying and perceptions of teaching," in *Powerful Learning Environments: Unravelling Basic Components and Dimensions*, 1st Edn, eds E. De Corte, L. Verschaffel, N. Entwistle, and J. van Merriënboer (Amsterdam: Pergamon), 89. doi: 10.14705/rpnet.2017.innoconf2016.658

Entwistle, N. J. (2009). *Teaching for Understanding at University: Deep Approaches and Distinctive Ways of Thinking*. Basingstoke: PalgraveMacmillan.

Entwistle, N. J. (2018). *Student Learning and Academic Understanding: A Research Perspective and Implications for Teaching*. New York, NY: Elsevier.

Entwistle, N. J., and Ramsden, P. (1983). *Understanding Student Learning*. London: Croom Helm.

Fryer, L. K., and Ginns, P. (2017). A reciprocal test of perceptions of teaching quality and approaches to learning: a longitudinal examination of teaching-learning connections. *Educ. Psychol.* 38, 1032–1049. doi: 10.1080/01443410.2017.1403568

Gagné, R. M. (1965). *Essentials of Learning for Instruction (Spanish Translation: Diana, 1975)*. New York, NY: The Dryden Press.

Gargallo, B., Morera, I., and García, E. (2015). Metodología innovadora en la universidad: sus efectos sobre los procesos de aprendizaje de los estudiantes universitarios [Innovative methodology in the university: its effects on the learning processes of university students]. *Anal. Psicol.* 31, 901–915. doi: 10.6018/analesps.32.1.179871

Garzón-Umerenkova, A., de la Fuente, J., Martínez-Vicente, J. M., Zapata-Sevillano, L., Pichardo, M. C., and García-Berbén, A. B. (2017). Validation of the Spanish short self-regulation questionnaire (SSSRQ) through rasch analysis. *Front. Psychol.* 8:276. doi: 10.3389/fpsyg.2017.00276

Goe, L., Bell, C., and Little, O. (2008). *Approaches to Evaluating Teacher Effectiveness: A Research Synthesis*. Louisville, KY: National Comprehensive Center for Teacher Quality.

Green, P. (2014). Measuring service quality in higher education: a South African case study. *J. Int. Educ. Res.* 10, 131–157. doi: 10.19030/jier.v10i2.8515

Gurpinar, E., Kulac, E., Tetik, C., Akdogan, I., and Mamakli, S. (2013). Do learning approaches of medical students affect their satisfaction with problem-based learning? *Adv. Physiol. Educ.* 37, 85–88. doi: 10.1152/advan.00119.2012

Hazan, B., and Miller, P. (2017). The role of psychological capital in academic adjustment among university students. *J. Happiness Stud.* 20, 51–65. doi: 10.1007/s10902-017-9933-3

Heikkilä, A., and Lonka, K. (2006). Studying in higher education: students' approaches to learning, self-regulation, and cognitive strategies. *Stud. High. Educ.* 31, 99–117. doi: 10.1080/03075070500392433

Howie, P., and Bagnall, R. (2013). A critique of the deep and surface approaches to learning model. *Teach. High. Educ.* 18, 389–400. doi: 10.1080/13562517.2012.733689

Jaramillo, J. M., Rendón, M. I., Muñoz, L., Weis, M., and Trommsdorff, G. (2017). Children's self-regulation in cultural contexts: the role of parental socialization theories, goals, and practices. *Front. Psychol.* 8:923. doi: 10.3389/fpsyg.2017.00923

Justicia, F., Pichardo, M. C., Cano, F., Berbén, A. B., and de la Fuente, J. (2008). The revised two-factor study process questionnaire (RSPQ-2F): exploratory and confirmatory factor analyses at item level. *Eur. J. Psychol. Educ.* 23, 355–372. doi: 10.1007/bf03173004

Kaplan, A. (2008). Clarifying metacognition, self-regulation, and self-regulated learning: what's the purpose? *Educ. Psychol. Rev.* 20:477. doi: 10.1007/s10648-008-9087-2

Karagiannopoulou, E., and Milienos, F. S. (2015). Testing two path models to explore relationships between students' experiences of the teaching–learning environment, approaches to learning and academic achievement. *Educ. Psychol.* 35, 26–52. doi: 10.1080/01443410.2014.895800

Karagiannopoulou, E., Milienos, F. S., and Athanasopoulos, V. (2018). Associations between defense styles, approaches to learning, and achievement among university students. *Front. Educ.* 3:53. doi: 10.3389/feduc.2018.00053

Kember, D., Webster, B. J., and Chan, W. S. (2020). Refocusing the 3P model to incorporate a learning and teaching environment and graduate attributes. *Educ. Psychol.* 40, 592–607. doi: 10.1080/01443410.2020.1732304

Köller, O., Meyer, J., Saß, S., and Baumert, J. (2019). New analyses of an old topic: effects of intelligence and motivation on academic achievement. *J. Educ. Res. Online* 1, 166–189.

Kossak, R. M. (2019). *The Effect of "Teach an LA" on Self-Reported Measures of Student Self-Efficacy*. Doctoral Dissertation, University of Colorado Boulder, Boulder, CO.

Kreber, C., Castleden, H., Erfani, N., and Wright, T. (2005). Self-regulated learning about university teaching: an exploratory study. *Teach. High. Educ.* 10, 75–97. doi: 10.1080/1356251052000305543

Lindblom-Ylänne, S., Nevgi, A., and Trigwell, K. (2011). Regulation of university teaching. *Instr. Sci.* 39, 483–495. doi: 10.1007/s11251-010-9141-6

Lodewyk, K. R., Winne, P. H., and Jamieson-Noel, D. L. (2009). Implications of task structure on self-regulated learning and achievement'. *Educ. Psychol.* 29, 1–25. doi: 10.1080/01443410802447023

Mahalanobis, P. C. (1930). On tests and measures of groups divergence, theoretical formulae. *Int. J. Asiat. Soc. Bengal* 26, 541–588.

Marton, F. (1976). "What does it take to learn? Some implications of an alternative view of learning," in *Strategies for Research and Development in Higher Education*, ed. N. J. Entwistle (Amsterdam: Swets and Zeitlinger), 32–43.

Marton, F., Hounsell, D., and Entwistle, N. (eds). (2005). *The Experience of Learning: Implications for Teaching and Studying in Higher Education*, 3rd Edn. Edinburgh: University of Edinburgh.

Moghimi, D., Van Yperen, N. W., Sense, F., Zacher, H., and Scheibe, S. (2020). Using the selection, optimization, and compensation model of action-regulation to explain college students' grades and study satisfaction. *J. Educ. Psychol.* doi: 10.1037/edu0000466

Monroy, F., and González-Geraldo, J. L. (2018). Measuring learning: discrepancies between conceptions of and approaches to learning. *Educ. Stud.* 44, 81–98. doi: 10.1080/03055698.2017.1345677

Monshi-Toussi, M. T., Akbar-Boori, A., and Ghanizadeh, A. (2011). The role of EFL teachers' self-regulation in effective teaching. *World J. Educ.* 1, 39–48.

Nabizadeh, N., Hajian, S., Sheikhan, Z., and Rafiei, F. (2019). Prediction of academic achievement based on learning strategies and outcome expectations among medical students. *BMC Med. Educ.* 19:99. doi: 10.1186/s12909-019-1527-9

Paloş, R., Sava, S. L., and Vîrgă, D. (2020). The role of teacher support, students' need satisfaction, and their psychological capital in enhancing students' self-regulated learning. *Stud. Psychol.* 62, 44–57.

Panadero, E. (2017). A review of self-regulated learning: six models and four directions for research. *Front. Psychol.* 8:422. doi: 10.3389/fpsyg.2017.00422

Paris, S. G., and Winograd, P. (2003). *The Role of Self-Regulated Learning in Contextual Teaching: Principals and Practices for Teacher Preparation*. Washington, DC: U.S. Department of Education.

Parpala, A., Lindblom-Ylänne, S., Komulainen, E., Litmanen, T., and Hirsto, L. (2010). Students' approaches to learning and their experiences of the teaching-learning environment in different disciplines. *Br. J. Educ. Psychol.* 80, 269–282. doi: 10.1348/000709909x476946

Pichardo, M. C., Justicia, F., de la Fuente, J., Martínez-Vicente, J. M., and García-Berbén, A. B. (2014). Factor structure of the self-regulation questionnaire (SRQ) at Spanish universities. *Span. J. Psychol.* 17:E62.

Prosser, M., and Trigwell, K. (1999). *Understanding Learning and Teaching: The Experience in Higher Education*. Suffolk, VA: Society for Research into Higher Education & Open University Press.

Randi, J. (2004). Teachers as self-regulated learners. *Teach. Coll. Rec.* 106, 1825–1853. doi: 10.1111/j.1467-9620.2004.00407.x

Reise, S. P., Scheines, R., Widaman, K. F., and Haviland, M. G. (2012). Multidimensionality and structural coefficient bias in structural equation modeling: a bifactor perspective. *Educ. Psychol. Meas.* 73, 5–26. doi: 10.1177/0013164412449831

Richardson, J. T. E. (2015). Approaches to learning or levels of processing: what did Marton and Säljö (1976a) really say? The legacy of the work of the Göteborg group in the 1970s. *Interchange* 46, 239–269. doi: 10.1007/s10780-015-9251-9

Richardson, M., Abraham, C., and Bond, R. (2012). Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychol. Bull.* 138, 353–387. doi: 10.1037/a0026838

Roe, R. A. (2003). ¿Qué hace competente a un psicólogo? [What makes a psychologist competent?]. *Papeles Psicól.* 24, 1–12.

Roehrig, A. D., and Chistesen, E. (2010). "Development and use of tool for evaluating effectiveness in grades K-12," in *Innovative Assessment for the 21st Century: Supporting Educational Assessment*, eds V. Schuter and B. Becker (New York, NY: Springer), 207–228. doi: 10.1007/978-1-4419-6530-1_12

Roehrig, A. D., Turner, J. E., Arrastia, M. C., Christesen, E., McElhaney, S., and Jakiel, L. M. (2012). "Effective teachers and teaching: characteristics and practices related to positive student outcomes," in *APA Educational Psychology Handbook*, Vol. 2, eds K. A. Harris, S. Graham, and T. Urdan (Washington, DC: American Psychological Association), 501–527. doi: 10.1037/13274-020

Rubin, M., Scevak, J., Southgate, E., Macqueen, S., Williams, P., and Douglas, H. (2018). Older women, deeper learning, and greater satisfaction at university: age and gender predict university students' learning approach and degree satisfaction. *J. Divers. High. Educ.* 11, 82–96. doi: 10.1037/dhe0000042

Ruohoniemi, M., Parpala, A., Lindblom-Ylänne, S., and Katajavuori, N. (2010). Relationships between students' approaches to learning, perceptions of the teaching? Learning environment, and study success: a case study of third-year veterinary students. *J. Vet. Med. Educ.* 37, 282–288. doi: 10.3138/jvme.37.3.282

Scevak, J., Southgate, E., Rubin, M., Macqueen, S., Douglas, H., and Williams, P. (2015). *Equity Groups and Predictors of Academic Success in Higher Education. A 2014 Student Equity in Higher Education Research Grants Project. Newcastle University (UK): Technical Report*. Available online at: http://www.researchgate.net/publication/286450707

Schertzer, C. B., and Schertzer, S. M. (2004). Student satisfaction and retention: a conceptual model. *J. Mark. High. Educ.* 14, 79–91. doi: 10.1300/j050v14n01_05

Shaw, M. P., Peart, D. J., and Fairhead, O. J. W. (2017). Perceived stress in university students studying in a further education college. *Res. Post Compulsory Educ.* 22, 442–452. doi: 10.1080/13596748.2017.1362534

Slavin, R. E. (2019). How evidence-based reform will transform research and practice in education. *Educ. Psychol.* 54, 1–13.

Tabachnick, B. G., and Fidell, L. S. (2013). *Using Multivariate Statistics*, 6th Edn. Boston, MA: Pearson.

Trigwell, K., Ellis, R. A., and Han, F. (2012). Relations between students' approaches to learning, experienced emotions and outcomes of learning. *Stud. High. Educ.* 37, 811–824. doi: 10.1080/03075079.2010.549220

Trigwell, K., and Prosser, M. (2004). Development and use of the approaches to teaching inventory. *Educ. Psychol. Rev.* 16, 409–424. doi: 10.1007/s10648-004-0007-9

Trigwell, K., Prosser, M., and Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *High. Educ.* 37, 57–70.

Trommsdorff, G. (2012). Development of "Agentic" regulation in cultural context: the role of self and world views. *Child Dev. Perspect.* 6, 19–26. doi: 10.1111/j.1750-8606.2011.00224.x

Vanno, V., Kaemkate, W., and Wongwanich, S. (2014). Relationships between academic performance, perceived group psychological capital, and positive psychological capital of Thai undergraduate students. *Procedia Soc. Behav. Sci.* 116, 3226–3230. doi: 10.1016/j.sbspro.2014.01.739

Vermunt, J. D. (1998). The regulation of constructive learning processes. *Br. J. Educ. Psychol.* 68, 149–171. doi: 10.1111/j.2044-8279.1998.tb01281.x

Vermunt, J. D. (2007). The power of teaching-learning environments to influence student learning. *Br. J. Educ. Psychol. Monogr. Ser.* 4, 73–90.

Vermunt, J. D., and Donche, V. (2017). A learning patterns perspective on student learning in higher education: state of the art and moving forward. *Educ. Psychol. Rev.* 29, 269–299. doi: 10.1007/s10648-017-9414-6

Vermunt, J. D., and van Rijswijk, F. A. W. M. (1988). Analysis and development of students' skill in self-regulated learning. *High. Educ.* 17, 647–682.

Vermunt, J. D., and Verloop, N. (1999). Congruence and friction between learning and teaching. *Learn. Instr.* 9, 257–280. doi: 10.1016/s0959-4752(98)00028-0

Wibrowski, C. R., Matthews, W. K., and Kitsantas, A. (2016). The role of a skills learning support program on first-generation college students' self-regulation, motivation, and academic achievement: a longitudinal study. *J. Coll. Stud. Ret.* 9, 317–332. doi: 10.1177/1521025116629152

Winne, P. H. (1995). Self-regulation is ubiquitous but its forms vary with knowledge. *Educ. Psychol.* 30, 223–228. doi: 10.1207/s15326985ep3004_9

Winne, P. H., and Hadwin, A. F. (1997). "Studying as self-regulated learning," in *Metacognition in Educational Theory and Practice*, eds D. J. Hacker, J. Dunlosky, and A. C. Graesser (Mahwah, NJ: Lawrence Erlbaum Associates, Inc), 277–304.

Yerdelen, S., and Sungur, S. (2019). Multilevel investigation of students' self-regulation processes in learning science: classroom learning environment and teacher effectiveness. *Int. J. Sci. Math. Educ.* 17, 89–110. doi: 10.1007/s10763-018-9921-z

Zimmerman, B. (2000). "Attaining self-regulation. A social cognitive perspective," in *Handbook of Self-Regulation*, eds M. Boekaerts, P. Pintrich, and M. Zeidner (San Diego, CA: Academic Press), 13–39. doi: 10.1016/b978-012109890-2/50031-7

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: a self-regulatory perspective. *Educ. Psychol.* 33, 73–86. doi: 10.1207/s15326985ep3302\%263_3

Zimmerman, B. J., and Schunk, D. H. (eds). (2001). *Self-Regulated Learning and Academic Achievement: Theoretical Perspectives*. Abingdon: Routledge.

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 10 February 2021
doi: 10.3389/fpsyg.2021.602904

# Self-Regulation and Regulatory Teaching as Determinants of Academic Behavioral Confidence and Procrastination in Undergraduate Students

*Jesús de la Fuente[1,2]*, Paul Sander[3], Angélica Garzón-Umerenkova[4], Manuel Mariano Vera-Martínez[5], Salvatore Fadda[6] and Martha Leticia Gaetha[7]*

*[1] School of Education and Psychology, University of Navarra, Pamplona, Spain, [2] School of Psychology, University of Almería, Almería, Spain, [3] Department of Psychology, Teesside University, Middlesbrough, United Kingdom, [4] School of Psychology, Fundación Universitaria Konrad Lorenz, Bogotá, Colombia, [5] School of Psychology, University of Granada, Granada, Spain, [6] Unit of Prevention of Stress, University of Sassari, Sassari, Italy, [7] Universidad Popular Autónoma del Estado de Puebla, Puebla, Mexico*

OPEN ACCESS

**Edited by:**
*Lawrence Jun Zhang, University of Auckland, New Zealand*

**Reviewed by:**
*Yu Huang, Wuhan University, China*
*Juan Luis Castejon, University of Alicante, Spain*

***Correspondence:**
*Jesús de la Fuente*
*jdlfuente@unav.es; jfuente@ual.es*

**Specialty section:**
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

**Received:** *04 September 2020*
**Accepted:** *14 January 2021*
**Published:** *10 February 2021*

**Citation:**
*de la Fuente J, Sander P, Garzón-Umerenkova A, Vera-Martínez MM, Fadda S and Gaetha ML (2021) Self-Regulation and Regulatory Teaching as Determinants of Academic Behavioral Confidence and Procrastination in Undergraduate Students. Front. Psychol. 12:602904. doi: 10.3389/fpsyg.2021.602904*

The combination of student Self-Regulation (SR) and the context of Regulatory Teaching (RT), each in varying degree, has recently been demonstrated to have effects on achievement emotions, factors and symptoms of stress, and coping strategies. The aim of the present research study is to verify its possible further effects, on academic behavioral confidence and procrastination. A total of 1193 university students completed validated online questionnaires with regard to specific subjects in their degree program. Using an ex post facto design, multivariate analyses and structural equation modeling (SEM) were carried out in order to test the relationships predicted by the model. SR and RT had a significant joint effect in determining the degree of academic behavioral confidence and of procrastination. Academic behavioral confidence also significantly predicted reasons for procrastinating, and these in turn predicted activities of procrastination. Conclusions are discussed, insisting on the combined weight of the two variables in determining academic behavioral confidence, reasons for procrastinating and activities subject to procrastination, in university students. Implications for guidance and educational support of university students and teachers are analyzed.

**Keywords: theory of self-regulated learning vs. externally-regulated learning, academic behavioral confidence, procrastination, university, structural equation modeling**

## INTRODUCTION

This study forms part of a series whose aim is to determine the combined effect of student self-regulation and of regulatory teaching on other academic variables. The aim of the present study, therefore, was to establish the combined effect of the student's level of self-regulation (SR) and the level of regulatory teaching (RT) on students' degree of academic behavioral confidence, as a precursor to reasons for procrastinating and to activities of procrastination. This study,

then, would complete the body of published evidence that consistently indicates a joint effect of the two variables, self-regulation and regulatory teaching, in this Research Topic (de la Fuente et al., 2020a).

## The Teaching and Learning Process as Object of Study in Educational Psychology

In formal academic situations, such as the university, it seems reasonable that the variables we study would be jointly determined by learner characteristics as well as by the design and implementation of the teaching process (Cabanach et al., 2007, 2013; Chartier et al., 2011; Alonso-Tapia et al., 2018; Gentsch et al., 2018; Cassady et al., 2019). Previous theoretical models have adopted this idea. Biggs' *3P model* (Biggs, 1989, 1993a,b, 1999a,b; Biggs et al., 2001) has evolved toward a more interactive vision, progressively integrating the teaching process more explicitly (Kember et al., 2020). The *Vermunt model* (Vermunt, 1995, 1996, 1998; Vermunt and Donche, 2017) has systematically analyzed the role of external regulation as a negative factor for appropriate learning styles (Vermunt, 2005, 2007). The *Entwistle model* (Entwistle and Ramsden, 1983; Entwistle, 1991) has specifically considered the weight of the context and teaching process in the university environment (Ramsden, 1991; Asikainen et al., 2014; Cano et al., 2020). *The Zimmerman* model (Zimmerman, 1990, 1998; Zimmerman and Schunk, 2001) has also considered the contextual factor, although in a more implicit way (Kim et al., 2020; Zalazar-Jaime and Medrano, 2020).

The Theory of Self- vs. Externally-Regulated Learning, *SRL vs. ERL Theory* (de la Fuente, 2017) has attempted to organize the different combinations of student regulation (learning process) and teacher regulation (teaching process) that can occur in a university academic setting, summarizing these in a five-combination heuristic (see **Table 1**). This heuristic assumes that each study variable should be contextualized within the teaching and learning process, representing a distinct approach to investigation in Educational Psychology. Assuming that the students and the teacher may have varying characteristics (high-medium-low in regulation), different combinations will result, and prove more or less favorable to the teaching and learning process:

(1) The worst, *Very Unfavorable* combination (type 1) refers to a classroom combination of a student with low self-regulation (SR) and a teaching process low in external regulation (RT). In this case, the model predicts low academic behavioral confidence and high procrastination.
(2) An *Unfavorable* combination (type 2) refers to a classroom combination of a student with low SR and a teacher with medium RT, or the inverse. Here, the model predicts medium-low academic behavioral confidence and medium-high procrastination.
(3) A *Medium* combination (type 3) refers to the combination of a student with medium SR and a teacher with medium RT. The model predicts medium academic behavioral confidence and a medium level of procrastination.
(4) A *Favorable* combination (type 4) refers to the combination of a student with medium SR and a teacher with high RT, or the inverse. The model predicts medium-high academic behavioral confidence and a medium-low level of procrastination.
(5) The *Most Favorable* combination (type 5) refers to the combination of a student with high SR and a teacher with high RT. The model predicts high academic behavioral confidence and a low level of procrastination.

Previous research has consistently shown this heuristic to establish significant differences in the factors and symptoms of stress (de la Fuente et al., 2020a), coping strategies (de la Fuente et al., 2020b), achievement emotions (de la Fuente et al., 2019), students' learning approaches (de la Fuente et al., 2020c) and academic achievement (de la Fuente et al., 2017). All these results are contextualized within the process of university teaching and learning (Gross, 2008, 2014, 2015a,b; Holinka, 2015; Harley et al., 2019; Hirvonena et al., 2019; Kobylińska and Kusev, 2019). Yet to be established, however, is its discriminatory power in determining the level of academic behavioral confidence and procrastination– two behavioral variables of learning that are polar opposites in their association with self-regulated learning at university. Consequently, this will be the aim of the present study.

## Academic Behavioral Confidence as Variable of the Teaching and Learning Process

### Academic Behavioral Confidence as a Variable of the Learning Process

Although *academic behavioral confidence* has been defined as an eminently personal and attitudinal construct (Sander and Sanders, 2009; Sander et al., 2013), its self-referring, subjective, perceptual nature suggests that it can be influenced by both personal and contextual factors. Previous research has reported that *academic behavioral confidence* is associated with and is a positive predictor of a deep learning approach and of academic achievement (de la Fuente et al., 2016). Moreover, it has been positively associated with self-regulation (Nicholson et al., 2013; de la Fuente et al., 2015b), and has a stable nature, associated with academic goals (Putwain et al., 2013). Another research report has shown the predictive value of academic confidence on academic performance (Burr and LeFevre, 2020). Academic confidence has also appeared as a predictor of coping strategies and achievement (Kirikkanat and Kali-Soyer, 2018), as well as predicting confidence in learning (Shoemaker, 2010). More recently, it has been found in association with and a positive predictor of positive achievement emotions, as well as negatively predicting negative emotions (Sander and de la Fuente, 2020).

Earlier research in the development of the academic behavioral confidence scale has shown that the scale meaningfully discriminates between students in different degree programs, such that students in programs that require higher grades at entry, for example Medicine, Speech and Language Therapy, and Nutrition have higher confidence in one or more of the Grades, Studying and Attendance sub-scales (Sander and Sanders, 2009). In a summary article, Sander (2009) presents findings that indicate that dyslexic students studying at universities in the

**TABLE 1 |** Combinations between model parameters hypothesized by SRL vs. ERL Theory (de la Fuente et al., 2017, 2019).

| Combination Level | | Regulation aver/rank | Regulation trend: Effect | Academic Behavioral Confidence*→ | Procrastination* |
|---|---|---|---|---|---|
| SR Level (range)* | RT Level (range)* | | | | |
| **3** (3.85–5.00) **H** | **3** (2.84–5.00) **H** | 3.0/**5** | **High-High:** *High Regulation* | *High* | *Low* |
| **2** (3.10–3.84) **M** | **3** (2.84–5.00) **H** | 2.5/**4** | **Medium-High**: *Regulation* | *M-H* | *M-L* |
| **3** (3.85–5.00) **H** | **2** (2.35–2.83) **M** | 2.5/**4** | **High-Medium**: *Regulation* | *M-H* | *M-L* |
| **2** (3.10–3.84) **M** | **2** (2.35–2.83) **M** | 2.0/**3** | **Medium:** *Non-Regulation* | *M* | *M* |
| **2** (3.10–3.84) **M** | **1** (1.00–2.34) **L** | 1.5/**2** | **Medium-Low**: *Dysregulation* | *M-L* | *M-H* |
| **1** (1.00–3.09) **L** | **2** (2.35–2.83) **M** | 1.5/**2** | **Low-Medium**: *Dysregulation* | *M-L* | *M-H* |
| **1** (1.00–3.09) **L** | **1** (1.00–2.34) **L** | 1.0/**1** | **Low-Low:** *High Dysregulation* | *Low* | *High* |

*SR level and teaching level (L, low; M, medium; H, High); *effects analyzed in this investigation.*

United Kingdom have lower academic confidence on the Grades, Verbalizing and Studying sub-scales but not on the Attendance sub-scale. Furthermore, other data from United Kingdom university students shows that scores on the academic behavioral confidence scale drop during a course of study (Sander, 2009; Putwain and Sander, 2016), a finding that is supported by other research (Beyer, 1999; Zusho et al., 2003; Papinczak et al., 2008).

### Academic Behavioral Confidence as a Variable Promoted Through Teaching

Prior research has demonstrated that level of regulatory teaching determined the degree of academic behavioral confidence (de la Fuente et al., 2015b). However, we have not yet seen whether academic behavioral confidence is determined linearly and jointly both by student characteristics and teaching process characteristics (Akbari and Sahibzada, 2020). A pertinent factor to be considered is that the grades and verbalizing components of academic behavioral confidence are under the control of the student only to a lesser degree, whereas the studying and attendance components are largely under the student's control (Sander, 2009; Sander and Sanders, 2009). A student may choose to study or attend whereas the grades one receives depends partly on the marker, and one's experience of discussing course materials depends on the person one is talking to. As Putwain and Sander (2016) say, "The dip and return of confidence in studying and attendance may reflect a closer alignment with self-regulative processes determined by control than grades and verbalizing" (p. 393). Finally, show how the expectations that students have of their and their teachers' responsibility in the teaching and learning process interact with student academic confidence in the prediction of grades.

## Procrastination as a Variable of the Teaching and Learning Process

### Procrastination as a Variable of the Learning Process

Procrastination has been studied and described for general matters of daily life as well as for specific areas, such as the contexts of health and academics. Procrastination is understood to be a failure in motivation that creates a gap between intention and action, with negative consequences for the individual (Steel, 2007; Steel and Klingsieck, 2015), and has been established as the polar opposite of self-regulation. It has thus been considered a dysregulatory behavior (de la Fuente, 2017), being negatively predicted by self-regulation (Garzón-Umerenkova et al., 2018). High levels of procrastination have also been related to anxiety problems, general stress, and physical and mental health issues (Stead et al., 2010; Sirois and Tosti, 2012; Kim and Seo, 2015). In general, research studies on procrastination can be classified as focusing either on the reasons that lead to procrastinating, or on the activities or frequency of procrastination behaviors. The *motives* that define the volitional basis leading to procrastination differ in valence (positive vs. negative emotionality) and direction (approach vs. avoidance), while frequency describes the intensity of procrastination in different activities.

The study of the *motives* or *reasons for procrastinating* has established certain commonalities, such as attraction/uncertainty about the task, fear of failure or fear of evaluation (Zarick and Stonebraker, 2009) and perfectionism (Sudler, 2013). Among university students, inadequate time management, test anxiety, and laziness are the principal triggers for procrastinating (Gil et al., 2019).

Examples of procrastination in activities of *daily life* may involve paying a bill or taking one's medication; in the academic context, preparing for a test or doing an assignment. General procrastination behaviors have been on the rise in recent decades. In the 1970s, figures for recurring procrastinators fell between 4–5% of the adult population, while this incidence has recently been estimated at 15–20% (Steel and Ferrari, 2012). Specifically, academic procrastination appears with greater frequency than general procrastination. Certain studies indicate that students often put off starting to prepare for exams (30–40%) or writing papers (46%) (Rothblum et al., 1986; Beswick et al., 1988).

At the same time, the *intensity* of academic procrastination shows differences between certain population subgroups. For example, gender has been described as having an indirect effect on procrastination and academic performance, with lower levels of procrastination and greater achievement in women; age also has an effect, where procrastination is positively predicted in younger people (Garzón-Umerenkova et al., 2018). Similarly, there is evidence to indicate that procrastination varies according to the student's degree program (Clariana, 2013); that there is a greater tendency to procrastinate in the transition from high school to university; and that procrastination is associated with plagiarism or dishonest academic behavior (Clariana et al., 2012).

Different studies have confirmed that procrastination is inversely associated with academic achievement: the greater the

procrastination, the lower the achievement (Kim and Seo, 2015). Procrastination has more predictive value for achievement than do variables like class attendance or university admissions scores (Steel, 2007; Rozental and Carlbring, 2014). Procrastination has also been associated with other important academic variables. When students perceive tasks as difficult, unattractive, ambiguous and requiring more effort, they tend to present higher rates of procrastination (Ferrari et al., 2006). Accordingly, those who present more confidence in their academic skills (high levels of self-efficacy) tend to procrastinate less, and procrastination has less impact on their academic achievement (Klassen et al., 2008).

The psychological mechanism by which procrastination originates in the student seems to be low *expectation of achievement;* this affects motivation to start the task and to follow through, possibly leading to avoidance behavior and procrastination (Rozental and Carlbring, 2014). *Self-efficacy* seems to mediate the effect of achievement expectations; students with low perceived self-efficacy are more vulnerable to being caught in a vicious cycle of procrastination (Wäschle et al., 2014). By contrast, high levels of self-efficacy are related to the use of planning tools and starting tasks at the right time (Wolters, 2003).

### Procrastination as a Variable Promoted Through the Teaching Process

Given that the mechanism behind this behavioral phenomenon is a lack of motivation or expectations, it is reasonable that most research has focused on procrastination as it relates to student characteristics, looking for internal explanatory mechanisms. However, it is also possible that procrastination can be triggered externally, by characteristics of the teaching process (Codina et al., 2020; Yang, 2020). Insufficient attention has been given to this perspective. Adopting the perspective of SRL vs. ERL Theory (de la Fuente, 2017) allows us to take this two-fold approach.

Situational and contextual factors –social factors included– play an important role in explaining the types of procrastination. Parents' and teachers' negative attitudes toward procrastination, for example, have been found to trigger a kind of procrastination as rebellion (Klingsieck et al., 2013). There is evidence that students' perception of autonomy-supportive teaching, or effective or regulatory teaching, is positively associated with feeling competent, and negatively associated with procrastination behaviors (Codina et al., 2020). Procrastination increases when the teacher lowers demands, is willing to negotiate academic deadlines, and tends to be more flexible in grading (Schraw et al., 2007). Consequently, task characteristics and teacher characteristics, as powerful contextual factors, are important in triggering or increasing the likelihood of procrastination in students (Steel and Klingsieck, 2016).

## Aims and Hypotheses

Based on the models and previous empirical data, the following research objectives were set: (1) to establish whether the combination levels defined in SRL vs. ERL Theory (**Table 1**) determine the level of academic behavioral confidence, as well as reasons for and activities of procrastination; (2) to determine the predictive value of both self-regulation and regulatory teaching in academic behavioral confidence, and the latter's predictive value in reasons for and activities of procrastination.

From these objectives, the following *hypotheses* were stated. (1) A *graded increase in level of regulation* (internal and external) would give rise to an increase in academic behavioral confidence, and a proportionate decrease in reasons for and activities of procrastination. By contrast, a *graded decrease in level of regulation* (internal and external) would give rise to a decrease in academic behavioral confidence, and a proportionate increase in reasons for and activities of procrastination. (2) Regulation factors in students and in the teaching would be positive, significant predictors of academic behavioral confidence; the latter would in turn negatively predict reasons for and activities of procrastination.

# MATERIALS AND METHODS

## Participants

To establish interdependence relations between low-medium-high levels of *Self-Regulation* (SR) and *Regulatory Teaching* (RT), we used a total sample of 1193 undergraduate students from two public universities of Spain, taken through convenience sampling. The sample contained students majoring in Psychology, Primary Education, and Educational Psychology; 85.5% were women and 14.5% were men. The age range was 19 to 25 years, and mean age was 21.33 ($\sigma = 2.26$) years.

## Instruments

### Self-Regulation (Meta-Behavioral Variable)

The *Short Self-Regulation Questionnaire* (SSRQ) (Miller and Brown, 1991) was used to measure this variable. The Spanish version has been validated in Spanish samples (Pichardo et al., 2014, 2018), showing acceptable validity and reliability values, comparable to the English version. The Spanish Short SRQ comprises four factors (goal setting-planning, perseverance, decision making and learning from mistakes) and contains 17 items (all with saturations greater than 0.40). This questionnaire has a Likert format, with possible responses ranging from 1 ("not true of me at all") to 5 ("very true of me). It has the advantage of significantly reducing completion time with respect to the original 63-item scale. The confirmatory factor structure is consistent (Chi-Square = 250.83, df = 112, CFI = 0.90, GFI = 0.92, AGFI = 0.90, RMSEA = 0.05). Internal consistency was acceptable for the questionnaire total ($\alpha = 0.86$) and for all factors: goal setting-planning ($\alpha = 0.79$), decision making ($\alpha = 0.72$), learning from mistakes ($\alpha = 0.72$), and perseverance ($\alpha = 0.73$). Correlations were obtained for the following: (1) between each item and its factor total, (2) between the factors, and (3) between each factor and the questionnaire total. The results were good in all cases, except for decision making, which had a lower correlation with other factors (0.41 to 0.58). The correlations between the original long SRQ and the long Spanish version, and between the English short SRQ and the Spanish short version are better for the short version (original SSRQ: $r = 0.85$ and Spanish SSRQ: $r = 0.94$; $p < 0.01$) than for the original, long SRQ ($r = 0.79$; $p < 0.01$).

### Regulatory Teaching (Meta-Instructional Variable)

The *Assessment of the Teaching-Learning Process, ATLP, student version* (de la Fuente et al., 2012) was used to evaluate students' perception of the teaching process. The Regulatory Teaching scale constitutes Dimension 1 of the confirmatory model. The ATLP-D1 contains 29 items with a five-factor structure: Specific regulatory teaching, regulatory assessment, preparation for learning, satisfaction with the teaching, and general regulatory teaching. Having been previously validated in university students (de la Fuente et al., 2012, 2020c), the scale shows a factor structure with adequate fit indices (Chi-Square = 590.626; df = 48, $p < 0.001$, CFI = 0.938, TLI = 0.939, NFI = 0.950, NNFI = 0.967; RMSEA = 0.058). Internal consistency is also adequate (ATLP D1: $\alpha = 0.83$; specific regulatory teaching, $\alpha = 0.897$; regulatory assessment, $\alpha = 0.883$; preparation for learning, $\alpha = 0.849$; satisfaction with the teaching, $\alpha = 0.883$ and general regulatory teaching, $\alpha = 0.883$). The ATLP is a self-report instrument that collects data from students and teachers and is available in Spanish and English. External validity results are also consistent, since there are several interdependent relationships between the reported perceptions of variables in an academic setting.

### Academic Behavioral Confidence (Attitudinal Variable)

This was measured by the Academic Behavioral Confidence Scale (Sanders and Sander, 2003; Sander and Sanders, 2006, 2009) in a validated Spanish version (Sander et al., 2011). Developed from the established constructs of self-concept and self-efficacy, the ABC scale assesses specific aspects in undergraduate students. This psychometric scale, designed for students from Spain and the United Kingdom, asks them to report their anticipated study-related behaviors within their degree program (assumed to consist primarily of lecture-based courses). Crucially distinct aspects of students' academic behavior are represented in four subscales: Grades, Studying, Verbalizing and Attendance (Sander, 2009). Students are required to respond to a question stem ('How confident are you that you will be able to...') for items such as '...manage your workload to meet coursework deadlines' and '...write in an appropriate academic style.' Responses fall along a five-point scale (1 = 'not at all confident,' 5 = 'very confident'). A higher score therefore indicates greater confidence in one's efficacy in study skills or behaviors. A four-factor model (confidence in attaining grades, studying, attending classes and discussing course material) has shown adequate reliability and validity in prior studies (Sander and Sanders, 2009). The confirmatory model showed good fit [Chi-square = 693.405; Degrees of freedom (152–54) = 98; $p \leq 0.001$; NFI = 0.916; RFI = 0.904; IFI = 0.927; TLI = 0.909, CFI = 0.927; RMSEA = 0.062; HOELTER = 276 ($p < 0.05$) and 302 ($p < 0.01$)]. There is also good internal consistency for the total scale [$\alpha = 0.952$; Part 1 = 0.932, Part 2 = 0.872; Spearman-Brown = 0.961; Guttman = 0.935].

### Procrastination (Motivational Variable)

Procrastination Assessment Scale-Students, in its Spanish version (Garzón and Gil, 2017). This scale was originally constructed by Solomon and Rothblum (1984) and has been often used in the study of academic procrastination internationally. Its 44 items describe the frequency of academic procrastination activities (18 items) and the underlying reasons for doing them (26 items). Thirteen possible reasons for procrastinating are incorporated, including such options as: evaluation anxiety, perfectionism, difficulty making decisions, dependency and help seeking, aversiveness of the task, lack of self-confidence and laziness. Response options are presented on a Likert scale with values from 1 to 5, where 1 means "does not reflect my motives at all," 3 means "it reflects them to a certain degree" and 5 means "it reflects them perfectly."

For the present study, we considered procrastination frequency in the academic activities addressed by the PASS: writing a term paper, studying for an exam, keeping up with weekly assigned reading, performing administrative tasks, attendance. Each activity also included the question: To what degree is procrastination in this area a problem for you? and, To what degree would you like to decrease your procrastination in this area? For this section, the test uses a five-point Likert scale: 1 (Never), 2 (Almost never), 3 (Sometimes), 4 (Almost always) and 5 (Always). Reasons for procrastinating were grouped into five factors: arousal seeking, low self-control, perfectionism, test anxiety and low self-confidence.

## Procedure

Participants voluntarily completed the scales using an online platform (de la Fuente et al., 2015a). The assessments covered a total of five specific teaching-learning processes of different university subjects over a period of two academic years. All the questionnaires were answered in their Spanish versions, previously translated and validated, using the online platform[1]. This research platform allows teachers and students to register online and give their informed consent. Each questionnaire is completed independently; students then have access to their scores for the total construct and for its factors. Additionally, the student can access self-help feedback, based on their scores, to work on aspects of their learning process. This platform is presently available in Spanish and English, but the number of available languages for questionnaire completion is currently being expanded, following validation of each tool in each language. *Self-regulation* and *Academic Behavioral Confidence* were evaluated in October-November of 2018 and 2019; *Procrastination Behavior and Regulatory Teaching* in March-April 2018 and 2019.

Students signed their informed consent and received a certificate of Project participation for completing the inventories outside of regular class hours. The procedure was approved by the respective Ethics Committees of the two universities, in the context of an R&D Project (see Funding).

## Data Analysis

### Research Design

In line with the method of sample selection, an *ex post facto* design was used, collecting the data and manipulating it by selection.

[1] www.inetas.net

**TABLE 2 |** Interdependent complex effects (3 × 3) of low-medium-high levels of *Self-Regulation (SR)* and low-medium-high levels of *Regulatory Teaching (RT)* with academic behavioral confidence and procrastination ($n$ = 986).

| **SR** | **Low($n$ = 246)** | | | **Medium($n$ = 473)** | | | **High($n$ = 267)** | | | **Variable** | **F(Pillai's)** | ***post-hoc* effects** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RT** | **Low** | **Med** | **High** | **Low** | **Med** | **High** | **Low** | **Med** | **High** | | | |
| ***N*=** | **58** | **134** | **54** | **85** | **230** | **158** | **29** | **102** | **136** | | | |
| **Academic Behavioral Confidence** | | | | | | | | | | | | |
| Total | 3.13 (0.64) | 3.40 (0.50) | 3.49 (0.51) | 3.54 (0.48) | 3.66 (0.44) | 3.86 (0.50) | 3.89 (0.51) | 4.00 (0.44) | 4.22 (0.44) | SR | $F(2,957) = 98.987^{**}$, $n^2 = 0.171$; | pow = 1,0; 1 < 2 <3** |
| | | | | | | | | | | RT | $F(2,957) = 19.795^{**}$, $n^2 = 0.040$; | pow = 1,0; 1 < 2 < 3** |
| Factors | | | | | | | | | | SR | $F(8,1981) = 31.307^{**}$; $n^2 = 0.116$; | |
| | | | | | | | | | | RT | $F(8,1981) = 7.301^{**}$; $n^2 = 0.030$ | |
| F1. Grades | 3.41 (0.76) | 3.75 (0.50) | 3.87 (0.53) | 4.03 (0.50) | 4.01 (0.45) | 4.16 (0.18) | 4.20 (0.43) | 4.33 (0.43) | 4.52 (0.41) | SR* | $F(2,957) = 87.830^{**}$, $n^2 = 0.115$; | pow = 1.0; 1 < 2 < 3** |
| | | | | | | | | | | RT* | $F(2,957) = 18.192^{**}$, $n^2 = 0.037$, | pow = 1.0; 1 < 2 < 3** |
| F2. Verbalization | 3.16 (0.75) | 3.47 (0.59) | 3.63 (0.56) | 3.64 (0.54) | 3.85 (0.51) | 4.01 (0.57) | 4.14 (0.63) | 4.21 (0.47) | 4.47 (0.53) | SR* | $F(2,957) = 119.302^{**}$, $n^2 = 0.200$; | pow = 1.0; 1 < 2 < 3** |
| | | | | | | | | | | RT* | $F(2,957) = 18.985^{**}$, $n^2 = 0.038$; | pow = 1.0; 1 < 2 < 3** |
| F3. Study | 2.62 (0.89) | 2.78 (0.97) | 2.85 (0.97) | 2.97 (0.97) | 3.01 (0.98) | 3.28 (0.89) | 4.14 (0.63) | 4.21 (0.47) | 4.44 (0.43) | SR | $F(2,957) = 31.389^{**}$, $n^2 = 0.062$; | pow = 1.0; 1 < 2 < 3** |
| | | | | | | | | | | RT | $F(2,957) = 3.525^{*}$, $n^2 = 0.007$; | pow = 0.625; 1,2 < 3** |
| F4. Attendance | 3.24 (0.95) | 3.62 (0.71) | 3.70 (0.71) | 3.72 (0.76) | 3.86 (0.75) | 4.00 (0.61) | 3.87 (0.70) | 4.03 (0.62) | 4.22 (0.64) | SR | $F(2,957) = 28.606^{**}$, $n^2 = 0.056$; | pow = 1.0; 1 < 2 < 3** |
| | | | | | | | | | | RT* | $F(2,957) = 13.737^{**}$, $n^2 = 0.027$; | pow = .998; 1,2 < 3** |
| **Procrastination** | | | | | | | | | | | | |
| **Reasons for Procrastination** | | | | | | | | | | | | |
| Total | 3.00 (0.49) | 2.63 (0.56) | 2.57 (0.91) | 2.41 (0.59) | 2.29 (0.58) | 2.20 (0.61) | 2.25 (0.57) | 2.11 (0.60) | 1.83 (0.47) | SR* | $F(2,202) = 13.022^{**}$, $n^2 = 0.114$; | pow = 0.997; 1 > 2 > 3** |
| | | | | | | | | | | RT | $F(2,202) = 3.083^{*}$, $n^2 = 0.030$; | pow = 0.590; 1 > 2,3** |
| Factors | | | | | | | | | | | | |
| R1. Arousal seekg | 3.10 (0.77) | 2.97 (0.75) | 2.82 (1.0) | 2.50 (0.85) | 2.48 (0.68) | 2.40 (0.85) | 2.20 (0.75) | 2.12 (0.67) | 2.06 (0.78) | SR | $F(2, 202) = 10.837^{**}$, $n^2 = 0.097$; | pow = 0.990; 1,2 > 3** |
| | | | | | | | | | | RT | $F(2, 202) = 0.182^{ns}$, $n^2 = 0.002$, | pow = 0.078; |
| R2. L. Self-control | 3.56 (0.90) | 3.35 (0.92) | 2.85 (1.0) | 2.88 (1.0) | 2.72 (.79) | 2.28 (0.94) | 2.65 (0.94) | 2.23 (0.93) | 2.03 (0.92) | SR* | $F(2, 202) = 10.992^{**}$, $n^2 = 0.098$; | pow = 0.990; 1 > 2 > 3** |
| | | | | | | | | | | RT* | $F(2, 202) = 5.337^{**}$, $n^2 = 0.050$; | pow = 0.836; 1 < 2,3** |
| R3. Perfectionism | 3.34 (0.51) | 2.89 (0.76) | 2.66 (1.0) | 2.76 (0.82) | 2.59 (0.72) | 2.51 (0.51) | 2.56 (0.71) | 2.34 (0.70) | 2.32 (0.67) | SR* | $F(2,202) = 6.111^{**}$, $n^2 = 0.057$; | pow = 0.684; 1 > 2 > 3* |
| | | | | | | | | | | RT | $F(2,202) = 2.201^{ns}$, $n^2 = 0.021$; | pow = 0.446 |
| R4. Test anxiety | 2.77 (0.78) | 2.28 (1.1) | 2.33 (1.3) | 1.94 (1.0) | 2.18 (1.0) | 1.88 (1.0) | 2.60 (0.96) | 1.97 (0.78) | 1.32 (0.60) | SR* | $F(2,202) = 3.943^{*}$ $n^2 = 0.038$; | pow = 0.704; 1 > 2,3** |
| | | | | | | | | | | RT* | $F(2,202) = 4.009^{*}$, $n^2 = 0.038$; | pow = 0.712; 1 > 3* |
| R5. Low Confidence | 2.12 (0.89) | 1.85 (0.83) | 2.08 (0.92) | 1.63 (0.79) | 1.82 (0.76) | 1.79 (0.72) | 1.33 (0.77) | 1.88 (0.89) | 1.42 (0.69) | SR | $F(2,202) = 3.375^{*}$, $n^2 = 0.032$; | pow = 0.632; 1 > 3* |
| | | | | | | | | | | RT | $F(2,202) = 1.574^{ns}$, $n^2 = 0.030$; | pow = 0.481; 1 > 3* |
| **Procrastination Activities** | | | | | | | | | | | | |
| Total | 3.00 (0.49) | 2.63 (0.56) | 2.50 (0.91) | 2.31 (0.59) | 2.27 (0.57) | 2.20 (0.61) | 2.25 (0.57) | 2.11 (0.60) | 1.83 (0.47) | SR* | $F(2,202) = 13.022^{**}$, $n^2 = 0.114$; | pow = 0.997; 1 > 2 > 3** |
| | | | | | | | | | | RT | $F(2,202) = 3.083^{*}$, $n^2 = 0.030$; | pow = 0.590; 1,2 > 3** |
| Factors | | | | | | | | | | SR* | $F(12,442) = 2.507^{**}$, $n^2 = 0.067$; | pow = 0.828; |
| | | | | | | | | | | RT | $F(12,442) = 1.569^{*}$, $n^2 = 0.050$; | pow = 0.590; |
| F1. Term papers | 3.71 (0.78) | 3.84 (0.70) | 3.66 (0.94) | 3.70 (0.55) | 3.36 (0.73) | 3.19 (0.81) | 2.33 (1.0) | 3.20 (0.83) | 3.13 (0.73) | SR* | $F(2,215) = 12.550^{**}$, $n^2 = 0.105$; | pow = 0.996; 1 > 2 > 3** |
| | | | | | | | | | | RT | $F(2,215) = 1.220^{ns;}$ $n^2 = 0.001$; | pow = 0.246; 1 > 3* |

*(Continued)*

**TABLE 2** | Continued

| SR | Low($n$ = 246) | | | Medium($n$ = 473) | | | High($n$ = 267) | | | Variable | F(Pillai's) | *post-hoc* effects |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RT | Low | Med | High | Low | Med | High | Low | Med | High | | | |
| *N*= | 58 | 134 | 54 | 85 | 230 | 158 | 29 | 102 | 136 | | | |
| F2. Study for exams | 3.87 (0.75) | 4.10 (0.56) | 3.97 (0.76) | 3.83 (0.74) | 3.52 (0.80) | 3.28 (1.0) | 2.93 (1.4) | 3.31 (0.99) | 3.11 (1.0) | SR* | $F(2,215) = 8.582^{**}$; $n^2 = 0.074$; | pow = 0.966; 1 > 2 > 3** |
| | | | | | | | | | | RT | $F(2,215) = 0.873^{ns}$; $n^2 = 0.008$; | pow = 0.211; 1,2 > 3* |
| F3. Assigned rdg. | 3.77 (0.78) | 3.64 (0.76) | 3.55 (1.0) | 3.55 (1.0) | 3.67 (0.86) | 3.26 (1.0) | 2.66 (1.3) | 3.23 (1.0) | 2.94 (0.95) | SR* | $F(2,215) = 6.619^{**}$; $n^2 = 0.058$; | pow = 0.909; 1 > 2,3** |
| | | | | | | | | | | RT | $F(2,215) = 1.585^{ns}$; $n^2 = 0.015$; | pow = 0.334; 1,2 > 3* |
| F4. Admin. tasks | 2.80 (0.87) | 3.14 (1.0) | 2.91 (1.0) | 2.44 (0.99) | 2.81 (1.0) | 2.40 (1.1) | 2.60 (1.36) | 2.68 (1.1) | 2.24 (1.1) | SR | $F(2,215) = 2.579^{*}$; $n^2 = 0.023$; | pow = 0.511; 1 > 3** |
| | | | | | | | | | | RT | $F(2,215) = 2.163^{ns}$; $n^2 = 0.020$; | pow = 0.440; 1,2 > 3* |
| F5. Attendance | 3.35 (0.87) | 3.18 (1.0) | 3.33 (1.2) | 3.08 (0.73) | 3.07 (0.98) | 2.66 (1.5) | 2.80 (1.1) | 2.88 (1.0) | 2.75 (1.1) | SR | $F(2,215) = 2.746^{*}$; $n^2 = 0.025$; | pow = 0.538; 1 > 3** |
| | | | | | | | | | | RT | $F(2,215) = 0.382^{ns}$; $n^2 = 0.004$; | pow = 0.111; |
| F6. Active in general | 3.33 (0.72) | 2.97 (0.93) | 3.50 (1.0) | 3.18 (0.73) | 3.00 (0.99) | 2.69 (0.96) | 3.20 (1.3) | 2.72 (1.0) | 2.61 (0.96) | SR | $F(2,215) = 2.477^{*}$; $n^2 = 0.023$; | pow = 0.494; 1 > 3** |
| | | | | | | | | | | RT | $F(2,215) = 1.487^{ns}$; $n^2 = 0.014$; | pow = 0.315; |

*Statistical effect with higher F value: featured effect. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

### *Inferential effects of regulation levels*

Through cluster analysis, continuous independent variables were transformed into discrete dependent variables, with three levels (low-medium-high). Preliminary analyses were carried out to determine the distribution of the variables, and so be able to perform analyses of variance [SR ($M$ = 3.48, $SD$ = 0.60); Kolmogoroff-Smirnoff = 0.25, $p < 0.200$; RT ($M$ = 3.37, $SD$ = 0.59); Kolmogoroff-Smirnoff = 0.37, $p < 0.3501$]. ANOVAs and MANOVAs were conducted, with Self-Regulation and Regulatory Teaching as independent Variables (IV), while Academic Behavioral Confidence and Procrastination were the dependent Variables. In all cases, error variance differences were confirmed to be non-significant (Box's M test as a multivariate statistical test used to check the equality of multiple variance-covariance matrices. The test is commonly used to test the assumption of homogeneity of variances and covariances in MANOVA and linear discriminant analysis), $p > 0.05$). The multivariate analyses (MANOVAs) showed a statistically significant main effect of the five interaction types on low-medium-high levels of the dependent variables (see **Table 1**):

*Combination 1* represents a statistically significant low level of SR and low level of RT (1 and 1). The average regulation level is 1.0, and its regulation rank is 1. The regulation trend is low SR and low RT; this is associated with a high level of dysregulation. The effects would be a low level of academic behavioral confidence and a high level of procrastination reasons and activities.

*Combination 2* represents a statistically significant low level in SR and medium level in RT, or vice versa (1 and 2, or 2 and 1). The average regulation level is 1.5, and its regulation rank is 2. The regulation trend is low SR and medium RT, or vice versa; associated in turn with a medium-low level of dysregulation. The effects, then, would be a low-medium level of academic behavioral confidence and a medium-high level of procrastination reasons and activities.

*Combination 3* represents a statistically significant medium level of SR and medium level of RT (2 and 2). The average regulation level is 2.0, and its regulation rank is 3. The regulation trend is medium SR and medium RT; this is associated with a medium level of dysregulation. The effects, then, would be a medium level of academic behavioral confidence and a medium level of procrastination reasons and activities.

*Combination 4* represents a statistically significant medium level in SR and high level in RT, or vice versa (2 and 3, or 3 and 2). The average regulation level is 2.5, and its regulation rank is 4. The regulation trend is high SR and medium RT, or medium SR and high RT; this is associated with a good level of regulation. The effects, then, would be a medium-high level of academic behavioral confidence and a medium-low level of procrastination reasons and activities.

*Combination 5* represents statistically significant high levels of SR and RT (3 and 3). The average regulation level is 3.0, and its regulation rank is 5. The regulation trend is high SR and high RT; this is associated with a high level of regulation. The effects, then, would be a high level of academic behavioral confidence and a low level of procrastination reasons and activities.

### *Predictive structural effects*

For analysis of SEM model fit, the comparative adjustment index (CFI) and the mean square approximation error (RMSEA) were used. CFI values equal to or greater than 0.90 and 0.95, respectively, were taken to indicate acceptable and close fit to the data (McDonald and Marsh, 1990). RMSEA values equal to or less than 0.08 and 0.05 were also taken to indicate acceptable and close levels of fit (Jöreskog and Sörbom, 1993). IBM-AMOS statistical program (v. 22) was used.

# RESULTS

## Interdependent Complex Effects Between Levels of Self-Regulation (SR) and Levels of Regulatory Teaching (RT)

### Effect on Total Academic Behavioral Confidence and Its Factors

There was a statistically significant main effect of SR levels (1 = low; 2 = medium; 3 = high) on total *Academic Behavioral Confidence* ($1 < 2 < 3$, $p < 0.001$). Complementarily, there was a statistically significant main effect of RT (1 = low; 2 = medium; 3 = high) on total *Academic Behavioral Confidence* ($1 < 2 < 3$, $p < 0.001$). A statistically significant effect of SR levels and RT levels was noted in all factors of *Academic Behavioral Confidence*. There was no statistically significant SR × RT interaction effect. The most powerful effect of SR was produced on the factors of *Grades* and *Verbalization,* while the most powerful effect of RT was on the factors of *Grades, Verbalization*, and *Attendance.* See **Table 2**.

### Effect on Total Reasons for Procrastination and Its Factors

A statistically significant main effect of SR levels (1 = low; 2 = medium; 3 = high) was noted on total *Reasons for Procrastination* ($1 > 2 > 3$, $p < 0.001$). Complementarily, a statistically significant main effect of RT levels (1 = low; 2 = medium; 3 = high) was noted on total *Reasons for Procrastination* ($1,2 > 3$, $p < 0.001$). Complementary, a statistically significant main effect of SR levels was noted on the

**TABLE 3 |** Effects of combination types on academic behavioral confidence, procrastination reasons and activities ($n$ = 1026).

| | Combination Types (IVs) | | | | | |
|---|---|---|---|---|---|---|
| | **1 ($n$ = 63)** | **2 ($n$ = 236)** | **3 ($n$ = 338)** | **4 ($n$ = 253)** | **5 ($n$ = 140)** | ***post-hoc* effects** |
| **DVs** | | | | | | |
| Configuration Group | | | | | | $F(4,1025) = 421.752^{***}$ (Pillai, $n^2 = 0.622$; pow = 1.0 |
| *GRUP-Self-Regulation* | 1.00 (0.00) | 1.38 (0.48) | 1.92 (0.51) | 2.43 (0.49) | 3.00 (0.00) | $F(4,1025) = 421.752^{***}$, $n^2 = 0.622$, pow = 1.0; all; $p < 0.001$ |
| *GRUP-Regulatory Teaching* | 1.00 (0.00) | 1.61 (0.48) | 2.07 (0.51) | 2.56 (0.49) | 3.00 (0.00) | $F(4,1025) = 370.801^{**}$, $n^2 = 0.591$, pow = 1.0; all $p < 0.001$ |
| **Academic Behavioral Confidence** | | | | | | |
| Total | 3.13 (0.64) | 3.50 (0.50) | 3.65 (0.47) | 3.92 (0.48) | 4.22 (0.44) | $F(4,961) = 78.261^{**}$; $n^2 = 0.246$; pow = 1.0; 5,4 > 3,2 > 1** |
| Factors | | | | | | $F(16,3844) = 20.745^{**}$; $n^2 = 0.079$; pow = 1.0 |
| F1. Grades | 3.41 (0.76) | 3.86 (0.52) | 4.01 (0.47) | 4.23 (0.50) | 4.52 (0.41) | $F(4,961) = 67.994^{**}$; $n^2 = 0.221$; pow = 1.0; 5,4 > 3,2 > 1** |
| F2. Verbalization | 3.16 (0.75) | 3.61 (0.59) | 3.84 (0.54) | 4.10 (0.53) | 4.77 (0.43) | $F(4,961) = 84.236^{**}$; $n^2 = 0.260$; pow = 1.0; 5 > 4 > 3,2 > 1** |
| F3. Study | 2.72 (0.89) | 2.85 (0.97) | 3.00 (0.85) | 3.34 (0.87) | 3.65 (0.89) | $F(4,961) = 24.558^{*}$; $n^2 = 0.093$; pow = 1.0; 5,4 > 3,2,1** |
| F4. Attendance | 3.24 (0.95) | 3.66 (0.73) | 3.76 (0.66) | 4.02 (0.61) | 4.22 (0.65) | $F(4,961) = 30.354^{**}$; $n^2 = 0.112$; pow = 1.0; 5,4 > 3 > 2,1** |
| **Reasons for Procrastination** | | | | | | |
| Total | 3.00 (0.49) | 2.47 (0.57) | 2.42 (0.65) | 2.16 (0.60) | 1.83 (0.65) | $F(4,206) = 11.080^{**}$; $n^2 = 0.177$; pow = 1.0; 1 > 2,3 > 4,5** |
| Factors | | | | | | $F(20,802) = 3.381^{**}$; $n^2 = 0.076$; pow = 1.0; |
| R1. Arousal | 3.10 (0.77) | 2.64 (0.81) | 2.54 (0.81) | 2.32 (0.79) | 2.06 (0.78) | $F(4,206) = 5.056^{**}$; $n^2 = 0.089$; pow = 0.962; 1 > 2,3 > 4,5** |
| R2. Low Self-control | 3.56 (0.90) | 3.11 (1.0) | 2.74 (0.84) | 2.26 (0.93) | 2.03 (0.92) | $F(4,206) = 12.184^{**}$; $n^2 = 0.191$; pow = 1.0; 1 > 2,3 > 4,5** |
| R3. Perfectionism | 3.43 (0.51) | 2.74 (0.80) | 2.70 (0.78) | 2.43 (0.76) | 2.32 (0.67) | $F(4,206) = 5.577^{**}$; $n^2 = 0.101$; pow = 0.981; 1 > 2,3 > 4,5** |
| R4. Test anxiety | 2.77 (0.78) | 2.11 (1.0) | 2.25 (1.0) | 1.91 (0.83) | 1.32 (0.60) | $F(4,206) = 7.241^{**}$; $n^2 = 0.123$; pow = 1.0; 1 > 2,3 > 4,5** |
| R5. Low Confidence | 2.12 (0.89) | 1.83 (0.81) | 1.74 (0.79) | 1.70 (0.69) | 1.42 (0.69) | $F(4,206) = 2.227^{*}$; $n^2 = 0.042$; pow = 0.658; 1 > 2,3,4 > 5* |
| **Activities of Procrastination** | | | | | | |
| Total | 3.45 (0.61) | 3.41 (0.51) | 3.20 (0.71) | 2.91 (0.72) | 2.80 (0.70) | $F(4,219) = 7.257^{**}$; $n^2 = 0.177$; pow = 0.997; 1,2 > 3 > 4,5** |
| Factors | | | | | | $F(24,868) = 1.815^{**}$; $n^2 = 0.048$; pow = 0.880 |
| F1. Term papers | 3.71 (0.78) | 3.67 (0.63) | 3.33 (0.85) | 3.19 (0.81) | 3.13 (0.73) | $F(4,219) = 6.174^{**}$; $n^2 = 0.101$; pow = 0.978; 1 > 2,3 > 4,5* |
| F2. Study for exams | 3.77 (0.75) | 3.67 (0.67) | 3.56 (0.33) | 3.30 (1.0) | 3.11 (1.0) | $F(4,219) = 6.604^{**}$; $n^2 = 0.108$; pow = 0.991; 1,2 > 3,4 > 5** |
| F3. Assigned reading | 3.77 (0.76) | 3.71 (0.76) | 3.27 (1.0) | 3.07 (0.96) | 2.94 (0.95) | $F(4,219) = 5.974^{**}$; $n^2 = 0.098$; pow = 0.984; 1,2 > 3 > 4,5** |
| F4. Admin. tasks | 2.80 (0.87) | 2.78 (1.0) | 2.81 (1.0) | 2.52 (1.1) | 2.24 (1.1) | $F(4,219) = 2.163^{*}$; $n^2 = 0.038$; pow = 0.633; 1,2,3 > 4 > 5* |
| F5. Attendance | 3.35 (0.87) | 3.31 (0.91) | 3.10 (1.0) | 2.76 (1.0) | 2.73 (1.1) | $F(4,219) = 2.110^{*}$; $n^2 = 0.037$; pow = 0.621; |
| F6. Activities in general | 3.33 (0.72) | 3.07 (0.84) | 3.05 (0.07) | 2.70 (1.1) | 2.61 (0.96) | $F(4,219) = 3.363^{**}$; $n^2 = 0.058$; pow = 0.842; |

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

factors of *Reasons for Procrastination.* The main partial effects of SR appeared in the procrastination reasons of *low self-control*, *perfectionism* and *test anxiety* ($1 > 2 > 3$, $p < 0.001$), while the main partial effects of RT appeared in the reasons *low self-control* and *test anxiety* ($1 > 2 > 3$, $p < 0.001$). See **Table 3** and **Figure 1**.

### Effect on Total Procrastination Behavior and Its Factors

A statistically significant main effect of SR levels (1 = low; 2 = medium; 3 = high) was noted on total *Procrastination Activities* ($1 > 2 > 3$, $p < 0.001$). Complementarily, a statistically significant main effect of RT was noted on total *Procrastination Activities* ($1,2 > 3$, $p < 0.001$). Also, a statistically significant main effect of SR levels (1 = low; 2 = medium; 3 = high) was noted on the factors of *Procrastination Activities.* The main partial effects of SR levels (1 = low; 2 = medium; 3 = high) appeared in the procrastination activities of *writing a term paper*, *studying for an exam*, and *keeping up with weekly reading* ($1 > 2 > 3$, $p < 0.001$), while the RT levels (1 = low; 2 = medium; 3 = high) variable did not carry sufficient statistical strength to determine differences in any specific procrastination activity. See **Table 2** and **Figure 2**.

## Combination Effects in Academic Behavioral Confidence and Procrastination

### Preliminary Analysis

The MANOVA that was carried out showed statistically significant differences, in all levels of the SR and RT variables, among the five groups. SR and RT are adequately configured as established in **Table 3**.

### Academic Behavioral Confidence

A statistically significant main effect of the *five combination of SR* levels *and RT* levels (see regulatory rank in **Table 1**) was noted on total *Academic Behavioral Confidence* ($5,4 > 3,2 > 1$; $p < 0.001$).

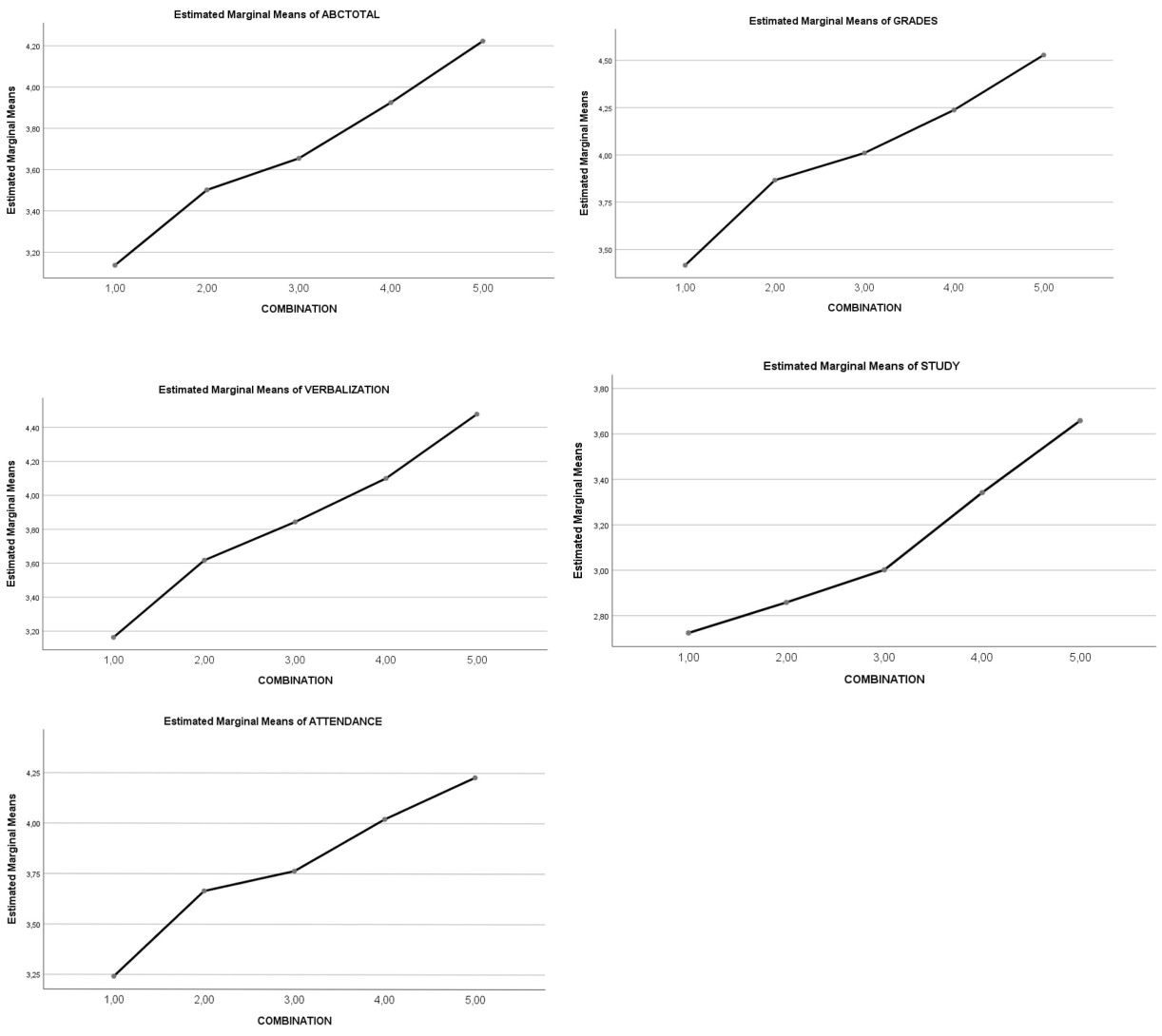


**FIGURE 1 |** Graphical representation of the effect of combination types (1–5) on *Academic Behavioral Confidence*.

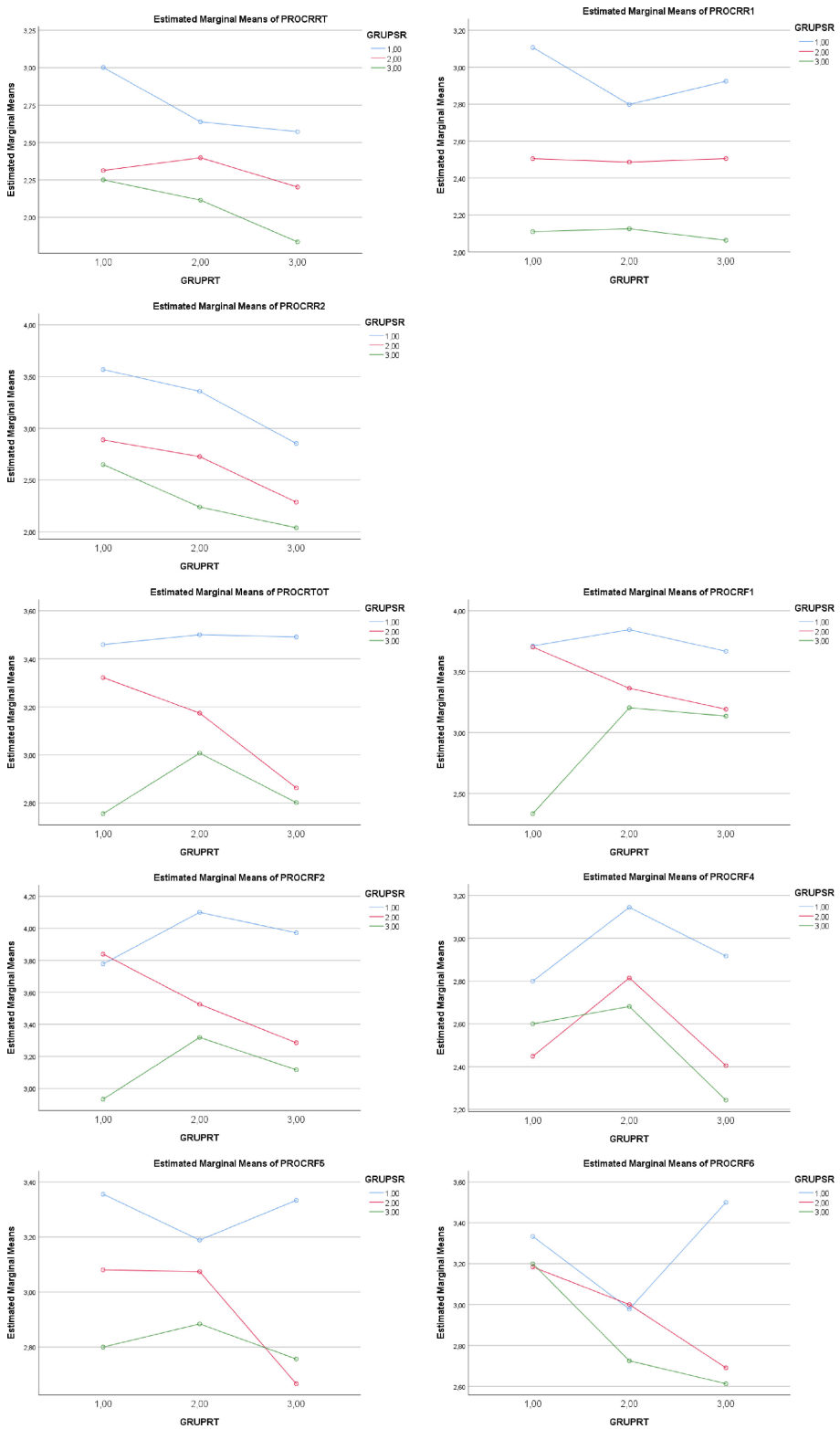


**FIGURE 2 |** Graphic representation of the effect of *Self-Regulation* level (GRUPSR) and *Regulatory Teaching* level (GRUPRT) on *Reasons* and *Activities of Procrastination.* PROCRF1, term papers; PROCRATF2, study for exams; PROCRATF3, assigned reading; PROCRATF4, admin. tasks; PROCRASTF5, attendance; PROCRATF6, activities in general. Reasons for procrastination: PROCRATOT, TOTAL; PROCRAR1, AROUSAL SEEKING; PROCRR2, LOW CONTROL; PROCRATR3, PERFECTIONISM.

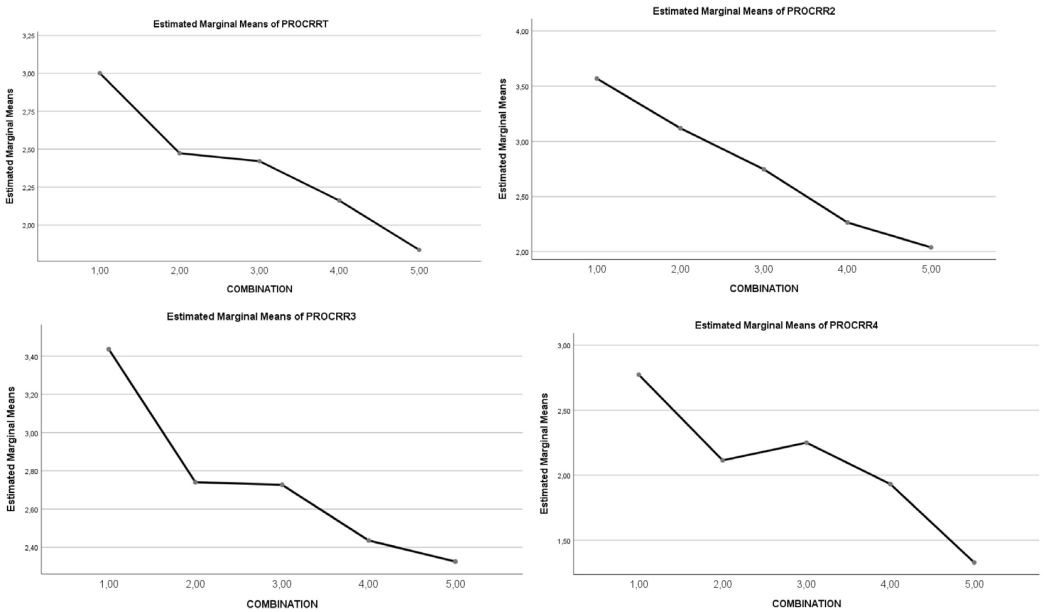


**FIGURE 3 |** Graphical representation of the effect of combination types (1–5) on reasons to procrastinate. Reasons to procrastinate: RF1. AROUSAL SEEKING; RF2. LOW CONTROL; RF3. PERFECTIONISM; RF4. TEST ANXIETY; RF5. LOW CONFIDENCE.

Complementarily, a significant main effect of the *five combinations of SR* levels *and RT* levels was noted on the factors of *Academic Behavioral Confidence* (with variations of 5,4 > 3,2 > 1; $p < 0.001$). See **Table 3** and **Figure 1**.

### Reasons for and Activities of Procrastination

A statistically significant main effect of the *five combinations of SR* levels *and RT* levels was noted on total *Reasons for Procrastination* (1 > 2,3 > 4,5, $p < 0.001$). Regarding the factors of *Reasons for Procrastination,* a statistically significant main effect of the *five combination of SR and RT* was noted in all (1 > 2,3 > 4,5, $p < 0.001$).

For total *Activities of Procrastination*, a statistically significant main effect of the *five combinations of SR and RT* levels was observed (1,2 > 3 > 4,5, $p < 0.001$). For all factors of *Activities of Procrastination*, a statistically significant main effect of the *five combinations of SR and RT* levels was noted, with particular statistical strength in *Writing term papers, Studying for exams* and *Keeping up with weekly reading* (1,2 > 3 > 4,5, $p < 0.001$). See **Table 3** and **Figures 3**, **4**.

## Structural Prediction Model

Pathway analysis (SEM) revealed an acceptable model of the relationships between variables. The relationship parameters of the two models are presented below. Both models were tested. In *model 1* the relationships Combination-> Academic confidence -> Activities of procrastination were tested, while in *model 2* the relationships Combination-> Academic confidence -> Reasons to procrastinate-> Activities of Procrastination The second model produced more consistent results and was taken as definitive. See **Table 4**.

### Standardized Direct Effects

Of particular interest was the differential weight of SR ($B = 0.62$) and RT ($B = 0.33$) on the latent variable COMBINATION. The Model reflected that the combination of regulation factors (COMB) was a significant, positive predictor of academic behavioral confidence (CONFIDENCE) ($B = 0.93$). CONFIDENCE was also a significant, negative predictor of procrastination reasons (RAZPROCRAST) ($B = -0.46$) and procrastination activities (FACTPROCRAST) ($B = -0.25$). Finally, reasons for procrastinating appeared as a significant, positive predictor of procrastination activities ($B = 0.32$). See **Table 5**.

### Standardized Indirect Effects

The combination of SR and RT (COMBINATION) had statistically significant effects on the totals for procrastination reasons and procrastination activities and on their factors. Academic behavioral confidence (CONFIDENCE) also had an indirect negative, predictive effect on each of the factors and total of procrastination activities. See **Table 6**.

A graphic representation of the final structural model is seen in **Figure 5**.

# DISCUSSION AND CONCLUSION

## Importance of the Level of Regulation Promoted Both Internally and Externally

Self- vs. Externally-Regulated Learning Theory (de la Fuente, 2017) had predicted that university students' academic confidence and procrastination could be determined, jointly, by the students' degree of *self-regulation* and by the

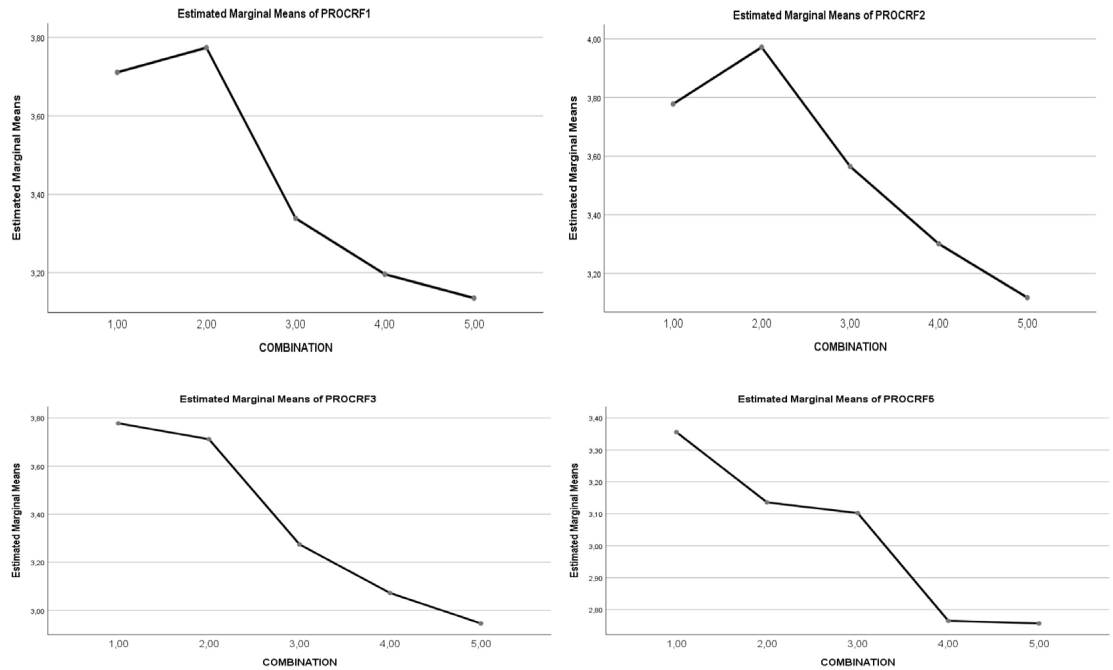


**FIGURE 4 |** Graphical representation of the effect of combination types (1–5) on procrastination activities. Procrastination activities: F1. TERM PAPERS; F2. STUDY FOR EXAMS; F3. WEEKLY READING; F4. ADMINIST. TASKS; F5. ATTENDANCE; F6. ACTIV. IN GENERAL.

**TABLE 4 |** Models of structural linear results of the variables.

| $Chi^2$ | *p* < | FG | CMFIN/FG | FI | RFI | IFI | TLI | CFI | HOELT | RMSEA |
|---|---|---|---|---|---|---|---|---|---|---|
| Model 1. 2229.258 | 0.001 | 242 | 9.211 | 719 | 0.835 | 0.843 | 0.860 | 0.810 | 0.189 | 0.103 |
| Model 2.1097.968 | 0.001 | 135 | 8.12 | 0.908 | 0.913 | 0.907 | 0.926 | 0.906 | 0.206 | 0.085 |

**TABLE 5 |** Standardized direct effects (default model).

| | COMBINATION | ACAD. BEH. CONFIDENCE | PROCRASTINATION REASONS | PROCRASTINATION ACTIVITIES |
|---|---|---|---|---|
| SELF-REGULATION | 0.618 | | | |
| REGULATORY TEACHING | 0.331 | | | |
| GRADES | | 0.813 | | |
| COMBINATION | | | | |
| ACAD. BEH. CONFIDENCE | 0.938 | | | |
| REAS. PROCRASTINATION | | | | |
| PROCRASTINATION ACT. | | | 0.320 | |
| VERBALIZATION | | 0.814 | | |
| ATTENDANCE | | 0.579 | | |
| STUDY | | 0.478 | | |
| R1. AROUSAL SEEKING | | | 0.735 | |
| R2. LOW CONTROL | | | 0.624 | |
| R3. PERFECTIONISM | | | 0.809 | |
| R4. TEST ANXIETY | | | 0.623 | |
| R5. LOW CONFIDENCE | | | 0.808 | |
| F1. TERM PAPERS | | | | 0.673 |
| F2. STUDY FOR EXAMS | | | | 0.772 |
| F3. ASSIGNED READING | | | | 0.891 |
| F4. ADMINIST. TASKS | | | | 0.463 |
| F5. ATTENDANCE | | | | 0.452 |
| F6. ACTIVITIES IN GENERAL | | | | 0.597 |

**TABLE 6 |** Standardized indirect effects (default model).

| | COMBINATION | ACADEMIC BEH. CONFID. | REASONS PROCRASTINATION | BEHAV. PROCRASTINATION |
|---|---|---|---|---|
| COMBINATION | | | | |
| ACAD. BEH. CONFIDENCE | | | | |
| REAS. PROCRASTINATION | −0.437 | −0.147 | | |
| PROCRASTINATION BEH. | −0.377 | | | |
| SELF-REGULATION | | | | |
| REGULATORY TEACHING | | | | |
| GRADES | | 0.771 | | |
| VERBALIZATION | | : | | |
| ATTENDANCE | | . | | |
| STUDY | | . | | |
| R1. AROUSAL SEEKING | | −0.321 | −0.338 | |
| R2. LOW CONTROL | −0.273 | −0.288 | | |
| R3. PERFECTIONISM | −0.353 | −0.373 | | |
| R4. TEST ANXIETY | | −0.272 | −0.287 | |
| R5. LOW CONFIDENCE | −0.169 | −0.179 | | |
| F1. TERM PAPERS | −0.254 | −0.268 | 0.215 | |
| F2. STUDY FOR EXAMS | −0.293 | −0.310 | 0.249 | |
| F3. WEEKLY READING | −0.336 | −0.354 | 0.285 | |
| F4. ADMINIST. TASKS | −0.175 | −0.184 | 0.148 | |
| F5. ATTENDANCE | −0.170 | −0.180 | 0.144 | |
| F6. ACTIV. IN GENERAL | −0.225 | −0.237 | 0.191 | |

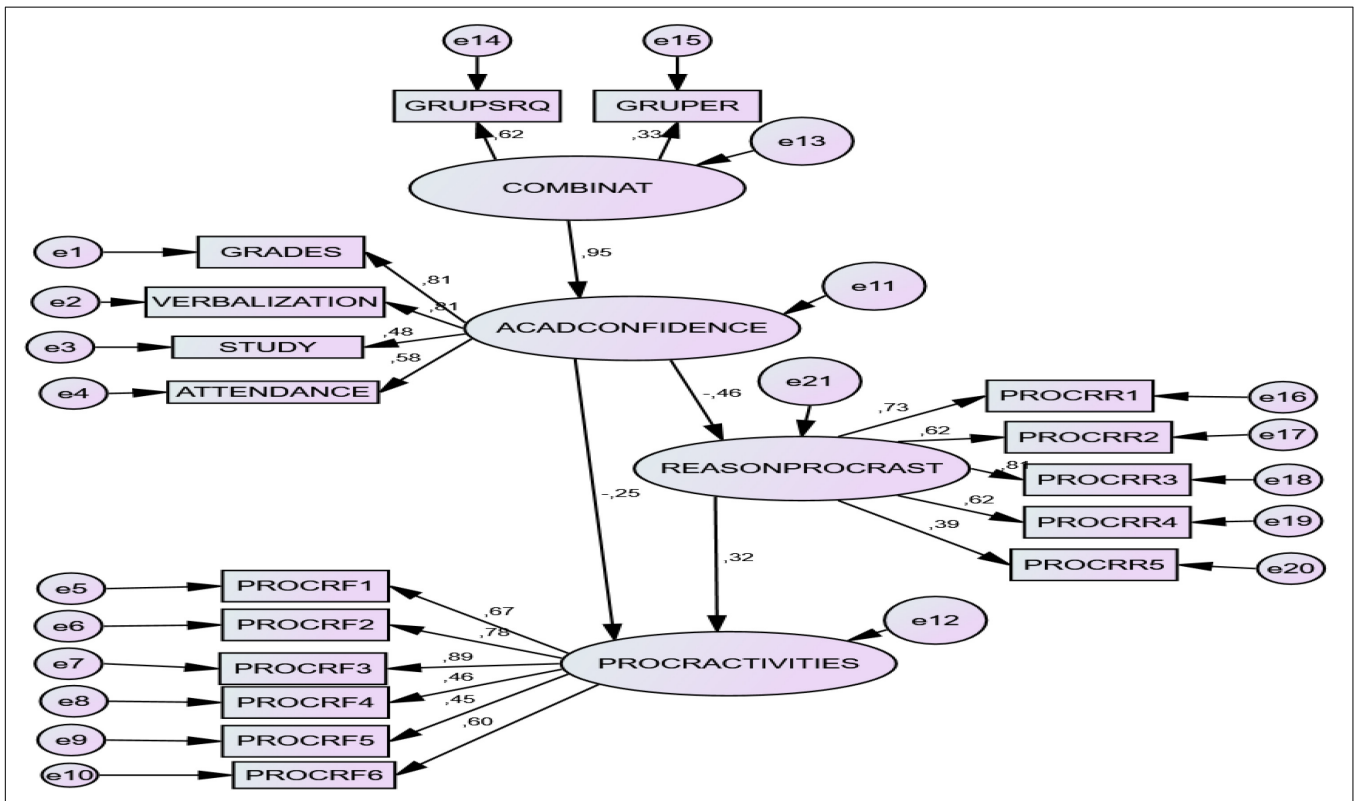


**FIGURE 5 |** SEM of relations between academic behavioral confidence, reasons for procrastination and procrastination activities. COMBINAT, *SR and RT GROUPS*: ACADCONFIDENCE, *Academic Behavioral Confidence*; REASONPROCRAT, *Reasons to procrastinate*: RR1. AROUSAL SEEKING; RR2. LOW CONTROL; RR3. PERFECTIONISM; RR4. TEST ANXIETY; RR5. LOW CONFIDENCE. PROCRACTIVITIES, *Procrastination activities* (Factors): F1. TERM PAPERS; F2. STUDY FOR EXAMS; F3. WEEKLY READING; F4. ADMINIST. TASKS; F5. ATTENDANCE; F6. ACTIV. IN GENERAL.

level of contextual, *external regulation* from the teaching process. Furthermore, this type of interaction could be understood as the combination of the *low-medium-high level* of the two factors, and is supported by prior evidence in this direction, in reference to achievement emotions (de la Fuente et al., 2015b), to coping strategies used (de la Fuente et al., 2019) and to factors and symptoms of stress (de la Fuente et al., 2020c). In this study, in line with the hypotheses posed, the results contribute evidence that a *graded increase in level of regulation* (internal and external) gave rise to an increase in academic behavioral confidence, and a proportionate decrease in reasons for and activities of procrastination. By contrast, a graded decrease in level of regulation (internal and external) would lead to a decrease in academic behavioral confidence, and a proportionate increase in reasons for and activities of procrastination (Putwain et al., 2015; Putwain, 2018; Putwain and Pescod, 2018). We may consider that Hypothesis 1 was validated in almost every case. Both individually and in combination, levels of self-regulation (SR) and of regulatory teaching (RT) have produced an increase in academic behavioral confidence, as well as a decrease in procrastination reasons and activities. These results further our conceptualization of *academic behavioral confidence,* by showing that it depends not only on the university student's level of regulation (de la Fuente et al., 2015b), but is also influenced by the level of regulation established in the teaching process. Specifically, the five-combination model (de la Fuente et al., 2019) is the most predictive model of variability in academic behavioral confidence (Sanders and Sander, 2003; Rusk et al., 2011; Saklofske et al., 2012).

*Hypothesis* 2 was also confirmed, establishing that regulation in students and regulation in teaching were both positive, significant predictors of academic behavioral confidence. Academic behavioral confidence, in turn, negatively predicted reasons for and activities of procrastination. Our linear predictive model revealed the same relationship in a structural format. It has been clearly shown that the combination of SR and RT predicts academic behavioral confidence, and that the latter directly and indirectly affects reasons for procrastinating and procrastination activites. Certain prior research studies have reported similar results, showing the predictive value of confidence with respect to procrastination in Secondary Education (Saputra et al., 2020). Klassen et al. (2008) showed that those who present more confidence in their academic skills (high levels of self-efficacy) procrastinate less. Given the results of the present study, there is evidence that academic behavioral confidence is determined not only by the student's personal factors; and that academic behavioral confidence affects not only the intensity but also the types of procrastination (Brando-Garrido et al., 2020).

## Conclusion, Limitations and Future Research

Once again, consistent with the evidence reported in prior studies (de la Fuente et al., 2015b, 2017, 2019, 2020c,d), it has been confirmed that both the level of SR (in greater measure) and the level of RT produce effects on academic behavioral confidence, and on procrastination reasons and activities, and that the former is predictive of the latter. In a complementary way, it is possible to consider academic confidence as a protective factor against procrastination during university learning, since it minimizes the reasons and behaviors of procrastination (Batool, 2020).

One limitation of this study is the exclusive use of questionnaires for collecting data; obtaining another type of evidence from other data sources would make it possible to triangulate the information (Aguilar and Barroso, 2015), as well as corroborate and/or examine in more depth the findings presented here. A second limitation is the sample composition, which is predominantly female. For this reason, the sampling of participants may affect generalizability of the findings.

Future studies could address questions like the connection to previously reported variables with similar effects (health, flourishing, academic outcomes, etc.) in a model that integrates the cumulative evidence. In addition, further study could be made of the critical components of student self-regulation and of regulatory teaching, components that account for the important differences between the groups compared in this study. A clear understanding of these practices, habits and competencies would make it possible to develop guidance programs or classroom interventions that offer specific training in personal self-regulation and teaching regulation, and would promote application of these principles in educational contexts of university (Martín et al., 2003; Linnenbrink-Garcia and Pekrun, 2011; Lüftenegger et al., 2016; Shaw et al., 2017; Tada, 2017; Lekwa et al., 2018; Loderer et al., 2018; Mainhard et al., 2018; Shannon et al., 2019; McGee, 2020).

Interventions that seek to increase self-regulation or to decrease procrastination describe three types of action strategies: therapeutic treatment, therapeutic prevention and teacher/counselor intervention (Zacks and Hen, 2018). Along these lines, it is possible to develop non-therapeutic strategies in the academic context, for example, teacher- or counselor-led interventions to increase academic behavioral confidence, or interventions to improve the teacher's external regulation skills. This type of strategy makes it possible to reach a larger student population, using a preventive approach (Freire et al., 2016, 2018; Frenzel et al., 2018).

## Implications for the Practice of Educational Psychology at University

These results once again confirm the importance of prior student variables (SR) in students' academic behavioral confidence, and in their reasons for procrastination and procrastination activities. Hence the importance of understanding individual characteristics (Park and Adler, 2003; Moffa et al., 2016; Murayama et al., 2017; Pidgeon and Pittner, 2017) for preventing academic failure, and for carrying out counseling and educational guidance processes with university students

(Parpala and Lindblom-Ylänne, 2012; Bhullar et al., 2014; Eckerlein et al., 2020).

One may also infer the need to intervene with teaching processes, offering training and guidance to help teachers design and develop more regulatory teaching processes, and reduce teaching processes that are non-regulatory or dysregulatory (Asikainen et al., 2014). Some meta-analytical studies (Schneider and Preckel, 2017) have indicated the importance of teacher-student interactions in academic achievement. After analyzing the effect of 105 variables on academic achievement, they found that the variable of teacher "availability and help" occupied the eleventh position, and "being friendly and respectful" with students occupied position 30. However, the present study shows that specific regulatory practices of teachers would have a positive impact on academic behavioral confidence, on reducing procrastination and on increasing students' academic achievement, and can guide educational practice (Vermunt, 1989; Willcoxson et al., 2011; Villasana et al., 2016; Utriainen et al., 2018).

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by http://www.estres.investigacion-psicopedagogica.org/lib/pdf/CERTIFICADO_COMITE_DE_ETICA_UNAV.pdf. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JF and AG-U contributed to conceptualization, design and analysis of data and contributed to first writing. PS wrote the final and revised the article. MV-M, SF, and MG contributed to data collection. All authors contributed to the article and approved the submitted version.

## FUNDING

R & D Project ref. PGC2018-094672-B-I00, University of Navarra, Pamplona, and Ministry of Science, Innovation and Universities, Spain; R & D Project UAL18-SEJ-DO31-A-FEDER, University of Almería, Spain, and the European Social Fund.

## REFERENCES

Aguilar, S., and Barroso, J. M. (2015). La triangulación de datos como estrategia en investigación educativa [Data triangulation as a strategy in educational research]. *Píxel-Bit. Rev. Medios Educ.* 47, 73–88. doi: 10.12795/pixelbit.2015.i47.05

Akbari, O., and Sahibzada, J. (2020). Students' self-confidence and its impacts on their learning process. *Am. Int. J. Soc. Sci. Res.* 5, 1–15. doi: 10.46281/aijssr.v5i1.462

Alonso-Tapia, J., Rodríguez-Rey, R., Garrido-Hernansaiz, H., Ruiz, M., and Nieto, C. (2018). Coping assessment from the perspective of the person-situation interaction: development and validation of the Situated Coping Questionnaire for Adults (SCQA). *Psicothema* 28, 479–486. doi: 10.7334/psicothema2016.19

Asikainen, H., Parpala, A., Lindblom-Ylänne, S., Vanthournout, G., and Coertjens, L. (2014). The development of approaches to learning and perceptions of the teaching-learning environment during bachelor level studies and their relation to study success. *High. Educ. Stud.* 4, 24–36. doi: 10.5539/hes.v4n4p24

Batool, S. S. (2020). Academic achievement: interplay of positive parenting, self-esteem, and academic procrastination. *Aust. J. Psychol.* 72, 174–187. doi: 10.1111/ajpy.12280

Beswick, G., Rothblum, E., and Mann, L. (1988). Psychological antecedents of student procrastination. *Aust. Psychol.* 23, 207–217. doi: 10.1080/00050068808255605

Beyer, J. M. (1999). Taming and promoting charisma to change organizations. *Leadersh. Q.* 10, 307–330. doi: 10.1016/S1048-9843(99)00019-3

Bhullar, N., Hine, D. W., and Phillips, W. J. (2014). Profiles of psychological well-being in a sample of Australian university students. *Int. J. Psychol.* 49, 288–294. doi: 10.1002/ijop.12022

Biggs, J. (1993b). What do inventories of students' learning really measure? A theoretical review and clarification. *Br. J. Educ. Psychol.* 63, 1–17. doi: 10.1111/j.2044-8279.1993.tb01038.x

Biggs, J. (1999b). What the student does: teaching for enhanced learning. *High. Educ. Res. Dev.* 18, 57–75. doi: 10.1080/07294360.2012.642839

Biggs, J. (1999a). *Teaching for Quality Learning at University*. Buckingham: Open UP and SRHE.

Biggs, J. B. (1989). Approaches to the enhancement of tertiary teaching. *High. Educ. Res. Dev.* 8, 7–25. doi: 10.1080/0729436890080102

Biggs, J. B. (1993a). From theory to practice: a cognitive systems approach. *High. Educ. Res. Dev.* 12, 73–85. doi: 10.1080/0729436930120107

Biggs, J. B., Kember, D., and Leung, D. Y. P. (2001). The revised two factory study process questionnaire: R-SPQ-2F. *Br. J. Educ. Psychol.* 71, 133–149. doi: 10.1348/000709901158433

Brando-Garrido, C., Montes-Hidalgo, J., Limonero, J. T., Gómez-Romero, M. J., and Tomás-Sábado, J. (2020). Relationship of academic procrastination with perceived competence, coping, self-esteem and self-efficacy in nursing students. . *Enfermería Clín.* 30, 398–403. doi: 10.1016/j.enfcle.2019.07.013

Burr, S. M. D. L., and LeFevre, J. A. (2020). Confidence is key: unlocking the relations between ADHD symptoms and math performance. *Learn. Individ. Differ.* 77:101808. doi: 10.1016/j.lindif.2019.101808

Cabanach, R. G., Fariña, F., Freire, C., González, P., and Ferradás, M. M. (2013). Diferencias en el afrontamiento del estrés en estudiantes universitarios hombres y mujeres [Differences in coping between male and female university students]. *Eur. J. Educ.Psychol.* 6, 19–32. doi: 10.30552/ejep.v6i1.89

Cabanach, R. G., Rodríguez, S., Valle, A., Piñeiro, I., and Millán, P. G. (2007). Metas académicas y vulnerabilidad al estrés en contextos académicos [Academic goals and vulnerability to stress in academic contexts]. *Aula Abierta* 36, 3–16.

Cano, F., Pichardo, M. C., Berbén, A. B. G., and Fernández-Cabezas, M. (2020). An integrated test of multidimensionality, convergent, discriminant and criterion validity of the course experience questionnaire: an exploratory structural equation modelling. *Assess. Eval. High. Educ.* 1–13. doi: 10.1080/02602938.2020.1771278

Cassady, J. C., Pierson, E. E., and Starling, J. M. (2019). Predicting student depression with measures of general and academic anxieties. *Front. Educ.* 4:11. doi: 10.3389/feduc.2019.00011

Chartier, I. S., Gaudreau, P., and Fecteau, M. (2011). From dispositional affect to academic goal attainment: the mediating role of coping. *Anxiety Stress Coping* 24, 43–58. doi: 10.1080/10615801003725360

Clariana, M. (2013). Personalidad, Procrastinación y conducta deshonesta en alumnado de distintos grados universitarios. *Electron. J. Res. Educ. Psychol.* 11, 451–472. doi: 10.14204/ejrep.30.13030

Clariana, M., Gotzens, C., Badia, M., and Cladellas, R. (2012). Procrastinación y engaño académico desde la Secundaria hasta la Universidad. *Electron. J. Res. Educ. Psychol.* 10, 737–754.

Codina, N., Castillo, I., Pestana, J. V., and Balaguer, I. (2020). Preventing procrastination behaviours: teaching styles and competence in university students. *Sustainability* 12:2448. doi: 10.3390/su12062448

de la Fuente, J. (2017). Theory of Self- vs. externally- regulated learning: fundamentals, evidence, and applicability. *Front. Psychol.* 8:1675. doi: 10.3389/fpsyg.2017.01675

de la Fuente, J., Kauffman, D., and Yılmaz-Soylu, M. (2020a). Achievement Emotions in University Teaching and Learning, Students' Stress and Well-being. Reseach Topic. *Front. Psychol.* 11.

de la Fuente, J., Lahortiga-Ramos, F., Laspra-Solís, C., Maestro-Martín, C., Alustiza, I., Aubá, E., et al. (2020b). A structural equation model of achievement emotions, coping strategies and engagement-burnout in undergraduate students: a possible underlying mechanism in facets of perfectionism. *Int. J. Environ. Res. Public Health* 17:2106. doi: 10.3390/ijerph17062106

de la Fuente, J., López, M., Zapata, L., Sollinas, G., and Fadda, S. (2015a). "Improving mental Health through an online self-assessment and self-help e-utility in university students," in *Progress in Education*, Vol. 33, ed. R. V. Nata (New York, NY: Nova Publisher), 63–74.

de la Fuente, J., Martínez-Vicente, J. M., Peralta-Sánchez, F. J., Garzón-Umerenkova, A., Vera, M. M., and Paoloni, P. (2019). Applying the SRL vs ERL theory to the knowledge of achievement emotions in undergraduate university students. *Front. Psychol.* 10:2070. doi: 10.3389/fpsyg.2019.02070

de la Fuente, J., Peralta-Sánchez, F. J., Martínez- Vicente, J. M., Sander, P., Garzón-Umerenkova, A., and Zapata, L. (2020c). Effects of self-regulation and regulatory teaching on the factors and symptoms of academic stress in undergraduate students. *Front. Psychol.* 11:1773. doi: 10.3389/fpsyg.2020.01773

de la Fuente, J., Sander, P., Kauffman, D., and Yilmaz-Soylu, M. (2020d). Differential effects of self- vs. external-regulation on learning approaches, academic achievement, and satisfaction in undergraduate students. *Front. Psychol.* 11:1773. doi: 10.3389/fpsyg.2020.543884

de la Fuente, J., Sander, P., Martínez-Vicente, J. M., Vera, M. M., Garzón, A., and Fadda, S. (2017). Combined effect of levels in personal self-regulation and regulatory teaching on meta-cognitive, on meta-motivational, and on academic achievement variables in undergraduate students. *Front. Psychol.* 8:232. doi: 10.3389/fpsyg.2017.00232

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Cardelle-Elawar, M., Sander, P., Justicia, F., et al. (2012). Regulatory teaching and self-regulated learning in college students: confirmatory validation study of the IATLP Scales. *Electron. J. Res. Educ. Psychol.* 10, 839–866.

de la Fuente, J., Zapata, L., Martínez-Vicente, J. M., Sander, P., and Cardelle-Elawar, M. (2015b). The role of personal self-regulation and regulatory teaching to predict motivational-affective variables, achievement, and satisfaction: a structural model. *Front. Psychol.* 6:399. doi: 10.3389/fpsyg.2015.00399

Eckerlein, N., Dresel, M., Steuer, G., Foerst, N., Ziegler, A., Schmitz, B., et al. (2020). "Modelling, assessing, and promoting competences for self-regulated learning in higher education," in *Student Learning in German Higher Education*, eds C. Lautenbach, H. A. Pant, M. Toepper, and O. Zlatkin-Troitschanskaia (Wiesbaden: Springer VS), 165–179. doi: 10.1007/978-3-658-27886-1_9

Entwistle, N. (1991). Approaches to learning and perceptions of the learning environment. *High. Educ.* 22, 201–204.

Entwistle, N., and Ramsden, P. (1983). *Understanding Student Learning*. London: Croom Helm.

Ferrari, J., Mason, C., and Hammer, C. (2006). Procrastination as a predictor of task perceptions: examining delayed and non-delayed tasks across varied deadlines. *Individ. Differ. Res.* 4, 28–36.

Freire, C., Ferradás, M. M., Núñez, J. C., Valle, A., and Vallejo, G. (2018). Eudaimonic well-being and coping with stress in university students: the mediating/moderating role of self-efficacy. *Int. J. Environ. Res. Public Health* 16:48. doi: 10.3390/ijerph16010048

Freire, C., Ferradás, M. M., Valle, A., Núñez, J. C., and Vallejo, G. (2016). Profiles of psychological well-being and coping strategies among university students. *Front. Psychol.* 7:1554. doi: 10.3389/fpsyg.2016.01554

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., and Lüdtke, O. (2018). Emotion transmission in the classroom revisited: a reciprocal effects model of teacher and student enjoyment. *J. Educ. Psychol.* 110, 628–639. doi: 10.1037/edu0000228

Garzón, A. Y., and Gil, J. (2017). Propiedades psicométricas de la versión en español de la prueba PASS. [Psychometric properties of the Spanish versión of PASS.]. *RIDEP* 1, 149–163. doi: 10.21865/RIDEP43_149

Garzón-Umerenkova, A., de la Fuente, J., and Acelas-Russi, L. (2019). "Características y dimensiones de la procrastinación académica en estudiantes universitarios colombianos," in *Diálogos sobre investigación* (Bogota: Fundación Universitaria Konrad Lorenz).

Garzón-Umerenkova, A., de la Fuente, J., Amate, J., Paoloni, P. V., Fadda, S., and Pérez, J. F. (2018). A linear empirical model of self-regulation on flourishing, health, procrastination, and achievement, among university students. *Front. Psychol.* 9:536. doi: 10.3389/fpsyg.2018.00536

Gentsch, K., Loderer, K., Soriano, C., Fontaine, J. R., Eid, M., Pekrun, R., et al. (2018). Effects of achievement contexts on the meaning structure of emotion words. *Cogn. Emot.* 32, 379–388. doi: 10.1080/02699931.2017.1287668

Gil, J., De Besa, M. R., and Garzón-Umerenkova, A. (2019). ¿Por qué procrastina el alumnado universitario? Análisis de motivos y caracterización del alumnado con diferentes tipos de motivaciones. [Why do university students procrastinate? An analysis of the reasons and characterization of students with different reasons for procrastination]. *Rev. Invest. Educ.* 38, 183–200. doi: 10.6018/rie.344781

Gross, J. J. (2008). *Handbook of Emotion Regulation*. New York, NY: Guilford.

Gross, J. J. (2014). *Handbook of Emotion Regulation*, 2nd Edn. New York, NY: Guilford.

Gross, J. J. (2015a). Emotion regulation: current status and future prospects. *Psychol. Inquiry* 26, 1–26. doi: 10.1080/1047840X.2014.940781

Gross, J. J. (2015b). The extended process model of emotion regulation: elaborations, applications, and future directions. *Psychol. Inquiry* 26, 130–137. doi: 10.1080/1047840X.2015.989751

Harley, J. M., Pekrun, R., Taxer, J. L., and Gross, J. J. (2019). Emotion regulation in achievement situations: an integrated model. *Educ. Psychol.* 54, 106–126. doi: 10.1080/00461520.2019.1587297

Hirvonena, R., Yli-Kivistöa, L., Putwain, D. W., Ahonena, T., and Kiuru, N. (2019). School-related stress among sixth-grade students – Associations with academic buoyancy and temperament. *Learn. Individ. Differ.* 70, 100–108. doi: 10.1016/j.lindif.2019.01.012

Holinka, C. (2015). Stress, emotional intelligence, and life satisfaction in college students. *Coll. Stud. J.* 49, 300–311.

Jöreskog, K. G., and Sörbom, D. (1993). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Scientific Software International.

Kember, D., Webster, B. J., and Chan, W. S. (2020). Refocusing the 3P model to incorporate a learning and teaching environment and graduate attributes. *Educ. Psychol.* 40, 592–607. doi: 10.1080/01443410.2020.1732304

Kim, K. R., and Seo, E. H. (2015). The relationship between procrastination and academic performance: a meta-analysis. *Personal. Individ. Differ.* 82, 26–33. doi: 10.1016/j.paid.2015.02.038

Kim, Y. E., Brady, A. C., and Wolters, C. A. (2020). College students' regulation of cognition, motivation, behavior, and context: distinct or overlapping processes? *Learn. Individ. Differ.* 80:101872. doi: 10.1016/j.lindif.2020.101872

Kirikkanat, B., and Kali-Soyer, M. (2018). A path analysis model pertinent to undergraduates' academic success: examining academic confidence, psychological capital and academic coping factors. *Eur. J. Educ. Res.* 7, 133–150. doi: 10.12973/eu-jer.7.1.133

Klassen, R., Krawchuk, L., and Rajani, S. (2008). Academic procrastination of undergraduates: low self-efficacy to self-regulate predicts higher levels of procrastination. *Contemp. Educ. Psychol.* 33, 915–931. doi: 10.1016/j.cedpsych.2007.07.001

Klingsieck, K. B., Grund, A., Schmid, S., and Fries, S. (2013). Why students procrastinate: a qualitative approach. *J. Coll. Stud. Dev.* 54, 397–412. doi: 10.1353/csd.2013.0060

Kobylińska, D., and Kusev, P. (2019). Flexible emotion regulation: how situational demands and individual differences influence the effectiveness of regulatorystrategies. *Front. Psychol.* 10:72. doi: 10.3389/fpsyg.2019.00072

Lekwa, A. J., Reddy, L. A., and Shernoff, E. S. (2018). Measuring teacher practices and student academic engagement: a convergent validity study. *Sch. Psychol. Q.* 34, 109–118. doi: 10.1037/spq0000268

Linnenbrink-Garcia, L., and Pekrun, R. (eds) (2011). Students' emotions and academic engagement [Special issue]. *Contemp. Educ. Psychol.* 36, 1–3. doi: 10.1016/j.cedpsych.2010.11.004

Loderer, K., Pekrun, R., and Lester, J. C. (2018). Beyond cold technology: a meta-analytic review of research on emotions in technology-based learning environments. *Learn. Instruct.* 70:101162. doi: 10.1016/j.learninstruc.2018.08.002

Lüftenegger, M., Klug, J., Harrer, K., Langer, M., Spiel, C., and Schober, B. (2016). Students' achievement goals, learning-related emotions and academic achievement. *Front. Psychol.* 7:603. doi: 10.3389/fpsyg.2016.00603

Mainhard, T., Oudman, S., Hornstra, L., Bosker, R. J., and Goetz, T. (2018). Student emotions in class: the relative importance of teachers and their interpersonal relations with students. *Learn. Instruct.* 53, 109–119. doi: 10.1016/j.learninstruc.2017.07.011

Martín, M. O., Trujillo, F. D., and Moreno, N. (2003). Estudio y evaluación del estrés académico en estudiantes de Grado de ingenierías industrieales en la Universidad de Málaga [assessment of academic stress in industrial engineering students at the University of Malaga]. *Rev. Educ. Hekademos* 13, 55–63.

McDonald, R. P., and Marsh, H. W. (1990). Choosing a multivariate model: noncentrality and goodness of fit. *Psychol. Bull.* 107, 245–255. doi: 10.1037/0033-2909.107.2.247

McGee, G. E. (2020). *Process Goals Raise Academic Confidence and Performance of First-Generation College Students*. Rock Hill, SC: Winthrop University.

Miller, W. R., and Brown, J. M. (1991). "Self-regulation as a conceptual basis for the prevention and treatment of addictive behaviours," in *Self-Control and the Addictive Behaviours*, eds N. Heather, W. R. Miller, and J. Greeley (Sydney: Maxwell Macmillan Publishing Australia), 3–79.

Moffa, K., Dowdy, E., and Furlong, M. J. (2016). Exploring the contributions of school belonging to complete mental health screening. *Educ. Dev. Psychol.* 33, 16–32. doi: 10.1017/edp.2016.8

Murayama, K., Goetz, T., Malmberg, L.-E., Pekrun, R., Tanaka, A., and Martin, A. J. (2017). "Within-person analysis in educational psychology: importance and illustrations," in *British Journal of Educational Psychology Monograph Series* II, Vol. 12, eds D. W. Putwain and K. Smart (Oxford: Wiley), 71–87.

Nicholson, L., Putwain, D., Connors, L., and Hornby-Atkinson, P. (2013). The key to successful achievement as an undergraduate student: confidence and realistic expectations? *Stud. High. Educ.* 38, 285–298. doi: 10.1080/03075079.2011.585710

Papinczak, T., Young, L., Groves, M., and Haynes, M. (2008). Effects of a metacognitive intervention on students' approaches to learning and self-efficacy in a first-year medical course. *Adv. Health Sci. Educ.* 13, 213–232. doi: 10.1007/s10459-006-9036-0

Park, C. L., and Adler, N. E. (2003). Coping style as a predictor of health and well-being across the first year of medical school. *Health Psychol.* 22, 627–631. doi: 10.1037/0278-6133.22.6.627

Parpala, A., and Lindblom-Ylänne, S. (2012). Using a research instrument for developing quality at the university. *Q. High. Educ.* 18, 313–328. doi: 10.1080/13538322.2012.733493

Pichardo, M. C., Cano, F., Garzón-Umerenkova, A., de la Fuente, J., Peralta-Sánchez, F. J., and Amate-Romera, J. (2018). Self-regulation questionnaire (SRQ) in Spanish adolescents: factor structure and rasch analysis. *Front. Psychol.* 9:1370. doi: 10.3389/fpsyg.2018.01370

Pichardo, M. C., Justicia, F., de la Fuente, J., Martínez-Vicente, J. M., and García-Berbén, A. B. (2014). Factor structure of the self-regulation questionnaire (SRQ) at Spanish universities. *Span. J. Psychol.* 17:e62. doi: 10.1080/02699931.2016.1204989

Pidgeon, A. M., and Pittner, L. (2017). Examining the differences between university students' levels of resilience on mindfulness, psychological distress and coping strategies. *Eur. Sci. J.* 13, 103–113.

Putwain, D., Sander, P., and Larkin, D. (2013). Academic self-efficacy in study-related skills and behaviours: relations with learning-related emotions and academic success. *Br. J. Educ. Psychol.* 83, 633–650. doi: 10.1111/j.2044-8279.2012.02084.x

Putwain, D. W. (2018). An examination of the self-referent executive processing model of test anxiety: control, emotional regulation, self-handicapping, and examination performance. *Eur. J. Psychol. Educ.* 34, 341–358. doi: 10.1007/s10212-018-0383-z

Putwain, D. W., Daly, A. L., Chamberlain, S., and Sadreddini, S. H. (2015). 'Sink or swim': buoyancy and coping in the cognitive test anxiety – academic performance Relationship. *Educ. Psychol. Int. J. Exp. Educ. Psychol.* 36, 1807–1825. doi: 10.1080/01443410.2015.1066493

Putwain, D. W., and Pescod, M. (2018). Is reducing uncertain control the key to successful test anxiety intervention for secondary school students? Findings from a randomized control trial. *Sch. Psychol. Q.* 33, 283–292. doi: 10.1037/spq0000228

Putwain, D. W., and Sander, P. (2016). Does the confidence of first-year undergraduate students change over time according to achievement goal profile? *Stud. High. Educ.* 41, 381–398. doi: 10.1080/03075079.2014.934803

Ramsden, P. (1991). A performance indicator of teaching quality in higher education: the course experience questionnaire. *Stud. High. Educ.* 16, 129–150. doi: 10.1080/03075079112331382944

Rothblum, E., Solomon, L., and Murakami, J. (1986). Affective, cognitive, and behavioral differences between high and low procrastinators. *J. Couns. Psychol.* 33, 387–394. doi: 10.1037/0022-0167.33.4.387

Rozental, A., and Carlbring, P. (2014). Understanding and treating procrastination: a review of a common self-regulatory failure. *Psychology* 5, 1488–1502. doi: 10.4236/psych.2014.513160

Rusk, R., Tamir, M., and Rothbaum, F. (2011). Performance and learning goals for emotional regulation. *Motiv. Emot.* 35, 444–460. doi: 10.1007/s11031-011-9229-6

Saklofske, D. H., Austin, E. J., Mastoras, S. M., Beaton, L., and Osborne, S. E. (2012). Relationships of personality, affect, emotional intelligence and coping with student stress and academic success: different patterns of association for stress and success. *Learn. Individ. Differ.* 22, 251–257. doi: 10.1016/j.lindif.2011.02.010

Sander, P. (2009). Current developments in measuring academic behavioural confidence. *Psychol. Teach. Rev.* 15, 32–44.

Sander, P., and de la Fuente, J. (2020). Modelling students' academic confidence, personality and academic emotions. *Curr. Psychol.* doi: 10.1007/s12144-020-00957-0 [Epub ahead of print].

Sander, P., de la Fuente, J., Stevenson, K., and Jones, T. (2011). The validation of the academic behavioural confidence scale with spanish psychology students. *Psychol. Learn. Teach.* 10, 11–24. doi: 10.2304/plat.2011.10.1.11

Sander, P., Putwain, D., and de la Fuente, J. (2013). "Using structural equation modelling to understand predictors of undergraduate students' academic performance," in *Theory and Method in Higher Education Research (International Perspectives on Higher Education Research*, ed. M. Tight (Bingley: Emerald Group Publishing Limited), 9. doi: 10.1108/S1479-362820130000009015

Sander, P., and Sanders, L. (2006). Understanding academic confidence. *Psychol. Teach. Rev.* 12, 29–39.

Sander, P., and Sanders, L. (2009). Measuring academic behavioural confidence: the ABC scale revisited. *Stud. High. Educ.* 34, 19–35. doi: 10.1080/03075070802457058

Sanders, L., and Sander, P. (2003). Academic behavioral confidence: a comparison of medical and psychology students. *Electron. J. Res. Educ. Psychol.* 13, 633–650.

Saputra, H. R., Alizamar, A., and Afdal, A. (2020). Relationship of confidence with academic procrastination of middle school students and its implications in guidance and counseling. *J. Neo Konseling* 2, 1–10. doi: 10.24036/00249kons2020

Schneider, M., and Preckel, F. (2017). Variables associated with achievement in higher education: a systematic review of meta-analyses. *Psychol. Bull.* 143:565. doi: 10.1037/bul0000098

Schraw, G., Wadkins, T., and Olafson, L. (2007). Doing the things we do: a grounded theory of academic procrastination. *J. Educ. Psychol.* 99, 12–25. doi: 10.1037/0022-0663.99.1.12

Shannon, M., Suldo, S. M., Storey, L. D., O'Brennan, L. M., Shaunessy-Dedrick, E., Ferron, J. M., et al. (2019). Identifying high school freshmen with signs of emotional or academic risk: screening methods appropriate for students in accelerated courses. *Sch. Ment. Health* 11, 210–227. doi: 10.1007/s12310-018-9297-9

Shaw, M. P., Peart, D. J., and William, O. J. (2017). Perceived stress in university students studying in a further education college. *Res. Post-Compulsory Educ.* 22, 442–452. doi: 10.1080/13596748.2017.1362534

Shoemaker, C. A. (2010). Student confidence as a measure of learning in an undergraduate principles of horticultural science course. *Hortechology* 20, 683–688. doi: 10.21273/HORTTECH.20.4.683

Sirois, F., and Tosti, N. (2012). Lost in the moment? An investigation of procrastination, mindfulness, and well-being. *J. Rational Emot. Cogn. Behav. Ther.* 30, 237–248. doi: 10.1007/s10942-012-0151-y

Solomon, L., and Rothblum, E. (1984). Academic procrastination: frequency and cognitive-behavioral correlates. *J. Couns. Psychol.* 31, 503–509. doi: 10.1037/0022-0167.31.4.503

Stead, R., Shanahan, M., and Neufeld, R. (2010). "I'll go to therapy, eventually": procrastination, stress and mental health. *Personal. Individ. Differ.* 49, 175–180. doi: 10.1016/j.paid.2010.03.028

Steel, P. (2007). The nature of procrastination: a meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychol. Bull.* 133, 65–94. doi: 10.1037/0033-2909.133.1.65

Steel, P., and Ferrari, J. (2012). Sex, education and procrastination: an epidemiological study of procrastinators' characteristics from a global sample. *Eur. J. Personal.* 27, 51–58. doi: 10.1002/per.1851

Steel, P., and Klingsieck, K. (2015). "Procrastination," in *The International Encyclopedia of The Social & Behavioral Sciences*, 2nd Edn, Vol. 19, ed. J. D. Wright (Oxford: Elsevier), 73–78.

Steel, P., and Klingsieck, K. B. (2016). Academic procrastination: psychological antecedents revisited. *Austr. Psychol.* 51, 36–46. doi: 10.1111/ap.12173

Sudler, E. (2013). *Academic Procrastination as Mediated By Executive Functioning, Perfectionism, and Frustration Intolerance in College Students*. St. John's University, New York, NY. doctoral dissertation.

Tada, A. (2017). The associations among psychological distress, coping style, and health habits in Japanese nursing students: a cross-sectional study. *Int. J. Environ. Res. Public Health* 14:1434. doi: 10.3390/ijerph14111434

Utriainen, J., Tynjälä, P., Kallio, E., and Marttunen, M. (2018). Validation of a modified version of the experiences of teaching and learning questionnaire. *Stud. Educ. Eval.* 56, 133–143. doi: 10.1016/j.stueduc.2017.12.007

Vermunt, D. H. M. (1989). "The interplay between internal and external regulation of learning, and the design of process-oriented instruction," in *Paper presented at the Conference of the European Association of Research on Learning and Instruction* (Madrid).

Vermunt, J. D. (1995). Process-oriented instruction in learning and thinking strategies. *Eur. J. Psychol. Educ.* 10, 325–349. doi: 10.1007/bf03172925

Vermunt, J. D. (1996). Metacognitive, cognitive and affective aspects of learning styles and strategies: a phenomenographic analysis. *High. Educ.* 31, 25–50. doi: 10.1007/bf00129106

Vermunt, J. D. (1998). The regulation of constructive learning processes. *Br. J. Educ. Psychol.* 68, 149–171. doi: 10.1111/j.2044-8279.1998.tb01281.x

Vermunt, J. D. (2005). Relations between student learning patterns and personal and contextual factors and academic performance. *High. Educ.* 49, 205–234. doi: 10.1007/s10734-004-6664-2

Vermunt, J. D. (2007). The power of teaching-learning environments to influence student learning. *Br. J. Educ. Psychol. Monogr. Ser.* 4, 73–90. doi: 10.1348/000709906X162406

Vermunt, J. D., and Donche, V. (2017). A learning patterns perspective on student learning in higher education: state of the art and moving forward. *Educ. Psychol. Rev.* 29, 269–299. doi: 10.1007/s10648-017-9414-6

Villasana, M., Alonso-Tapia, J., and Ruiz, M. (2016). A model for assessing coping and its relation to resilience in adolescence from the perspective of "person-situation interaction". *Personal. Individ. Differ.* 98, 250–256. doi: 10.1016/j.paid.2016.04.053

Wäschle, K., Allgaier, A., Lachner, A., Fink, S., and Nückles, M. (2014). Procrastination and self-efficacy: tracing vicious and virtuous circles in self-regulated learning. *Learn. Instruct.* 29, 103–114. doi: 10.1016/j.learninstruc.2013.09.005

Willcoxson, L., Cotter, J., and Joy, S. (2011). Beyond the first-year experience: the impact on attrition of student experiences throughout undergraduate degree studies in six diverse universities. *Stud. High. Educ.* 36, 331–352. doi: 10.1080/03075070903581533

Wolters, C. (2003). Understanding procrastination from a self-regulated learning perspective. *J. Educ. Psychol.* 95, 179–187. doi: 10.1037/0022-0663.95.1.179

Yang, Y. (2020). Research on the influence of interactive teaching method on the learning effect of college english. *J. Contemp. Educ. Res.* 4, 65–69. doi: 10.26689/jcer.v4i1.974

Zacks, S., and Hen, M. (2018). Academic interventions for academic procrastination: a review of the literature. *J. Prev. Interv. Community* 46, 117–130. doi: 10.1080/10852352.2016.1198154

Zalazar-Jaime, M. F., and Medrano, L. A. (2020). An integrative model of self-regulated learning for university students: the contributions of social cognitive theory of carriers. *J. Educ.* doi: 10.1177/0022057420904375 [Epub ahead of print].

Zarick, L., and Stonebraker, R. (2009). I'll do it tomorrow: the logic of procrastination. *Coll. Teach.* 57, 211–215. doi: 10.1080/87567550903218687

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: an overview. *Educ. Psychol.* 25, 3–17. doi: 10.1207/s15326985ep2501_2

Zimmerman, B. J. (1998). "Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models," in *Self-Regulated Learning: From Teaching to Self-Reflective Practice*, eds D. H. Schunk and B. J. Zimmerman (Guilford Publications), 1–19.

Zimmerman, B. J., and Schunk, D. H. (2001). *Self-Regulated Learning and Academic Achievement: Theoretical Perspectives*. Abingdon: Routledge.

Zusho, A., Pintrich, P. R., and Coppola, B. (2003). Skill and will: the role of motivation and cognition in the learning of college chemistry. *Int. J. Sci. Educ.* 25, 1081–1094. doi: 10.1080/0950069032000052207

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 10 June 2021
doi: 10.3389/fpsyg.2021.604692

# Can Team Resilience Boost Team Creativity Among Undergraduate Students? A Sequential Mediation Model of Team Creative Efficacy and Team Trust

*Mudan Fan[1], Wenjing Cai[2,3,4]* and Lin Jiang[3]*

*[1] School of Education, Weinan Normal University, Weinan, China, [2] Intellectual Property Research Institute, University of Science and Technology of China, Hefei, China, [3] School of Public Affairs, University of Science and Technology of China, Hefei, China, [4] Department of Management and Organization, Vrije Universiteit Amsterdam, Amsterdam, Netherlands*

OPEN ACCESS

**Edited by:**
*Douglas F. Kauffman, Medical University of the Americas – Nevis, United States*

**Reviewed by:**
*Regina Antunes Teixeira Dos Santos, Federal University of Rio Grande do Sul, Brazil*
*Xuesong Zhai, Zhejiang University, China*

***Correspondence:**
*Wenjing Cai*
*w.cai@vu.nl*

**Specialty section:**
*This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology*

**Received:** *10 September 2020*
**Accepted:** *05 May 2021*
**Published:** *10 June 2021*

**Citation:**
*Fan M, Cai W and Jiang L (2021) Can Team Resilience Boost Team Creativity Among Undergraduate Students? A Sequential Mediation Model of Team Creative Efficacy and Team Trust. Front. Psychol. 12:604692. doi: 10.3389/fpsyg.2021.604692*

Although recent literature has highlighted the critical role of resilience in creativity literature, existing findings have failed to indicate the processes through which resilience contributes to creativity at the graduate level. The current study fills this gap by hypothesizing the influence of team resilience on team creativity through a sequential mediating mechanism. A time lagged research study was conducted, and a sample of 201 undergraduate students and their teacher filled out questionnaires at three different time points (with 2-week intervals). After aggregating the data at the team level, we employed the PROCESS macro in SPSS to analyze data and test all the hypotheses through performing a sequential mediation analysis. We found that (a) team resilience would predict team creativity; and (b) team efficacy and team trust sequentially mediated the relation between team resilience and team creativity. The results in our study advance the emergent literature on linking resilience and creativity for the practical applications of resilience and creativity in education settings.

**Keywords: team resilience, team efficacy, team creativity, undergraduate students, team trust**

## INTRODUCTION

As a necessity to thriving in the 21st century, creativity has been highlighted in colleges and universities, which have an obligation to help cultivate students' creativity (Parker-Bell, 2010). In educational settings, creativity represents a student's way of thinking, learning, and producing information in school courses, such as science and mathematics (Torrance and Goff, 1990), which reflects the characteristic of "problem solving." Extensive literature has indicated that educators are increasingly focused on developing students' creativity defined as students producing novel and useful ideas and solutions to address challenges and problems (Amabile, 1997). Specifically, scholars have provided strong evidence indicating that personal factors, such as Big-Five personality traits, are the traits most central to creativity and positive psychology (i.e., PsyCap). Among this line of

research, *resilience* is found to play a role in fostering creativity (Kim, 2015; Fernandez-Martinez et al., 2017). Defined as individuals' ability to bounce back from risks or failures and to adapt to dynamics and success, resilience can ensure students to try to solve problems, exhibit optimism, become positive role models, and show flexibility (Haglund et al., 2007). Previous research has indicated that resilient students have more psychological safety in overcoming the challenges that accompanied creative endeavors (Luthans et al., 2004).

However, an important yet neglected research problem is still unclear—that is, *whether and how resilience contributes to creativity among graduate students at the team level*. Theoretically, team resilience refers to the extent to which a team believes its capabilities on effectively coping tasks and recovering positively to difficulties together (Carmeli et al., 2014). Understanding the intervening processes through which team resilience can contribute to undergraduate students' creativity is important for effective policy development and intervention implementation in educational settings. First, a recent review indicates that limited empirical studies have been conducted to identify how team resilience helps teams adapt to adversity during creative processes (Chapman et al., 2020). The facts show that it is not only individuals who face difficulties but also teams that commonly experience adversity (Alliger et al., 2015). In educational settings, especially in universities and colleges, students are encouraged to improve their communication and social relationships with other individuals and groups (Urdan and Schoenfelder, 2006; Kim and Kim, 2017); therefore, to respond to scholars' calling for testing the effect of team resilience on desirable team outcomes (Chapman et al., 2020), examining the association between team resilience and team creativity among undergraduate students is urgently needed for theoretical development and educational practices. Moreover, previous research has indicated the mediating roles of psychological factors such as well-being and personal psychological resources (Richtner and Lofsten, 2014; Arnout and Almoied, 2020). However, the results overlooked the potential mediating role of some key psychological characteristics at the team level and only illustrated the partial mediation models. Thus, exploring the sequence of some team-level psychological mediators becomes an important concern since causal mechanisms can provide a more comprehensive picture to clearly depict the effects of team resilience on team creativity.

As such, by inviting undergraduate students to organize temporary teams for a research project, this study examines the potential linkage between team resilience and team creativity via exploring the sequential mediating roles of team creative efficacy and team trust. Specifically, we draw on social identity theory to propose two mediators—i.e., team creative efficacy and team trust. Team creative efficacy refers to team members' shared belief on their team's ability of achieving a particular goal (Bandura, 1997), and team trust refers to team members' shared belief on whether they are free to share both task-related and personal information without any concern for differences. The social identity approach suggests that individuals' sense of self can be predominately defined in terms of their social identity (i.e., their sense of themselves as group members who share goals, values, and interests with others) (Tajfel et al., 1979). Previous studies applying this theoretical framework have indicated that team members whose sense of self is as group members (as "we" and "us") have more positive psychological characteristics (e.g., attachment) (Cameron, 1999; Postmes and Branscombe, 2010) toward making more contributions to the group. By following this line of study, we expect team creative efficacy and team trust to be two prominent mediators; that is, when team resilience is high, team members are more likely to build their creative efficacy belief on behalf of their own teams, which in turn effectively fosters the team. **Figure 1** shows our proposed sequential mediation model.

## Team Resilience

In the area of resilience research, some studies specifically examined the resilience among students (Kim, 2015; Fernandez-Martinez et al., 2017), because high levels of stress and related academic burnout are widespread among graduate students (Dyrbye et al., 2010; Divaris et al., 2012). Specifically, resiliency has been suggested as a mediator to the stressors of learning and may have positive long-term and far-reaching effects among students (Johnson, 2008). In the educational settings, a student's resilience can be characterized as "the capacity to resist or manage adversity without developing physical or psychological disabilities" during school training (Campbell-Sills et al., 2006). Recently, scholars' attention is increasingly transferring to the team level phenomena by investigating team resilience (Chapman et al., 2020), because both individuals and groups have to face difficulties and experience adversity (Bowers et al., 2017). Theoretically, by representing the critical team level capacity that facilitates the rebound of teams after an adverse event, team resilience can be defined as "a team's belief that it can absorb and cope with strain, as well as a team's capacity to cope, recover and adjust positively to difficulties" (Carmeli et al., 2014, p. 149). Teams that thrive, rebound, or positively adapt to adversity are more unlikely to experience the deleterious effects of challenging situations. Through examining resilience at the team level, researchers attempt to identify how teams and groups positively adapt to adversity (Bennett, 2010; Alliger et al., 2015; Consoli et al., 2015).

In the educational context, existing research evidence has confirmed that students who develop resilience are better equipped to learn from failure and adapt to change (Yeager and Dweck, 2012); thus resilient teams should be more flexible to adverse changes and well prepared for future planning and preparation (e.g., Cavrak et al., 2019). Relating to the participants in the current study, namely, undergraduate students majoring in hospitality management, hospitality professional education is perceived by many students to be a stressful experience with students studying service-related courses reporting increased levels of anxiety, fatigue, burnout and lack of motivation. Therefore, resilient students are more likely to cope with such adversities and achieve better results (Kwek et al., 2013; Jones and Wynn, 2019). In addition, team-based learning has become a prominent trend in hospitality-related courses (Jacobs et al., 2001). Therefore, faced with such challenges and requirements, it is important to investigate the phenomena and the effects of

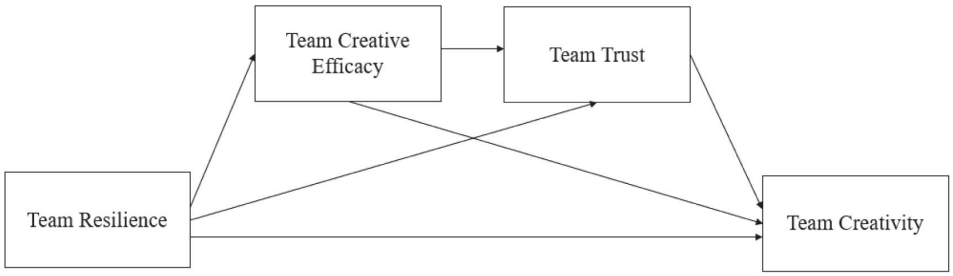


**FIGURE 1 |** Proposed sequential mediation model.

team resilience among undergraduate students by studying the associations of team resilience with other desirable outputs in educational settings.

## Team Creativity

Creativity has been highlighted in the educational context by showing its merits of developing students' potential to address unexpected challenges by coming up with creative solutions (Torrance and Goff, 1990). Targeting solving problems, researchers and educators in the hospitality and service fields are calling for the development of students' creativity due to the increased competition in this industry (Liu et al., 2017). Consistent with this line of research, scholars have recently investigated students' creativity at the team level (Rego et al., 2007; Aggarwal and Woolley, 2018; Bodla et al., 2018) since creative activities in teams can solve problems and leverage opportunities through the integration of divergent thoughts and perspectives (Barczak et al., 2010).

Given that an individual's creative inputs might not directly contribute to the whole team's creative achievements, to understand the factors that drive team creativity (Kurtzberg and Amabile, 2000), it is important to extend the focus of analysis from the creative capabilities of the individual team members to team interaction processes and emergent states. Researchers conducting studies among students have consistently found that some contextual factors, especially positive team-oriented variables (e.g., team diversity), can predict team creativity (Grawitch et al., 2003; Kim et al., 2007; Curseu, 2010). For example, Barczak et al. (2010) found that members' perceptions that their peers are reliable and competent are vital to enhancing the creativity of the team.

## Team Rresilience and Team Creativity

Previous studies have accumulated evidence by revealing that team resilience is beneficial to some desirable outcomes. Based on these findings, in the current study, we expect to discover a positive relation between team resilience and team creativity. Specifically, when students are learning in resilient teams, they could feel that their teams are displaying an ability to thrive in situations of adversity, improvise and adapt to significant change or stress. In this situation, they may be unlikely to experience the potentially damaging effects of threatening situations. As a result, the teams' potential to engage in creative endeavors to realize creative ideas will be high. Moreover, Waxman et al. (2003) have consistently shown that a high level of resilience enables students to maintain high motivational achievement and performance, even when they are faced with stressful events and conditions that place them at risk of poor performance.

## Social Identity Theory

Social identity theory is a psychologically oriented theory that indicates that individuals gain part of their self-concept from memberships in social groups (Tajfel, 1978). Specifically, social identity is a part of an individual's self-concept that originates from his membership of a social group together with the value and emotional significance attached to that membership (Tajfel, 1978, p. 63). Previous literature drawing on this theory has illustrated that individuals recognize their own membership in groups by defining the social boundaries surrounding particular groups and then self-categorizing themselves as either belonging or not belonging to those groups (Postmes and Branscombe, 2010).

Social identity theory has been widely used in the educational literature to understand students' desirable outcomes (e.g., learning in context) (e.g., Kelly, 2009). Specifically, both educational psychologists (adopting a social identity perspective) and social psychologists (applying the social identity approach to educational settings) focus on the influence of social identities on various aspects of learning-related behaviors and/or attitudes among students (e.g., Bliuc et al., 2011). For example, Edwards and Harwood (2003) found that students' social identification is related to perceptions of favored and disfavored instructors.

## The Mediator of Team Creative Efficacy

Team creative efficacy is a team-level concept that is defined as a shared belief concerning a team's ability to organize and execute courses of action required to achieve a specific outcome (Bandura, 1997). In the educational context, team creative efficacy among students represents a shared belief in collaborating to develop the creativity of the process during collaborative learning activities (Cheng and Yang, 2011). Previous studies have shown that creative efficacy belief is a beneficial type of personal psychological state that contributes to facilitating students' desirable outcomes regarding creativity (e.g., Fan and Cai, 2020). Relatedly, team creative efficacy specifically

representing a team's psychological state has been outlined by the bulk of the literature which indicates that when a team is characterized by high resilience, team members are significantly motivated to produce positive achievements. For example, in Lyons et al. (2016) qualitative study, they found that when students expressed confidence in their collective efficacy, they were more likely to act as a collective agency toward such behaviors as solving problems together and attending to relationships. Moreover, there is a prominent research stream underlining the beneficial role of team creative efficacy on individuals' engagement in team creative processes (Shin and Zhou, 2007) because all team members share a high level of confidence in their joint efforts to come up with creative solutions. For example, empirical work by Shin and Eom (2014) shows that teams with high creative efficacy are more likely to achieve higher levels of team creativity than teams with low creative efficacy.

According to the theoretical suggestion of social identity theory, team resilience can strengthen all team members' identification with their group because this team-level phenomenon represents a specific psychosocial phenomenon, and the collective psychological state of team members' common cognition, motivation and emotion is triggered (Kennedy et al., 2017). In this situation, team members raise a sense of "us" and treat their own efforts as an important contribution to the whole team. Furthermore, the higher level of resilience the team obtains, the greater the group membership that will be experienced by all the team members. Team resilience may generate more team-oriented attribution. Following this line of reasoning, it is reasonable to expect a positive relation between team resilience and team creative efficacy. Specifically, researchers have indicated that teams that encompass a broader perspective in the face of adversity tend to develop a positive adaption (Bennett, 2010).

## The Mediator of Team Trust

Team trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another. This interpersonal attribute is one of the important elements of teamwork and is based on both emotional bonds and perceived competencies of individual members (Barczak et al., 2010). When members trust each other, they tend to feel less vulnerable, which facilitates the channeling of energy for creating and discovering rather than defending (Gibb, 1978). In educational settings, scholars and educators acknowledge that building trusting relationships with team members plays a crucial role in learning development and knowledge creation (Tseng and Yeh, 2013). For example, given that trust stresses interpersonal and interdependent group dynamics, when learners perceive team trust during their study period, the effectiveness of their online learning teams increases significantly (Chen et al., 2011; Deortentiis et al., 2013).

Based on the theoretical framework of the social identity approach, as resilience at the team highlights the individual's sense of "us" within the team, when teams are characterized as resilient, all the team members tend to display such behaviors on behalf of their teams as effective collective actions in the face of highly complex environmental conditions (Hambrick, 1994). This happens because resilient environments in the team facilitate team members' connections with each other, in terms of identity (Roberts, 2007). Consequently, they (i.e., team members) develop positive relationships—e.g., trust—based on their sense of security to express their true feelings (Stephens et al., 2013).

Previous creativity literature has suggested the benefits of team trust on team creative outputs (Kipkosgei et al., 2020). Generally, trust is identified as a critical feature for promoting successful partnerships among diverse members of a team, because trust is key to holding members together as a cohesive unit (Kasper-Fuehrera and Ashkanasy, 2001; Bijlsma and Koopman, 2003). Since creative teams are known for their ability to identify and exploit unique opportunities by using imaginative strategies to procure and orchestrate resources across functional groups (Cheng, 2011), team trust supports better communication, information sharing, focus and greater cooperation (Barczak et al., 2010).

# OVERVIEW OF THE CURRENT STUDY

The above review and reasoning establish that resilience contributes to undergraduate students' creativity at the team level. However, more empirical examinations are required in the creativity literature to explore the processes by which team resilience contributes to team creativity among undergraduate students. Based on the abovementioned discussion, we draw on social identity theory to expect the potential serial mediation effects of team creative efficacy and team trust.

First, we assess the potential positive association between team resilience and team creativity. Specifically, as resilient teams should be more flexible to adverse changes, it is reasonable to predict that teams with a high level of resilience tend to generate more flexible and adaptive responses to adversity (Meneghel et al., 2016); additionally, they are more likely to use setbacks as challenges or opportunities for coming up with creative solutions (Carmeli et al., 2014). Thus, we hypothesize a positive relationship between team resilience and team creativity. That is, team resilience is positively related to team creativity (H1).

Second, we examine the mediating roles of team creative efficacy in linking team resilience and team creativity among undergraduate students. Specifically, according to the theoretical arguments in social identity theory, when studying in a team characterized as highly resilient, team members view their teams as having the capacity for positive adaptation through collective interactions (Bowers et al., 2017). Thus, team members tend to build a strong sense of confidence about their teams' capability to address creative problems. In this situation where all students share a high level of confidence in their joint efforts within the team, they are more likely to come up with creative solutions by working together. Thus, we propose the next hypothesis: team creative efficacy mediates the relationship between team resilience and team creativity (H2).

Third, we examine the other mediator—i.e., team trust—linking the positive association between team resilience and team creativity. Specifically, resilient teams in the face of adversity are

more likely than non-resilient teams to increase all members' attentiveness within the team toward building team trust. In this trusting environment, team members are more willing to take a risk by sharing information and cooperating with their team members (Mayer et al., 1995), resulting in a creative solution to their task. Accordingly, we propose that team trust mediates the relationship between team resilience and team creativity (H3).

Finally, we explore a sequential mediating process to address the following question: How do team creative efficacy and team trust relate to each other in the social context and relate to the process of creative performance at the team level? Specifically, in teams with a high level of resilience, team members may identify themselves with the whole team by developing their joint efforts in a creative manner, thereby increasing the teams' creative performance. That is, team resilience can directly enhance all the members' sense of the teams' confidence in being creative, thus providing a sound working environment of trust in the teams, which finally facilitates the teams' creative outputs. In addition, as social identity theory suggests, in the team process, team members' social identity points to particular social psychological processes—that is, one member's psychological state can transfer to other team members. Regarding collective efficacy belief, team creative efficacy—representing team members' shared belief regarding the team's ability to accomplish a creative task—may result in building trust within a team, because individuals holding greater beliefs about their teams' creative capabilities may reinforce more interactive activities with other team members; thus, these members tend to develop a sense of trust with other members within the team. Therefore, we propose the final hypothesis that team creative efficacy and team trust sequentially mediate the relationship between team resilience and team creativity (H4).

# MATERIALS AND METHODS

## Procedure and Participants

The sample in the current study was composed of 201 undergraduate students from a university in mainland China. This university was chosen from the collaborating members in our research project which aims to explore the predictors of students' creativity in Chinese universities. At this university, courses were designed to stimulate learners' creativity, and undergraduate students participated in creative activities in and after class. Among all the departments in this university, we randomly selected the Department of Hospitality Management to participate in our research. One of the authors contacted the teacher from the department of hospitality management to confirm whether she would like to join our research project with her students. After receiving her confirmation, we started our survey research in the teacher's course. We decided to involve students who were enrolled in a second-year bachelor's course on hospitality management. These students not only accumulated related knowledge about the hospitality and tourism industry but also got along with their classmates after the first year of study; thus, they could work closely to complete a class project by collectively initiating creative tasks in hospitality-related business topics. These students were informed that their participation helped them fulfill a course requirement and obtain course credits. To guarantee confidentiality, all participants involved were informed of the survey objectives at the very beginning of the study. The teacher asked all the undergraduate students to complete the paper-and-pencil questionnaires in the classroom during the class period. When they completed the survey, they returned it directly to the teacher's hands. Afterward, the teacher sent the questionnaires to the author.

The teacher initiated a project that developed marketing plans in the modern hospitality industry. In this project, students should provide a final proposal including the real-world marketing policies and in-depth analysis of some hospitality managerial issues. All the undergraduate students were involved in completing this project by working with a team. That is, they were asked to organize teams by themselves, and each team had 5–8 team members. Before forming project teams, members were asked to work closely with their teammates to complete their projects during this project by researching and discussing information, such as customer profiles, the marketing environment and competition, which are required for the project.

A 1-month milestone agenda was suggested to the teams. In the first week, student participants organized their own team and initiated some project plans. During this week, 31 teams were formed, and team members were getting close to each other within each team. After forming teams, we started our time-lagged research design in the following weeks. Specifically, at Time 1, undergraduate students were asked to rate their team resilience. After 1 week, at Time 2, undergraduate students were asked to rate their team efficacy and their team trust. After 1 week, at Time 3, the teacher was asked to rate each team's creativity. Among these student participants ($N$ = 201), 66.2% were male ($SD$ = 0.47), and the average number of team members in each team was 6.48.

## Measurements

We used validated scales from previous literature. Since these scales are originated and developed in papers written in English, these English original scales are required to be translated to have an accurate and high quality questionnaire. The back-translation method was employed to provide a Chinese instrument (Brislin, 1986). Seven-point Likert scales (from 1 = strongly disagree, to 6 = strongly agree) were used.

### Team Resilience

A seven-item scale from Mallak (1998) was used to assess resilience at the team level (Cronbach's $\alpha$ = 0.89) which refers to a team's collective resources can be harnessed to positively adapt to adversity. The original scale shows good reliability (Cronbach's $\alpha$ from 0.85 to 0.95) in previous studies. Our questionnaire asked students to rate the extent to which their team has the capacity to bounce back from failure, setbacks, conflicts, or any other threat to well-being. One sample item is "In difficult situations, my team tries to look on the positive side." The Kaiser–Meyer–Olkin (KMO) value was 0.88, with the Bartlett test of sphericity achieving statistical significance ($p < 0.001$).

### Team Creative Efficacy

We adopted the four-item scale from Shin and Eom (2014) to measure team creative efficacy belief (Cronbach's α = 0.87) which refers to team members' shared beliefs in their team's capabilities to generate creative ideas together. This scale has been widely used in prior studies which generate good reliability (Cronbach's α from 0.80 to 0.93). Since we specifically examined the influences of team green-oriented efficacy belief, we designed these items to explicitly represent the team members' shared beliefs in their team's capabilities of performing green innovative tasks. One sample item is "Our team is able to solve green tasks if we invest the necessary effort." The KMO value was 0.79, with the Bartlett test of sphericity achieving statistical significance ($p < 0.001$).

### Team Trust

We used the four-item scale from Bierly et al. (2009) (Cronbach's α = 0.82) to rate team trust referring to team members' willingness to rely on each other to take accountability as a whole team. The validity of this scale has been shown in previous studies (Cronbach's α from 0.84 to 0.89). We asked undergraduate students to assess their own teams' trust. One sample item is "Over-all, the people on my team were very trustworthy." The KMO value was 0.75, with the Bartlett test of sphericity achieving statistical significance ($p < 0.001$).

### Team Creativity

We used the eight-item scale from Rego et al. (2007) (Cronbach's α = 0.92) to rate team creativity referring to teams producing novel ideas and solutions to address challenges and problems. This is a widely used scale in the educational literature during to its high validity (Cronbach's α from 0.81 to 0.95). We asked the teacher to assess each team's creativity based on team's final proposals. One sample item is "Team members come up with creative solutions to problems." The KMO value was 0.88, with the Bartlett test of sphericity achieving statistical significance ($p < 0.001$).

### Control Variables

We control the team size (i.e., the number of team members) as past literature suggested its potential influence on creative outcomes at the team level (Barczak et al., 2010).

## Analytical Strategy

We first aggregated data from the individual to the team level. Because team resilience, team efficacy, and team trust all represent the shared perception of the team members' belief and attitude, the team members' (i.e., undergraduate students') responses to these team-level characteristics were aggregated to form a measure at the team level. We computed $r_{wg}$ to evaluate the interrater agreement, ICC(1) (intraclass correlation coefficient) to evaluate the intraclass correlations, and ICC(2) to evaluate the reliability of the group means (Bliese, 2000). The team resilience results indicated that ICC(1) is 0.11, ICC(2) is 0.58, and the average $r_{wg}$ is 0.86. The team efficacy results showed that ICC(1) is 0.13, ICC(2) is 0.54, and the average $r_{wg}$ is 0.85. The team trust results showed that ICC(1) is 0.10, ICC(2) is 0.51, and the average $r_{wg}$ is 0.83. All these indicators show that our data aggregation is appropriate.

Before testing hypotheses, we first used the SPSS software version 21 (Chicago, IL, United States) to analyze the data. Specifically, we calculated the descriptive statistics to characterize all the variables in the current study—computing Pearson's product-moment correlation to test the directions and correlations among all the variables. To test our hypothesis that team creative efficacy and team trust act as serial mediators of the relationship between team resilience and team creativity, we used the SPSS PROCESS macro, Model 6, to test the stability and significance of the mediation effects. Particularly, we calculated 95% confidence intervals of the indirect effects derived from bias-corrected bootstrap estimates with 5,000 iterations, which are significant at $p = 0.05$ if the 95% confidence interval does not include zero. We employed PROCESS to test our hypotheses because it is widely used in the social, business, and health sciences to estimate direct and indirect effects in single and multiple mediation models (e.g., Hayes and Scharkow, 2013; Baroudi et al., 2018). PROCESS generates all of the statistics calculations and implements bootstrapping in a way that facilitates inference about moderated and mediated effects (Hayes and Scharkow, 2013; Hayes et al., 2017). In the current study, specifically, we used the Model 6 to perform a sequential mediation analysis which explicitly test how the independent variable (i.e., team resilience) can influence the dependent variable (i.e., team creativity) through influencing two distinguished mediators in a sequential way (i.e., influencing team efficacy and then team trust).

# RESULTS

## Descriptive Analysis

We present the descriptive statistics of the variables in **Table 1**. The results show that team resilience is significantly correlated with team creativity (β = 0.23, $p < 0.05$), and the correlation coefficient presents the expected positive significance, providing initial support for H1. As discussed, team resilience also correlates to team creative efficacy (β = 0.39, $p < 0.05$) and team trust (β = 0.45, $p < 0.05$). Moreover, both team creative efficacy (β = 0.50, $p < 0.05$) and team trust (β = 0.37, $p < 0.05$) correlate to team creativity. The results are consistent with our expectations.

**TABLE 1 |** Descriptive statistics and correlations between variables.

| Variables | Mean | *SD* | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| (1) Team size | 6.32 | 0.98 | | | | |
| (2) Team resilience | 4.64 | 0.41 | 0.17 | | | |
| (3) Team creative efficacy | 4.79 | 0.40 | 0.15 | 0.39** | | |
| (4) Team trust | 5.00 | 0.35 | 0.09 | 0.45** | 48** | |
| (5) Team creativity | 4.43 | 0.87 | 0.31 | 0.23** | 0.50** | 37** |

*N = 31 (team-level). **p < 0.05.*

## Confirmatory Factor Analysis and Validity

In order to validate the developed constructs, a measurement model was estimated with a confirmatory factor analysis in which each measurement item was loaded on its proposed constructs, and the constructs were allowed to be correlated in the analysis (Anderson and Gerbing, 1988). All measurement items were loaded on their expected constructs (**Table 2**). The model indices indicated good fit: $\chi^2$ = 312.70, df = 153, $\chi^2$/df = 2.04, RMSEA = 0.07, and SRMR = 0.07, CFI = 0.95, TLI = 0.94.

Furthermore, we assessed the composite reliabilities and construct validity. The composite reliability of indicators needed to exceed the cut-off value of 0.70 (Hair et al., 1998). Next, we calculated the average variance extracted (AVE) to check the convergent validity of the constructs. Theoretically, AVE > 0.50 does convey sufficient variance for the variables to converge into a single construct (Hair et al., 1998). The discriminant validity of constructs was assessed when the AVE was compared to the squared correlation between latent constructs; and the squares correlations between constructs were less than the AVE, suggesting discriminant validity (Fornell and Larcker, 1981). The results shown in **Table 2** indicated that the AVE of each construct was more than 0.50, composite reliability of indicators was more than 0.70, and the AVE of each construct was higher than the squared correlations between pairs of constructs, indicating construct validity.

## Hypotheses Testing

To test the hypothesis of whether team creative efficacy and team trust sequentially mediate the impact of team resilience on team creativity, we performed a sequential mediation analysis (Model 6, as described in PROCESS) with bootstrap methods (Hayes, 2013). **Figure 2** describes all the paths for the full process model. **Table 3** displayed the coefficients. The results show that the total effect (C1) of team resilience on team creativity was found to be significant (β = 0.92, $t$ = 2.81, $p$ < 0.001), supporting H1. However, the results in **Table 3** show that the total direct effect (C1') without the effect of the two mediators was non-significant (β = −0.57, $t$ = −1.37, $p$ = 0.18). The total indirect effect (i.e., the sum of the specific indirect effects) was significant, with a total indirect effect (β = 0.92, *SE* = 0.32) and a 95% confidence interval between 0.34 and 1.64.

Moreover, the specific indirect effect resulting from team creative efficacy only was not significant (a1b1 = 0.30; 95% CI = −0.48 and 1.12); and the specific indirect effect resulting from team trust was non-significant (a2b2 = −0.09; 95% CI = −0.58 and 0.47). The results indicated that neither H2 nor H3 are supported.

To test the sequential multiple mediation effect (i.e., H4), the results showed that the specific indirect effect of team resilience on team creativity through both team creative efficacy and team trust (a1a3b2) was significant, with a point estimate of 0.71 and a 95% confidence interval between 0.01 and 1.62, providing full

**TABLE 2 |** Results of confirmatory factor analysis and correlations of constructs.

| Construct | Standardized factor loadings | Composite reliabilities | AVE | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| (1).Team creative efficacy | | 0.87 | 0.64 | 1 | | | |
| EFFIC1 | 0.75 | | | | | | |
| EFFIC2 | 0.82 | | | | | | |
| EFFIC3 | 0.90 | | | | | | |
| EFFIC4 | 0.71 | | | | | | |
| (2) Team trust | | 0.78 | 0.50 | 0.126*** | 1 | | |
| TRUST1 | 0.83 | | | | | | |
| TRUST2 | 0.72 | | | | | | |
| TRUST3 | 0.48 | | | | | | |
| TRUST4 | 0.69 | | | | | | |
| (3) Team resilience | | 0.89 | 0.55 | 0.102*** | 0.099*** | 1 | |
| TR1 | 0.74 | | | | | | |
| TR2 | 0.82 | | | | | | |
| TR3 | 0.81 | | | | | | |
| TR4 | 0.70 | | | | | | |
| TR5 | 0.86 | | | | | | |
| TR6 | 0.87 | | | | | | |
| TR7 | 0.75 | | | | | | |
| (4) Team creativity | | 0.95 | 0.79 | 0.007 | 0.045*** | 0.031** | 1 |
| CREA1 | 0.83 | | | | | | |
| CREA2 | 0.91 | | | | | | |
| CREA3 | 0.94 | | | | | | |
| CREA4 | 0.96 | | | | | | |
| CREA5 | 0.80 | | | | | | |

*AVE, average variance extracted. **p < 0.01, **p < 0.001.*

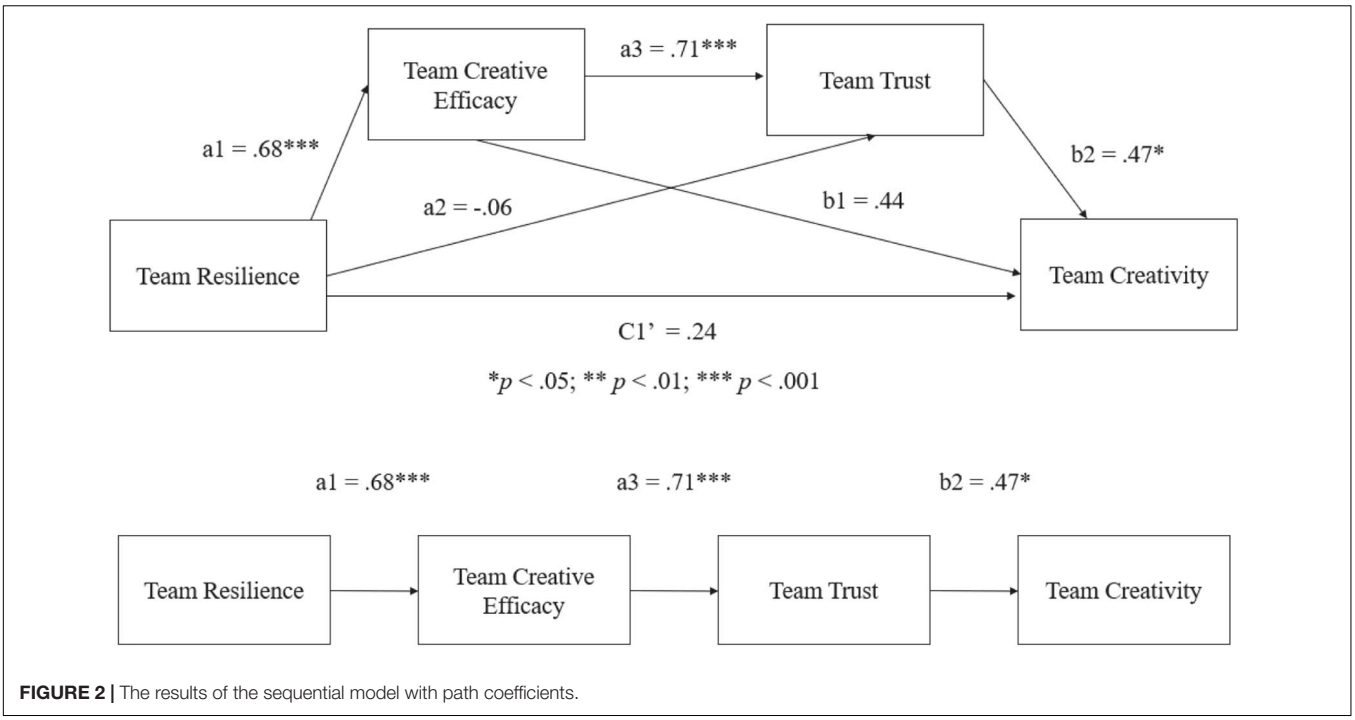


**FIGURE 2 |** The results of the sequential model with path coefficients.

support for H4. Therefore, our proposition—i.e., team resilience is a unique aspect that might lead to positive team creative efficacy, which in turn might be a unique predictor to increase the level of team trust, and the team trust uniquely enhances team creativity—was supported fully by the statistical analysis carried out in the current study. Taken together, the results prove that team creative efficacy and team trust sequentially mediates the linkage between team resilience and team creativity.

# DISCUSSION

## Overview of Findings

Although previous studies examined the potential association between resilience and creativity, limited studies have explored the mediating process on this association at the team level in the educational settings. Focusing on the context of undergraduate students, our results established the positive effect of team resilience on team creativity among undergraduate students. Moreover, we found that team resilience yields better team creativity through higher levels of team creative efficacy and higher team trust; that is, the indirect effect of team resilience on the undergraduates' team creativity works first through team creative efficacy and then through team trust.

## Theoretical Implications

Our study fills a theoretical void in the literature by linking resilience and creativity at the team level in educational settings. First, we focus on the link at the team level by proposing the positive association between team resilience and team creativity; therefore, we extend the current understanding of the resilience-creativity linkage, from the individual level to the team level. Consistent with previous research findings suggesting that resilient individuals are more likely to behave in a creative way in the workplace setting (Kim, 2015; Fernandez-Martinez et al., 2017), our findings extend this line of thinking by showing that resilience positively relates to creativity among undergraduate students (Waxman et al., 2003; Consoli et al., 2015). By revealing the potential positive linkage between resilience and creativity among undergraduate students in China, we extend current understanding in the educational literature that such students' positive psychological states as resilience is critical for effective creative work.

At the same time, we used aggregated scores for a team-level analysis, and our results reveal that teams with a high level of resilience can produce more creative outputs. That is, in the situation where undergraduate students organize a team for a project, the team with a high level of resilience is more likely than the team with a low level of resilience to use setbacks as challenges or opportunities for growth (Carmeli et al., 2014); as a result, the team as a whole can come up with more creative responses to adversity. In doing so, we highlight the team resilience as a significant predictor contributes to undergraduates' collective creativity in the context of higher education; that is, when undergraduates organize a team with a high level of resilience, they can study together toward addressing tasks and projects in a creative manner. This finding specifically suggests that resilient teams experience a greater ability to cope with setbacks and obstacles encountered in the learning and educational context, which in turn allows them overcome adversity and maintain or enhance creative outcomes. These results highlight the need for future research to consider a wider range of

**TABLE 3 |** Results of sequential mediation analyses (PROCESS Model 6 in SPSS).

Model 6
Y = Team creativity
X = Team resilience
M1 = Team creative efficacy
M2 = Team trust
Sample size: 31 teams

| **Outcome: Model 1:** | **Team creative efficacy** | | | | | |
|---|---|---|---|---|---|---|
| | **Summary** | | | | | |
| | ***R*** | ***R*-sq** | | ***F*** | **Df1** | **Df2** | ***p*** |
| | 0.70 | 0.49 | | 13.18 | 2.00 | 28.00 | 0.0001 |
| | **Coefficient** | | ***SE*** | | ***t*** | ***p*** |
| Constant | 1.58 | | 0.67 | | 2.36 | 0.0254 |
| Team resilience | 0.68 | | 0.13 | | 5.02 | 0.0000 |
| **Outcome: Model 2:** | **Team trust** | | | | | |
| | **Summary** | | | | | |
| | ***R*** | ***R*-sq** | | ***F*** | **Df1** | **Df2** | ***p*** |
| | 0.77 | 0.59 | | 13.11 | 3.00 | 27.00 | 0.0000 |
| | **Coefficient** | | ***SE*** | | ***t*** | ***p*** |
| Constant | 1.89 | | 0.57 | | 3.32 | 0.0026 |
| Team resilience | −0.06 | | 0.15 | | −0.41 | 0.6819 |
| Team creative Efficacy | 0.71 | | 0.15 | | 4.79 | 0.0001 |
| **Outcome: Model 3:** | **Team creativity** | | | | | |
| | **Summary** | | | | | |
| | ***R*** | ***R*-sq** | | ***F*** | **Df1** | **Df2** | ***p*** |
| | 0.71 | 0.50 | | 6.50 | 4.00 | 26.00 | 0.0009 |
| | **Coefficient** | | ***SE*** | | ***t*** | ***p*** |
| Constant | −3.90 | | 1.93 | | −2.02 | 0.0535 |
| Team resilience | −0.57 | | 0.41 | | −1.37 | 0.1827 |
| Team creative efficacy | 0.44 | | 0.57 | | 0.78 | 0.45 |
| Team trust | 0.47 | | 0.55 | | 2.69 | 0.0124 |
| **Outcome: Model 4:** | **Team ceativity** | | | | | |
| | **Summary** | | | | | |
| | ***R*** | ***R*-sq** | | ***F*** | **Df1** | **Df2** | ***p*** |
| | 0.56 | 0.39 | | 8.85 | 3.00 | 25.00 | 0.0000 |
| | **Coefficient** | | ***SE*** | | ***t*** | ***p*** |
| Constant | 4.34 | | 0.36 | | 3.54 | 0.0000 |
| Team resilience | 0.92 | | 0.47 | | 2.81 | 0.0000 |

**Total, direct, indirect effects**

**Total effects of team resilience on team creativity**

| **Effect** | ***SE*** | ***t*** | ***p*** |
|---|---|---|---|
| 0.92 | 0.32 | 2.81 | 0.0000 |

*(Continued)*

**TABLE 3** | Continued

| **Direct effects of team resilience on team creativity** | | | | |
|---|---|---|---|---|
| | **Effect** | ***SE*** | ***t*** | ***p*** |
| | −0.57 | 0.41 | −1.37 | 0.1827 |
| **Indirect effects of team resilience on team creativity** | | | | |
| | **Effect** | **Boot *SE*** | **BootLLCI** | **BootULCI** |
| Total: | 0.92 | 0.32 | 0.34 | 1.64 |
| Ind 1: | 0.30 | 0.39 | −0.48 | 1.12 |
| Ind 2: | −0.09 | 0.25 | −0.58 | 0.47 |
| Ind 3: | 0.71 | 0.40 | 0.01 | 1.62 |
| **Indirect effect key** | | | | |
| Ind 1: | Team resilience → team creative efficacy → team creativity | | | |
| Ind 2: | Team resilience → team trust → team creativity | | | |
| Ind 3: | Team resilience → team creative efficacy → team trust → team creativity | | | |

*Analysis notes.*

*Bootstrap samples for bias corrected bootstrap confidence intervals: 5,000.*

*Level of confidence for all confidence intervals in output: 95%.*

*BootLLCI = lower limit confidence interval, BOOTULCI = upper limit confidence interval.*

perspectives to link undergraduates' resilience and creativity at team level. For example, according to the theoretical framework of self-regulation process, students teams composed of undergraduates with high resilience may be motivated to regulate their collective behaviors to achieve better outcomes (e.g., creative results).

Moreover, our findings suggest the mediating role of team creative efficacy and team trust in the relationship between team resilience and team creativity. In doing so, we address scholars' call for exploring the mechanism through which resilience exerts influences on creativity (Bowers et al., 2017). That is, although previous studies have acknowledged that students can self-regulate their psychological factors (e.g., efficacy belief and motivations) to behave creatively (e.g., Gu et al., 2017), existing research failed to empirically uncover the important role of psychological attributes among undergraduate students in the creativity domain. Specifically, we found the sequence of two important psychological factors—i.e., team creative efficacy and tea trust—that link the between team resilience and team creativity. These findings consistently supported the arguments that when students receive such positive information as team resilience and encouragements from their learning contexts, there are more likely to experience positive psychological arousal by developing confidence and interactions within their learning group (Urdan and Schoenfelder, 2006; Tseng and Yeh, 2013; Lyons et al., 2016), which in turn facilitates their creative outputs (e.g., thinking creatively and coming up with creative solutions) (Barczak et al., 2010; Curseu, 2010).

In addition, the serial mediation model offers new insights to the literature by revealing the possibilities of different pathways in explaining the relationship between resilience and creativity at the team level. That is, there is a significant indirect relationship between team resilience and team creativity through both team creative efficacy belief and the level of team trust. In this vein, we empirically demonstrate the intervening processes of psychological flourishing at the team level in linking resilience and creativity in sequence. These findings also suggest the potential "developing" functions of collective confidence and the subsequent potential "building" function of trust within groups through the positive association between team resilience and team creativity, which corroborates the results of earlier studies suggesting the sequential mediators in investigating students; creativity (Miron-Spektor and Beenen, 2015). Since the psychological perspective include a wide range of psychological attributes at the teal level, the complex intervening mechanism requires further research to identify alternative psychology-oriented factors.

Further, through applying social identity theory, we extend the current understanding to better explain the relationship between resilience and creative outcomes at the team level among graduate students. Specifically, previous research primarily employs the emotional and cognitive perspectives to reveal the association between resilience and creativity, which overlooks the collective attributions in the processes (e.g., Bowers et al., 2017; Chapman et al., 2020). However, to address this research limitation, we are among the first attempts to utilize the social identity approach to investigate the psychology and behavior of team members in resilience and creativity literature. In this way, the social identity approach points to particular sequential psychological mechanisms through which team resilience transfers to the team creative outcomes in the educational context (e.g., Haslam et al., 2013). That is, resilient teams transfer to team members by means of team processes that strengthen team members' collective sense of 'us,' as manifested by their increased team creative efficacy beliefs about their creative capabilities, and then enhanced trust among all the team members. Accordingly, our

results specifically contribute to developing a social identity approach to students' creativity that provides a theoretical lens of identity in social environment for integrating and building upon insights provided by established approaches. Meanwhile, we also enrich a core insight of the social identity approach through highlighting some core aspects of identification-oriented process by systematically theorizing about the interactive relationship between the group's psychological characteristics. In this vein, our findings move beyond relatively vague references to the importance of "team factors" as a mediator between these elements (Nieuwenhuis et al., 2019). To further explore the interplay between learning, identity, and context in the educational context, relevant research in the future could investigate the role of broader social and psychological factors in creative learning among students.

## Educational Implications

Our empirical findings reveal several practical implications for educators. First, building up resilience could help students find creative ways for dealing with their unique difficulties and problems. Given the significant role of team resilience in achieving team creativity, students should be encouraged to develop their internal factors related to resilience, such as optimism and flexibility. For example, teachers can focus praise on students' efforts for creative thinking and activities. Meanwhile, our findings again imply that relationships are key to team resiliency, and teachers should build a community to help students all become connected to one another. In addition, undergraduate students are encouraged to set and achieve goals through building the practice of self-monitoring, and as a result, they would see the results of their creative work.

Moreover, given team creative efficacy as a key mediator, students can emphasize shaping team member interactions and try to create a communication environment in the teams. For example, team leaders should plan various activities that increase opportunities for member interaction, communication and collaboration. Finally, undergraduate students are encouraged to focus on building trust during their teamwork processes, since team trust is key mediator to transfer the benefits of resilience to creativity. For example, students can organize open communication to build trust in their teams. Meanwhile, teachers can give students more responsibilities to complete their team work; in this way, they would build trust with their teammates toward an increase in team productivity. Finally, since classroom dynamics and teaching methods can shape a classroom culture of resiliency, schools are encouraged to train teachers to reward students when they (i.e., students) obtain good grades or behave in an expected way of being resilience together.

## Limitations and Avenues for Further Research

The present study has some limitations. First, the sample was restricted to Chinese undergraduate students who only majored in hospitality management; therefore, whether the results are applicable to other samples is not confirmed. Future studies are highly encouraged to use other samples to replicate and generalize our findings, such as undergraduate students from science majors. Second, our time-lagged research design was conducted with only 1-week intervals, and thus, we cannot determine causal association for the most part. For example, if the team can provide more creative outputs, all the team members may develop a higher level of resilience (Chen et al., 2018). Accordingly, research in the future can use a longitudinal research design or an experimental research design to re-establish our findings in terms of causality.

Furthermore, according to the theoretical arguments of the social identity theory, contextual factors are likely to stimulate individuals' specific identity toward a specific outcome, we encourage future research to explore the potential mediators of students' identity which could transfer the effect of team resilience and team creativity. Taking creative identity role as an example, when team resilience is high, students tend to actively engage in taking risks during their learning processes; as a result, their creative outputs via working together would be higher. The final limitation is about the instruments designed with a 6-point Likert-type scale. Although previous research has indicated that 6-point and 5-point formats are both acceptable for survey studies (Chyung et al., 2017), further studies are still encouraged to use 5- point or 7-point Likert-type scale to provide a more accurate measuring toward reliability of our current results.

# CONCLUSION

Drawing on social identity theory, this paper examines the effect of team resilience on team creativity through a sequential mediating mechanism. This study finds a positive relationship between team resilience and team creativity. Moreover, the empirical findings confirm the sequential mediation effect of team creative efficacy and team trust. That is, team resilience exerts a positive influence on team creativity through enhancing team creative efficacy and then increasing team trust. These results contribute to the development of linking resilience and creativity at the team level among undergraduate students through exploring the sequential mediators of different psychological characteristics.

# DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

# ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Vrije Universiteit Amsterdam Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

MF and WC: conceptualization. WC and LJ: methodology, software, formal analysis, data curation, and writing—review and editing. MF, WC, and LJ: validation and writing—original draft preparation. WC: investigation and supervision. MF: resources, project administration, and funding acquisition. All authors have read and agreed to the published version of the manuscript.

## FUNDING

This research was funded and supported by the National Natural Science Foundation of China (grant number 72002211), the USTC Research Funds of the Double First-Class Initiative (grant number YD2160002010), the Fundamental Research Funds for the Central Universities (grant number WK2160000013), and the Funds of S&T Innovation Strategy and Soft Science Research in Anhui Province (grant number 202006f01050007).

## REFERENCES

Aggarwal, I., and Woolley, A. W. (2018). Team creativity, cognition, and cognitive style diversity. *Manag. Sci.* 65, 1586–1599. doi: 10.1287/mnsc.2017.3001

Alliger, G. M., Cerasoli, C. P., Tannenbaum, S. I., and Vessey, W. B. (2015). Team resilience: how teams flourish under pressure. *Organ. Dynam.* 44, 176–184.

Amabile, T. M. (1997). Motivating creativity in organizations: on doing what you love and loving what you do. *California Manag. Rev.* 40, 39–58. doi: 10.2307/41165921

Anderson, J. C., and Gerbing, D. W. (1988). Structural equation modeling in practice. *Psychol. Bull.* 103, 411–423.

Arnout, B. A., and Almoied, A. A. (2020). A structural model relating gratitude, resilience, psychological well-being and creativity among psychological counsellors. *Counsell. Psychotherapy Res.* 21, 470–488. doi: 10.1002/capr.12316

Bandura, A. (1997). *Self-fficacy: The Exercise of Control*. New York, NY: Freeman and Company.

Barczak, G., Lassk, F., and Mulki, J. (2010). Antecedents of team creativity: an examination of team emotional intelligence, team trust and collaborative culture. *Creat. Innovat. Manag.* 19, 332–345. doi: 10.1111/j.1467-8691.2010.00574.x

Baroudi, S. E., Khapova, S. N., Fleisher, C., and Jansen, P. G. (2018). How do career aspirations benefit organizations? the mediating roles of the proactive and relational aspects of contemporary work. *Front. Psychol.* 9:2150. doi: 10.3389/fpsyg.2018.02150

Bennett, K. M. (2010). How to achieve resilience as an older widower: turning points or gradual change? *Ageing Soc.* 30, 369–382. doi: 10.1017/s0144686x09990572

Bierly, P. E. III, Stark, E. M., and Kessler, E. H. (2009). The moderating effects of virtuality on the antecedents and outcome of NPD team trust. *J. Product Innovat. Manag.* 26, 551–565. doi: 10.1111/j.1540-5885.2009.00680.x

Bijlsma, K., and Koopman, P. (2003). Introduction: trust within organisations. *Personnel Rev.* 32, 543–555. doi: 10.1108/00483480310488324

Bliese, P. D. (2000). "Within-group agreement, non-independence, and reliability: implications for data aggregation and analysis," in *Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions, and New Directions*, eds K. J. Klein and S. W. J. Kozlowski (San Francisco, CA: Jossey-Bass), 349–381.

Bliuc, A. M., Ellis, R. A., Goodyear, P., and Hendres, D. M. (2011). Understanding student learning in context: relationships between university students' social identity, approaches to learning, and academic performance. *Eur. J. Psychol. Educ.* 26, 417–433. doi: 10.1007/s10212-011-0065-6

Bodla, A. A., Tang, N. Y., Jiang, W., and Tian, L. W. (2018). Diversity and creativity in cross-national teams: the role of team knowledge sharing and inclusive climate. *J. Manag. Organ.* 24, 711–729. doi: 10.1017/jmo.2016.34

Bowers, C., Kreutzer, C., Cannon-Bowers, J., and Lamb, J. (2017). Team resilience as a second-order emergent state: a theoretical model and research directions. *Front. Psychol.* 8:1360. doi: 10.3389/fpsyg.2017.01360

Brislin, R. W. (1986). "The wording and translation of research instruments," in *Cross-cultural Research and Methodology Series, Field Methods in Cross-cultural Research*, eds W. J. Lonner and J. W. Berry (Thousand Oaks, CA: Sage Publications, Inc), 137–164.

Cameron, J. E. (1999). Social identity and the pursuit of possible selves: implications for the psychological well-being of university students. *Group Dynam. Theory Res. Pract.* 3:179. doi: 10.1037/1089-2699.3.3.179

Campbell-Sills, L., Cohan, S. L., and Stein, M. B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behav. Res. Therapy* 44, 585–599. doi: 10.1016/j.brat.2005.05.001

Carmeli, A., Sheaffer, Z., Binyamin, G., Reiter-Palmon, R., and Shimoni, T. (2014). Transformational leadership and creative problem-solving: the mediating role of psychological safety and reflexivity. *J. Creat. Behav.* 48, 115–135. doi: 10.1002/jocb.43

Cavrak, I., Bosnic, I., Ciccozzi, F., and Mirandola, R. (2019). Resilience of distributed student teams to stress factors: a longitudinal case-study. *Inform. Software Technol.* 114, 258–274. doi: 10.1016/j.infsof.2019.05.011

Chapman, M. T., Lines, R. L. J., Crane, M., Ducker, K. J., Ntoumanis, N., Peeling, P., et al. (2020). Team resilience: a scoping review of conceptual and empirical work. *Work Stress* 34, 57–81. doi: 10.1080/02678373.2018.1529064

Chen, C. C., Wu, J., Ma, M., and Knight, M. B. (2011). Enhancing virtual learning team performance: a leadership perspective. *Hum. Systems Manag.* 30, 215–228. doi: 10.3233/hsm-2011-0750

Chen, X. J., Cheung, H. Y., Fan, X. T., and Wu, J. (2018). Factors related to resilience of academically gifted students in the chinese cultural and educational environment. *Psychol. Schools* 55, 107–119. doi: 10.1002/pits.22044

Cheng, H. H., and Yang, H. L. (2011). Student team projects in information systems development: measuring collective creative efficacy. *Australasian J. Educ. Technol.* 27, 881–895.

Cheng, V. M. Y. (2011). Infusing creativity into eastern classrooms: evaluations from student perspectives. *Think. Skills Creat.* 6, 67–87. doi: 10.1016/j.tsc.2010.05.001

Chyung, S. Y., Roberts, K., Swanson, I., and Hankinson, A. (2017). Evidence-based survey design: the use of a midpoint on the Likert scale. *Perform. Improv.* 56, 15–23. doi: 10.1002/pfi.21727

Consoli, M. L. M., Delucio, K., Noriega, E., and Llamas, J. (2015). Predictors of resilience and thriving among latina/o undergraduate students. *Hispanic J. Behav. Sci.* 37, 304–318. doi: 10.1177/0739986315589141

Curseu, P. L. (2010). Team creativity in web site design: an empirical test of a systemic model. *Creat. Res. J.* 22, 98–107. doi: 10.1080/10400410903579635

Deortentiis, P. S., Summers, J. K., Ammeter, A. P., Douglas, C., and Ferris, G. R. (2013). Cohesion and satisfaction as mediators of the team trust—team effectiveness relationship: an interdependence theory perspective. *Career Dev. Int.* 18, 521–543. doi: 10.1108/cdi-03-2013-0035

Divaris, K., Polychronopoulou, A., Taoufik, K., Katsaros, C., and Eliades, T. (2012). Stress and burnout in postgraduate dental education. *Eur. J. Dental Educ.* 16, 35–42. doi: 10.1111/j.1600-0579.2011.00715.x

Dyrbye, L. N., Power, D. V., Massie, F. S., Eacker, A., Harper, W., Thomas, M. R., et al. (2010). Factors associated with resilience to and recovery from burnout: a prospective, multi-institutional study of us medical students. *Med. Educ.* 44, 1016–1026. doi: 10.1111/j.1365-2923.2010.03754.x

Edwards, C., and Harwood, J. (2003). Social identity in the classroom: an examination of age identification between students and instructors. *Commun. Educ.* 52, 60–65. doi: 10.1080/03634520302463

Fan, M., and Cai, W. (2020). How does a creative learning environment foster student creativity? an examination on multiple explanatory mechanisms. *Curr. Psychol.* 1–10.

Fernandez-Martinez, E., Andina-Diaz, E., Fernandez-Pena, R., Garcia-Lopez, R., Fulgueiras-Carril, I., and Liebana-Presa, C. (2017). Social networks,

engagement and resilience in university students. *Int. J. Environ. Res. Public Health* 14:1488. doi: 10.3390/ijerph14121488

Fornell, C., and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *J. Market. Res.* 18, 39–50. doi: 10.2307/3151312

Gibb, J. R. (1978). *Trust: A New View of Personal and Organizational Development*. Los Angeles: Guild of Tutors Press.

Grawitch, M. J., Munz, D. C., Elliott, E. K., and Mathis, A. (2003). Promoting creativity in temporary problem-solving groups: the effects of positive mood and autonomy in problem definition on idea-generating performance. *Group Dynamics-Theory Res. Pract.* 7, 200–213. doi: 10.1037/1089-2699.7.3.200

Gu, J., He, C., and Liu, H. (2017). Supervisory styles and graduate student creativity: the mediating roles of creative self-efficacy and intrinsic motivation. *Stud. Higher Educ.* 42, 721–742.

Haglund, M. E., Nestadt, P. S., Cooper, N. S., Southwick, S. M., and Charney, D. S. (2007). Psychobiological mechanisms of resilience: relevance to prevention and treatment of stress-related psychopathology. *Dev. Psychopathol.* 19, 889–920. doi: 10.1017/s0954579407000430

Hair, J. F. J., Anderson, R. E. J., Tatham, R. L., and Black, W. C. (1998). *Multivariate Data Analysis*, 5th Edn. Upper Saddle River, NJ: Prentice- Hall.

Hambrick, D. C. (1994). What if the academy actually mattered? *Acad. Manag. Rev.* 19, 11–16. doi: 10.5465/amr.1994.9410122006

Haslam, S. A., Adarves-Yorno, I., Postmes, T., and Jans, L. (2013). The collective origins of valued originality: a social identity approach to creativity. *Personal. Soc. Psychol. Rev.* 17, 384–401. doi: 10.1177/1088868313498001

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-based Approach*. New York, NY: Guilford Press.

Hayes, A. F., Montoya, A. K., and Rockwood, N. J. (2017). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Australasian Market. J. (AMJ)* 25, 76–81. doi: 10.1016/j.ausmj.2017.02.001

Hayes, A. F., and Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: does method really matter? *Psychol. Sci.* 24, 1918–1927. doi: 10.1177/0956797613480187

Jacobs, J. W., Lopa, J. M. L., and Sorgule, P. (2001). Pilot-testing a student-designed team exam in an introduction to hospitality and tourism management course. *J. Hospitality Tourism Educ.* 13, 113–120. doi: 10.1080/10963758.2001.10696706

Johnson, B. (2008). Teacher–student relationships which promote resilience at school: a micro-level analysis of students' views. *Br. J. Guidance Counsell.* 36, 385–398. doi: 10.1080/03069880802364528

Jones, P., and Wynn, M. G. (2019). The circular economy, natural capital and resilience in tourism and hospitality. *Int. J. Contemporary Hospital. Manag.* 31, 2544–2563. doi: 10.1108/ijchm-05-2018-0370

Kasper-Fuehrera, E. C., and Ashkanasy, N. M. (2001). Communicating trustworthiness and building trust in interorganizational virtual organizations. *J. Manag.* 27, 235–254. doi: 10.1016/s0149-2063(01)00090-3

Kelly, S. (2009). Social identity theories and educational engagement. *Br. J. Soc. Educ.* 30, 449–462. doi: 10.1080/01425690902954620

Kennedy, D. M., Sommer, S. A., and Nguyen, P. A. (2017). Optimizing multi-team system behaviors: insights from modeling team communication. *Eur. J. Operat. Res.* 258, 264–278. doi: 10.1016/j.ejor.2016.08.036

Kim, B., and Kim, Y. (2017). College students' social media use and communication network heterogeneity: implications for social capital and subjective well-being. *Comp. Hum. Behav.* 73, 620–628. doi: 10.1016/j.chb.2017.03.033

Kim, H. (2015). Community and art: creative education fostering resilience through art. *Asia Pacific Educ. Rev.* 16, 193–201. doi: 10.1007/s12564-015-9371-z

Kim, M. S., Kim, Y. S., and Kim, T. H. (2007). "Analysis of team interaction and team creativity of student design teams based on personal creativity modes," in *Proceedings of the ASME 2007 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference* (New York, NY: ASME).

Kipkosgei, F., Kang, S. W., and Choi, S. B. (2020). A team-level study of the relationship between knowledge sharing and trust in kenya: moderating role of collaborative technology. *Sustainability* 12:1615. doi: 10.3390/su12041615

Kurtzberg, T. R., and Amabile, T. M. (2000). From guilford to creative synergy: opening the black box of team-level creativity. *Creat. Res. J.* 13, 285–294. doi: 10.1207/s15326934crj1334_06

Kwek, A., Bui, H. T., Rynne, J., and So, K. K. F. (2013). The impacts of self-esteem and resilience on academic performance: an investigation of domestic and international hospitality and tourism undergraduate students. *J. Hospitality Tourism Educ.* 25, 110–122. doi: 10.1080/10963758.2013.826946

Liu, C. H., Horng, J. S., Chou, S. F., and Huang, Y. C. (2017). Analysis of tourism and hospitality sustainability education with co-competition creativity course planning. *J. Hospitality Leisure Sport Tourism Educ.* 21, 88–100. doi: 10.1016/j.jhlste.2017.08.008

Luthans, F., Luthans, K. W., and Luthans, B. C. (2004). Positive psychological capital: beyond human and social capital. *Bus. Horizons* 47, 45–50. doi: 10.1016/j.bushor.2003.11.007

Lyons, W. E., Thompson, S. A., and Timmons, V. (2016). 'We are inclusive. we are a team. Let's just do it': commitment, collective efficacy, and agency in four inclusive schools. *Int. J. Inclusive Educ.* 20, 889–907. doi: 10.1080/13603116.2015.1122841

Mallak, L. (1998). Putting organizational resilience to work. *Industrial Manag.* 40, 8–13.

Mayer, R. C., Davis, J. H., and Schoorman, F. D. (1995). An integrative model of organizational trust. *Acad. Manag. Rev.* 20, 709–734. doi: 10.5465/amr.1995.9508080335

Meneghel, I., Salanova, M., and Martinez, I. M. (2016). Feeling good makes us stronger: how team resilience mediates the effect of positive emotions on team performance. *J. Happiness Stud.* 17, 239–255. doi: 10.1007/s10902-014-9592-6

Miron-Spektor, E., and Beenen, G. (2015). Motivating creativity: the effects of sequential and simultaneous learning and performance achievement goals on product novelty and usefulness. *Organ. Behav. Hum. Decision Processes* 127, 53–65. doi: 10.1016/j.obhdp.2015.01.001

Nieuwenhuis, M., Manstead, A. S., and Easterbrook, M. J. (2019). Accounting for unequal access to higher education: the role of social identity factors. *Group Processes Intergroup Relat.* 22, 371–389. doi: 10.1177/1368430219829824

Parker-Bell, B. (2010). Art therapy with children and adolescents. *Innov. Inter. Child Adol. Ment. Health* 18, 30–47.

Postmes, T., and Branscombe, N. R. (2010). *Rediscovering Social Identity*. New York, NY: Psychology Press.

Rego, A., Sousa, F., Pina e Cunha, M., Correia, A., and Saur-Amaral, I. (2007). Leader self-reported emotional intelligence and perceived employee creativity: an exploratory study. *Creat. Innovat. Manag.* 16, 250–264. doi: 10.1111/j.1467-8691.2007.00435.x

Richtner, A., and Lofsten, H. (2014). Managing in turbulence: how the capacity for resilience influences creativity. *R D Manag.* 44, 137–151. doi: 10.1111/radm.12050

Roberts, K. A. (2007). Self-efficacy, self-concept, and social competence as resources supporting resilience and psychological well-being in young adults reared within the military community. *Dissertation Abstracts Int.* 68:1319.

Shin, S. J., and Zhou, J. (2007). When is educational specialization heterogeneity related to creativity in research and development teams? transformational leadership as a moderator. *J. Appl. Psychol.* 92:1709. doi: 10.1037/0021-9010.92.6.1709

Shin, Y., and Eom, C. (2014). Team proactivity as a linking mechanism between team creative efficacy, transformational leadership, and risk-taking norms and team creative performance. *J. Creat. Behav.* 48, 89–114. doi: 10.1002/jocb.42

Stephens, J. P., Heaphy, E. D., Carmeli, A., Spreitzer, G. M., and Dutton, J. E. (2013). Relationship quality and virtuousness: emotional carrying capacity as a source of individual and team resilience. *J. Appl. Behav. Sci.* 49, 13–41. doi: 10.1177/0021886312471193

Tajfel, H. (1978). *Differentiation Between Social Groups: Studies in the Social Psychology of Intergroup Relations*. London: Academic Press.

Tajfel, H., Turner, J. C., Austin, W. G., and Worchel, S. (1979). An integrative theory of intergroup conflict. *Organ. Identity: Reader* 56:65.

Torrance, E. P., and Goff, K. (1990). *Fostering Academic Creativity in Gifted Students*. Princeton, NJ: Citeseer.

Tseng, H. W., and Yeh, H. T. (2013). Team members' perceptions of online teamwork learning experiences and building teamwork trust: a qualitative study. *Comp. Educ.* 63, 1–9. doi: 10.1016/j.compedu.2012.11.013

Urdan, T., and Schoenfelder, E. (2006). Classroom effects on student motivation: goal structures, social relationships, and competence beliefs. *J. School Psychol.* 44, 331–349. doi: 10.1016/j.jsp.2006.04.003

Waxman, H. C., Gray, J. P., and Padron, Y. N. (2003). *Review of Research on Educational Resilience*. Santa Cruz: Center for Research on Education Diversity and Excellence, University of California.

Yeager, D. S., and Dweck, C. S. (2012). Mindsets that promote resilience: when students believe that personal characteristics can be developed. *Educ. Psychol.* 47, 302–314. doi: 10.1080/00461520.2012.722805

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

# Advantages of publishing in Frontiers

**OPEN ACCESS**
Articles are free to read for greatest visibility and readership

**FAST PUBLICATION**
Around 90 days from submission to decision

**HIGH QUALITY PEER-REVIEW**
Rigorous, collaborative, and constructive peer-review

**TRANSPARENT PEER-REVIEW**
Editors and reviewers acknowledged by name on published articles

**Frontiers**
Avenue du Tribunal-Fédéral 34
1005 Lausanne | Switzerland

**Visit us:** www.frontiersin.org
**Contact us:** frontiersin.org/about/contact

**REPRODUCIBILITY OF RESEARCH**
Support open data and methods to enhance research reproducibility

**DIGITAL PUBLISHING**
Articles designed for optimal readership across devices

**FOLLOW US**
@frontiersin

**IMPACT METRICS**
Advanced article metrics track visibility across digital media

**EXTENSIVE PROMOTION**
Marketing and promotion of impactful research

**LOOP RESEARCH NETWORK**
Our network increases your article's readership