

How social and personal resources support teaching and learning effectiveness

Edited by

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How social and personal resources support teaching and learning effectiveness

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Editorial: How social and personal resources support teaching and learning effectiveness

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KEYWORDS

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Editorial on the Research Topic

How social and personal resources support teaching and learning effectiveness

This editorial summarizes the contributions to the Frontiers Research Topic “*How social and personal resources support teaching and learning effectiveness*,” established under the Educational Psychology section and appearing under the Frontiers in Psychology journals.

This Special Issue explored how personal and social resources can impact teaching and learning and how teachers and students value them in dealing with different challenging tasks in the educational environment. Thus, nine articles were accepted for publication. Empirical studies and systematic reviews were considered to answer the following questions: *Are personal or social resources more significant for the effectiveness of teaching and learning, or does their impact depend on the context? How can we develop these resources? How do these resources shape academic performance, job satisfaction, and, finally, the wellbeing of teachers and students?*

Thus, [Hoferichter et al.](#) explored the interaction of two social resources (i.e., teachers and peer support) with stress and academic achievement, both on individual and class levels. They worked with 733 7th and 8th-grade students, and the results revealed that teachers perceived support is associated with students' ability to cope with stressful situations and lower levels of helplessness. On the class level, peer support was related to a higher ability to cope and academic achievement. The context effects also show that in classes with higher peer support, students are more likely to benefit in terms of coping ability and achievement. In classes with higher teacher support, students tend to show less coping ability. A specific stressful situation in an academic environment is represented by the exams students must pass. Thus, [Schürmann et al.](#) worked with 92 students to investigate whether there are naturally occurring profiles based on the examinee's basic need strength and perceived need for support in real-life oral exams and if these profiles differed in stress responses and achievement. The results revealed two higher-quality (low/high, high/high) and two lower-quality (low/low, high/low) need strength/need support classes. Higher-quality classes that met or exceeded the needs displayed more beneficial stress and emotional response patterns than lower-quality classes. Gain-related emotions mediated achievement in the higher-quality classes. These findings emphasize the necessity to consider learners' emotional states and needs in teachers' didactic efforts because the perceived need for support and satisfaction can shape emotional and physiological stress reactions during the exam. [Martinot et al.](#) included parental involvement in their research and investigated whether parents, peers and teachers are the best sources of social support for school engagement. Based on 623 middle-school students from a privileged or priority education area, the results showed that the mother provided more support, followed by the father, the teachers, and the peers.

Also, each source of social support contributed to school engagement (except for maternal support). Emerging as the best source of support for school engagement, peers and teachers had significant direct effects among students from the priority education area and both direct and indirect effects among students from the advantaged area. Additionally, peer support had a double-edged impact on school engagement among students in the priority education area. [Shao and Kang](#) focused on how adolescents' peer relationships are linked to learning engagement through the chain mediating roles of self-efficacy and academic resilience. Results indicated that peer relationship was indirectly but positively associated with learning engagement *via* self-efficacy and academic resilience, respectively, and sequentially. More importantly, the authors found that the direct effect was much lower than the indirect effects, of which self-efficacy was the greatest. This result suggested that adequate interventions should be provided to facilitate adolescents' peer relationships, self-efficacy, and academic resilience, thus promoting their learning engagement and, also, academic success.

The role of student engagement was also investigated by [Ma and Wei](#). They were interested in its mediating role in the relationship between perceived classroom climate and academic performance, according to the motivation process of the study demands-resources (SD-R) model. Thus, working with 307 English-major teacher education students in Guangxi, China, they found that perceived classroom climate (an environmental resource) enhances student engagement (a personal resource), academic performance (a study outcome), and student engagement partially mediates the relationship between the two variables. Because many studies used concepts and measurement tools related to "school climate" as substitutes for school support, [Li et al.](#) made a systematic literature review of core Chinese- and English-language journals published in 2000–2021 to analyze school support's concept and measurement tools. Their research shows that school support is mainly approached through two disciplines, namely psychology and pedagogy. The theoretical foundation is provided especially by social support, ecosystem, and school climate theories. Many studies emphasize the values and school climate that contribute to creating a sense of safety in the school and influence the quality of interpersonal relationships that shape the support students receive from teachers. Also, it is helpful to develop and validate school support measurement tools with good psychometrics properties to provide a practical reference for educators worldwide.

Personal resources are also essential in dealing with different challenging tasks in the educational environment. For instance, the last 2 years of experience have shown us the importance of digital skills in managing academic activities. [Assante et al.](#) investigated the role of personal resources (i.e., self-direction and universalism) in supporting learning effectiveness related to the digital citizenship development process, namely the critical perspective toward online participation and the Internet. Working with 536 Romanian students in various social sciences domains, their findings illustrated that only higher universalism relates to sustainable digital citizenship, while self-direction has no effect. Also, individual orientation toward information-seeking endorses digital citizenship and a critical perspective toward online participation and the Internet, while cognitive integrity harmed digital citizenship. Moreover, students

with higher universalism reported higher learning orientation. Beyond the need to develop digital competencies, the effects of media overuse on wellbeing cannot be neglected. [Toma et al.](#) investigated the protective role of hope on students' wellbeing during the pandemic period when all the academic activities moved into the online environment. Three hundred and thirty-three Romanian students were involved in the study. The results showed significant negative associations between attention problems, smartphone addiction, and wellbeing, with dispositional hope as a protective factor. Although smartphone addiction appeared especially harmful to the wellbeing of students with high dispositional hope, they reported greater levels of wellbeing than those with low levels of hope regardless of smartphone addiction.

Personal resources are also essential for teaching efficacy. Thus, [Wang et al.](#) explored the internal mechanisms among teachers' assessment literacy, psychological capital, professional identity, and teaching efficacy, working with 351 secondary school teachers in Henan Province, China. Their findings illustrate that teachers' assessment literacy, as a constructive resource, affects teaching efficacy directly. Their psychological capital and professional identity, as energy resources, mediate the relationship between the two variables. According to the COR theory, this study emphasizes that wealth, individual constructive resources, and energy resources facilitate positive gain spirals in key resources.

Thus, these studies revealed how personal and social resources could help teachers to deal with the challenges of the teaching and learning process and how these resources could help them to be efficient in the teaching process and experience wellbeing in the educational environment. Also, the results of these articles offered details related to each of these resources that could help students to self-regulate the learning process, achieve their academic goals, and experience student engagement.

Author contributions

RP drafted the manuscript. DV critically reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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The association between peer relationship and learning engagement among adolescents: The chain mediating roles of self-efficacy and academic resilience

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Previous studies have shown that peer relationship affects learning engagement. And learning engagement plays a vital role in promoting knowledge acquisition and production, enhancing adolescents' academic success. However, few studies have focused on the mechanism between peer relationship and learning engagement. As such, based on Social Cognitive Theory, this study attempts to explore how peer relationship of adolescents is linked to learning engagement through the chain mediating roles of self-efficacy and academic resilience. The participants were 250 students who were selected *via* random sampling in a public middle school, in Eastern China, in June 2021. All the participants filled in the structured self-report questionnaires on peer relationship, self-efficacy, academic resilience, and learning engagement. The data were analyzed with structural equation modeling (SEM) in SPSS 24.0 and AMOS 24.0. Results indicated that peer relationship was directly and positively associated with learning engagement. Results also indicated that peer relationship was indirectly and positively associated with learning engagement *via* self-efficacy and academic resilience, respectively, and sequentially. More importantly, it was found that the direct effect was much lower than the indirect effects of which self-efficacy was the greatest. It is suggested that appropriate interventions and support should be provided to facilitate adolescents' peer relationship, self-efficacy, and academic resilience, thus promoting their learning engagement and academic success.

KEYWORDS

peer relationship, learning engagement, self-efficacy, academic resilience, adolescents

Introduction

Peer relationship refers to a kind of interpersonal relationship developed in the process of interaction in small clusters of individuals that are closely connected with each other based on shared interests and friendships (Rohrbeck and Garvin, 2014). Peer relationship is categorized into dimensions such as warmth, support, attachment, friendship quality, and communication quality (Boele et al., 2019; Terleksi et al., 2020). As a critical social relationship, peer relationship is crucial to the physical and mental development of adolescents. It not only reduces adolescents' social anxiety, shapes their moral cognition and behaviors, but also enhances their engagement, which contributes to their academic successes (Fredricks, 2011; Tillfors et al., 2012; Zulfiqar, 2020; Chiu et al., 2021). Student engagement, as a key element in learning, can be defined from three perspectives, namely, behavioral, emotional, and cognitive engagement (Fredricks et al., 2004; Reeve and Tseng, 2011; Yazzie-Mintz and McCormick, 2012). Behavioral engagement refers to students' participation and involvement in academic activities that reflect on-task attention, effort, and persistence (Fredricks et al., 2004). Emotional engagement refers to student's positive feeling, attitude, and perception toward learning activities (Park and Yun, 2017; Tvedt et al., 2019). Cognitive engagement refers to students' active involvement in learning with positive psychological status (Nguyen et al., 2016; Yang Y. et al., 2021). Among them, behavioral engagement reflects the substantive connotation of student engagement (Newmann, 1992) and it is relatively easier to measure due to their observable characteristics (Nguyen et al., 2016). Based on the above literature, learning engagement can be defined as students' positive psychological state of mind concerning learning behaviors, with three dimensions—vigor, dedication, and absorption (Schaufeli et al., 2002a; Christenson et al., 2012). Vigor is defined as how individuals are ready to work hard and persevere in their studies, even in facing difficulties. Dedication refers to individuals' strong senses of responsibility and achievement toward learning, while absorption refers to individuals' concentration on learning for long periods of time and obtaining positive psychological experiences during the process of learning (Li et al., 2019).

Research has shown that peer relationship is correlated with learning engagement, in which self-efficacy is a potential predictor (Sökmen, 2019). Self-efficacy is understood as “an individual belief in one's capabilities to organize and execute the courses of action required in producing given attainments” (Bandura, 1997a, p3). It is also defined as “the perception of one's ability to successfully perform a particular behavior” (Block et al., 2010, p44). Research has noted that academic resilience is also a potential predictor of learning engagement (Romano et al., 2021). Academic resilience is considered as the personal ability to overcome acute or chronic adversity in learning (Martin, 2013) or effectively deal with setbacks, challenges, adversity, and pressure in the academic setting

(Martin and Marsh, 2006) with three-dimensional elements, namely, perseverance, adaptability, and emotional response (Cassidy, 2016). However, few studies have tested how peer relationship of adolescents is linked to learning engagement through the mediating roles of self-efficacy and academic resilience based on relative theory.

Social Cognitive Theory (SCT) (Bandura, 1997b) is based on a psycho-social model, which explains socio-cognitive constructs of behaviors (Komendantova et al., 2018). It has been viewed as an important theoretical framework to explain human behaviors (Yazdanpanah et al., 2015; Hou et al., 2021). SCT proposes that environment and personal factors influence human behaviors (Bandura, 1986). That is to say, human behaviors are motivated and regulated by a combination of environmental, personal, and behavioral factors (Bandura, 2012). Environmental factors are social support and barriers to individuals' behaviors. Personal factors include knowledge, self-efficacy, and outcome expectations associated with behavioral adoption (Komendantova et al., 2018). Of the personal factors, self-efficacy is a major element and plays a central role in changing behaviors (Bandura, 1997b). Behavioral factors consist of endeavor or planning to execute a behavior (Shahangian et al., 2021). Several researchers have applied SCT to explore classroom cognitive engagement or online learning engagement among college students (Sahil and Hashim, 2011; El-Sayad et al., 2021; Kuo et al., 2021). However, little has been done to explore the interrelated associations of the influencing factors in adolescents' learning engagement with SCT. Therefore, the study attempts to apply SCT, (1) to explore the mechanism in which peer relationship predicts learning engagement among adolescents *via* self-efficacy and academic resilience, and (2) to provide evidence for how peer relationship influences adolescents' learning engagement.

The study includes the following contributions. First, the study examines the association between peer relationship and learning engagement based on Social Cognitive Theory in the Chinese context, which provides evidence for the research on similar themes in other countries. Second, the study explores the mechanism between peer relationship and learning engagement by emphasizing the chain mediating roles of self-efficacy and academic resilience. The new perspective may explain that adolescents' learning engagement is mainly affected by self-efficacy and academic resilience (personal factors) that stem from sound peer relationship (environmental factor).

Peer relationship and learning engagement

Relevant studies have showed that peer relationship can exert a direct influence on learning engagement (Juvonen et al., 2012; Gremmen et al., 2018). Fredricks et al. (2019) have suggested that support from peers aligns with greater learning engagement. Similarly, Kiefer et al. (2015) have pointed out that

support from peers can exert a profound influence on students' learning engagement. When students can get support from their peers, they are more likely to feel confident in learning; on the contrary, when students have less support from their peers, they are more likely to feel afraid to accomplish tasks, which lessens their learning engagement (Juvonen et al., 2012; Geven et al., 2013; Shin and Chang, 2022). In addition, Furrer et al. (2014) have reported that the quality of students' relationships with peers is a fundamental substrate for the development of learning engagement. It is reported that high-quality friendship is protective against being conflicted, rejected, and bullied, which promotes engagement in learning (Terleksi et al., 2020). Hence, it could be argued that adolescents with sound peer relationship are likely to engage in learning. Based on this view, the following hypothesis is proposed.

H1: Peer relationship is positively associated with learning engagement.

Self-efficacy as a mediator

In social cognitive theory, Bandura (1997b) has emphasized the construction of self-efficacy and its impact on learning. Students with stronger self-efficacy tend to set higher goals and undertake more challenging tasks. And they are more likely to put forth the effort and be persistent in learning. Even when it comes to academic challenges or difficulties, they still stick to it instead of giving it up (Masud et al., 2016).

Several studies have acknowledged that self-efficacy is often influenced by peer interaction (Ruegg, 2014; Sökmen, 2019; Shyr et al., 2021). Support from peer interaction is important in establishing a positive attitude and increasing self-confidence and the ability to make judgments in learning (Chu and Chu, 2010), while imitation from peer interaction contributes to the development of adolescents' cognition, emotion, and behaviors. It is reported that adolescents accept the influence of role models in peer imitation to promote the development of their self-efficacy (Lee et al., 2021). In addition, peer collaboration exerts an influence on self-efficacy (Lee and Evans, 2019). It is believed that peer relationship is positively associated with adolescents' self-efficacy.

Self-efficacy is also believed to be one of the key factors influencing students' learning engagement (Wu et al., 2020; Shao and Kang, 2022). Students with higher self-efficacy have higher engagement in learning. Some researchers have suggested that self-efficacy can help develop positive beliefs about personal skills and abilities, thus enabling students to be more involved in their learning (Zhen et al., 2017; Ahmed et al., 2018). Other researchers have argued that self-efficacy affects students' classroom participation, thereby affecting students' learning engagement (Sökmen, 2019). Similarly, Liem et al. (2008) have also pointed out that peer relationship plays an important

role in adolescents' self-efficacy, which affects their learning engagement. The above views indicate that peer relationship may affect adolescents' learning engagement *via* the indirect role of self-efficacy. Based on these, the following hypotheses are proposed:

H2: Peer relationship is positively associated with self-efficacy.

H3: Self-efficacy is positively associated with learning engagement.

H4: Self-efficacy plays a mediating role in the association between peer relationship and learning engagement.

Academic resilience as a mediator

Academic resilience is influenced by peer relationship (Baltaci and Karataş, 2015). Permatasari et al. (2021) have proposed that peer support could contribute to academic resilience in the learning process. Chen et al. (2017) have emphasized that peer support was a consistent predictor of academic resilience. Hoshek et al. (2016) have argued that more contact with peers can ease students' negative perceptions in dealing with academic challenges. Frisby et al. (2020) have also argued that the relational resources that students have at school, especially with peers, may inspire students' academic resilience. Hence, these shreds of evidence support the belief that peer relationship may enhance adolescents' academic resilience.

Academic resilience influences adolescents' learning engagement (Cheung et al., 2014). Students with academic resilience tend to express higher levels of achievement despite risks and difficulties (Simões et al., 2021). Romano et al. (2021) have argued that students with a higher level of academic resilience show a higher level of learning engagement. Gillham et al. (2013) have demonstrated that students who feel more connected with peers have higher academic resilience, which plays a crucial role in learning engagement. Therefore, this study speculates that there is a positive relationship between adolescents' academic resilience and their learning engagement, and academic resilience may play an intermediary role between peer relationship and learning engagement.

Academic resilience is believed to influence by self-efficacy (Cassidy, 2016). In another word, self-efficacy is a significant predictor of academic resilience (Martin and Marsh, 2008; Murray, 2018; Rachmawati et al., 2020; Hydar Choupani and Dehsorkhi, 2021; Kuo et al., 2021), which provides a fundamental basis for the serial variables of self-efficacy and academic resilience. According to SCT, the environment filled

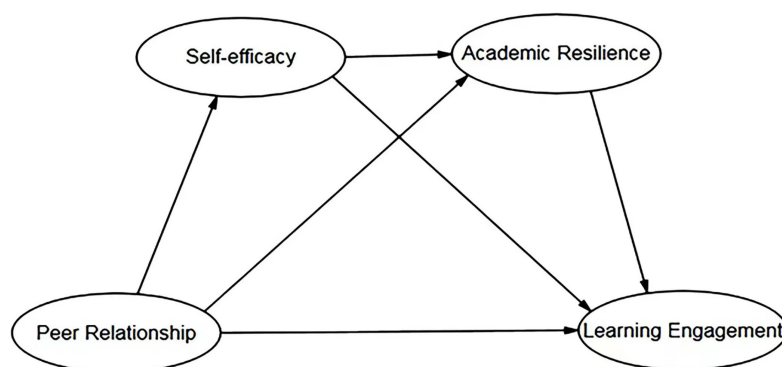


FIGURE 1
The Proposed theoretical model.

with peers is conducive to enhancing their self-efficacy (Zysberg and Schwabsky, 2020). With enhanced self-efficacy, students are more able to encounter difficulties, engage themselves in challenging learning tasks, and develop their academic resilience (Skinner and Pitzer, 2012; Cassidy, 2015). And the personal factors—self-efficacy and academic resilience affect their behavior—learning engagement (Wang and Holcombe, 2010; Honicke and Broadbent, 2016; Virgā et al., 2020). Therefore, it is believed that peer relationship may influence learning engagement *via* the serial variables of self-efficacy and academic resilience.

Based on the above analysis, this study intends to examine whether peer relationship may positively contribute to learning engagement *via* the mediating roles of sequential self-efficacy and academic resilience. In view of this, the following hypotheses are proposed:

H5: Peer relationship is positively associated with academic resilience.

H6: Self-efficacy is positively associated with academic resilience.

H7: Academic resilience is positively associated with learning engagement.

H8: Academic resilience plays a mediating role in the association between peer relationship and learning engagement.

H9: Self-efficacy and academic resilience play a chain mediating role in the association between peer relationship and learning engagement.

Guided by Social Cognitive Theory and the above hypotheses, we have constructed a theoretical model to test the association between peer relationship and learning engagement, as well as the mediating roles of self-efficacy and academic resilience (see Figure 1).

Materials and methods

Sampling and procedure

The sample size was estimated according to the requirement of Structural Equation Modeling (SEM) (Zhang et al., 2020) that the appropriate sample size was targeted at least ten times the total observed variables. The samples for the study were drawn from participants who were 13–14 years old from a public middle school, in Eastern China, in June 2021. One of the main reasons for choosing the school was that it is a relatively large-scale public school with more than 3,000 students. In the school, 270 students from seventh and eighth grades were randomly chosen to participate in the survey. Finally, 250 valid samples with a response rate of 92.6% were obtained and adopted for data analysis.

Before conducting the study, permission was obtained from the Research Ethics Committee of Qufu Normal University, the headmaster of the participating school, and the parents of the participants. Then, the survey was described to the students for a better understanding. Lastly, the students were told the purpose of the study and guided to complete the questionnaires anonymously.

Questionnaire design

The questionnaire was designed with reference to previous instruments that had been widely accepted with high reliability and validity. It was composed of two main parts. The first part aimed to measure the general demographic variables to

capture sample characteristics. The second part, as the main body of the questionnaire, consisted of four latent variables, namely, peer relationship, self-efficacy, academic resilience, and learning engagement, with nineteen measurement items (Table 1). All measurement items within the model were rated on a 5-point Likert scale with a response category ranging from 1 (strong disagreement) to 5 (strong agreement). The four dimensions of the questionnaire were modified from well-accepted instruments. The four items of peer relationship were from Wei (1998). The five items of self-efficacy were from Schwarzer (1994). The five items of academic resilience were from Cassidy (2016). The five items of learning engagement were from Fang et al.'s (2008) Chinese version modified in line with Utrecht Work Engagement Scale-Student (Schaufeli et al., 2002a,b). The modified items had good reliability and validity in the context of Chinese culture, which has been widely used in China. The specific measurement items are shown in Table 1.

TABLE 1 Latent variables and items.

Latent variable	Code	Measurement items
Peer relationship (PR)	PR1	Classmates are willing to listen to my opinions.
	PR2	When classmates are ill, I feel very sad.
	PR3	When I achieve success, my classmates are proud of me.
	PR4	When classmates are unhappy or crying, I usually go to comfort them.
Self-efficacy (SE)	SE1	If I try my best, I can always solve problems.
	SE2	It is easy for me to pursue my dream and achieve my goals.
	SE3	I can calmly face difficulties because I trust my ability to deal with problems.
	SE4	When there is trouble, I can usually think of some ways to cope with it.
	SE5	No matter what happens to me, I can handle it.
Academic resilience (AR)	AR1	When facing difficulties in learning, I can try to think of new solutions.
	AR2	When I am discouraged by my studies, I can use situations to motivate myself.
	AR3	I can't change my long-term goals and ambitions until I make a success.
	AR4	I usually look forward to showing that I can improve my grades.
	AR5	I can do my best to stop thinking negative thoughts when I fail to achieve the desired goals.
Learning Engagement (LE)	LE1	When I get up in the morning, I want to study.
	LE2	I can keep on learning, even if it does not go smoothly.
	LE3	I feel that I have a clear learning goal and that learning is meaningful.
	LE4	When I study, I feel time passing quickly.
	LE5	I am proud of my persistent learning.

Statistical analysis

The data were analyzed with SPSS 24.0 and Amos 24.0. First, the Harman single factor test was carried out to test the common method bias. Then, descriptive analysis was conducted to examine the sample characteristics. Finally, structural equation modeling (SEM) analysis was performed to examine the measurement model and the structural model. Specifically, confirmatory factor analysis was performed to examine the reliability and validity by providing the values of factor loadings, CR, and AVE. And the analyses of the goodness-of-fit index and path coefficient were adopted to test the acceptable level for the structural model. In addition, sensitivity analysis was conducted to calculate the effect size. Lastly, the bootstrapping method was used to evaluate the statistical significance of the mediating effects of the proposed hypotheses.

Results

Common method variance

All the data were obtained from the self-report of middle school students. In order to reduce the common method variance that may influence the validity and reliability of the study (Podsakoff et al., 2012), the Harman single factor test was adopted to test the common method bias by SPSS 24.0 (Podsakoff et al., 2003). The results indicated that there were 4 factors with a characteristic root greater than 1, and the variance explanation rate of the first factor was 41.696%, less than the critical criterion of 50% (Hair et al., 2010), indicating that the common method variance was not serious.

Sample characteristics

As shown in Table 2, the distribution between males and females was almost equal. The sample was split evenly across gender, with 48% of students studying in Grade Seven and 52% in Grade Eight. Students living in the towns were the larger group in the sample. Students were split across median household monthly income with a great proportion falling from 5,000 to 10,000 Yuan (42%), 3,000–5,000 Yuan (38%), less than 3,000 Yuan (11.6%) to 10,000 Yuan and more (8.4%).

Measurement model

The study aimed to test the measurement model with CFA by reporting the reliability and validity of the model. Cronbach's α is used as the most common index to estimate the reliability. Its value ranges between 0.80 and 0.89, indicating that the model is reliable (Yockey, 2010). Factor loadings,

TABLE 2 Descriptive summary of socio-demographic profile of students.

Demographic	Sample (<i>n</i> = 250)	Frequency	Percentage
Gender	Male	117	46.8%
	Female	133	53.2%
Grade	Grade 7	120	48%
	Grade 8	130	52%
Resident	Town	198	79.2%
	Countryside	52	20.8%
Median household monthly income	Less than 3,000 Yuan	29	11.6%
	3,000–5,000 Yuan	95	38.%
	5,000–10,000 Yuan	105	42.%
	10,000 Yuan and more	21	8.4%

composition reliability (CR), and the average variance extracted (AVE) are adopted to measure convergent validity (Chen and Lin, 2019). All the indexes are 0.5 or higher, indicating this model has good convergent validity. The square root value of AVE is greater than the correlation coefficient value, showing that there is discriminant validity between the constructs (Fornell and Larcker, 1981).

As indicated in Table 3, Cronbach's α ranged from 0.818 to 0.901. The standardized factor loadings ranged from 0.671 to 0.864 and they were significant ($p < 0.001$). The values of CR and AVE ranged from 0.820 to 0.903, and from 0.533 to 0.651 respectively. It can be seen from Table 4 that the square root values of AVE in each construct were greater than any other correlation coefficient value. Overall, all the values exceeded the standardized value, thus indicating that the model had a reasonable degree of reliability and validity.

Structural model

The study adopted the goodness-of-fit index and path coefficient to assess the structural model in Amos 24.0. Researchers suggested that a structural model had a good fit to the data with indexes of χ^2/df (Chi-square/df) between 0 and 3, IFI, CFI, TLI, GFI, and AGFI greater than 0.9, SRMR and SMSEA less than 0.08 (Zhang et al., 2020). Table 5 shows that their goodness-of-fit index values were as follows: Chi-square (χ^2)/df = 1.469 (χ^2 = 214.446, df = 146), IFI = 0.973, CFI = 0.972, TLI = 0.968, GFI = 0.914, AGFI = 0.888, SRMR = 0.0483, SMSEA = 0.043. The result of sensitivity analysis also shows that the effect size was 0.437, reaching the cut-off value of effect size that Cohen (1992) recommended. As such, the current 250 sample size can obtain statistically convincing test results.

Most values reached the suggested value, indicating that the alternative structural model was revealed to be adequate. In addition, Figure 2 shows the explanatory variance and path coefficient of the alternative structural model with standardized parameter estimation. The construct of peer relationship explained 19% of the variance of the self-efficacy construct with a standardized regression coefficient of 0.437. The constructs of peer relationship and self-efficacy explained a 36% variance of academic resilience, with standardized regression coefficients of 0.244 and 0.450 respectively. Peer relationship, self-efficacy, and academic resilience illustrated a 58% variance of the learning engagement construct with the corresponding standardized regression coefficients of 0.193, 0.348, and 0.384 respectively. The bootstrap test was conducted with 5,000 resamplings, and all the path coefficients were statistically significant ($P < 0.001$). Therefore, the alternative structural model was verified by these data.

Hypotheses tested

As shown in Table 6, the hypotheses H1, H2, H3, H5, H6, and H7 were statistically significant and their paths were supported by the empirical data. Specifically, peer relationship significantly and positively predicted learning engagement ($\beta = 0.193$, $P < 0.01$), hence H1 was verified; peer relationship and self-efficacy established significant and positive relationships ($\beta = 0.437$, $P < 0.001$), therefore H2 was supported; self-efficacy was significantly and positively related to learning engagement ($\beta = 0.348$, $P < 0.001$), therefore H3 was verified; peer relationship was significantly and positively associated with academic resilience ($\beta = 0.244$, $P < 0.01$), therefore H5 was supported; self-efficacy was significantly and positively correlated with academic resilience ($\beta = 0.450$, $P < 0.001$), therefore H6 was verified; academic resilience significantly and positively predicted learning engagement ($\beta = 0.384$, $P < 0.001$), therefore H7 was verified.

Analyses of the mediating effect of peer relationship on learning engagement

To analyze the mediating effect, the bootstrap method suggested by MacKinnon (2008) was used. It is believed that a statistically significant mediating effect must meet the following conditions: Z value is greater than 1.96 and the value of 95% bias-corrected confidence intervals (CI) excludes 0. As presented in Table 7, the total effect of peer relationship on learning engagement was 0.462 [$Z = 5.250$, 95% bias-corrected CI (0.307, 0.657), $P < 0.01$] and the direct effect of peer relationship on learning engagement was 0.173 [$Z = 2.471$, 95% bias-corrected CI (0.043, 0.316),

$P < 0.01$], indicating that both the total effect and direct effect were statistically significant. The indirect effects were 0.068 [$Z = 3.091$, 95% bias-corrected CI (0.036, 0.132), $P < 0.01$] in the pathway of peer relationship-self-efficacy-academic resilience-learning engagement, 0.137 [$Z = 2.978$, 95% bias-corrected CI (0.067, 0.252), $P < 0.01$] in the pathway of peer relationship-self-efficacy-learning engagement, and 0.084 [$Z = 2.270$, 95% bias-corrected CI (0.028, 0.175), $P < 0.01$] in the pathway of peer relationship-academic resilience-learning engagement, showing that all the mediating effects were statistically significant.

To further explore the potential mediating roles played by self-efficacy and academic resilience in the association between peer relationship and learning engagement, three alternative models were tested. First, an alternative model was tested to examine the mediating role played by self-efficacy. In this case, the model was found to be adequate, with fit indices: $X^2/df = 1.591$, IFI = 0.977, CFI = 0.976, TLI = 0.971, GFI = 0.937, AGFI = 0.910,

SRMR = 0.0454, SMSEA = 0.049, indicating that self-efficacy played a mediating role in the association between peer relationship and learning engagement. Second, an alternative model was tested, in which academic resilience played a mediating role. The model was revealed to be adequate with fit indices: $X^2/df = 1.324$, IFI = 0.985, CFI = 0.985, TLI = 0.982, GFI = 0.946, AGFI = 0.924, SRMR = 0.0405, SMSEA = 0.036, showing that academic resilience played a mediating role in the association between peer relationship and learning engagement. Third, an alternative model was tested to examine the mediating roles played by self-efficacy and academic resilience. The model was found to be adequate with fit indices (as shown in Table 5).

Data analysis indicated that the mediating effect of peer relationship on learning engagement was associated with self-efficacy and academic resilience, which significantly and positively played a partial mediating role in the association between peer relationship and learning engagement. And H4,

TABLE 3 Reliability and validity examination.

Latent variable	Item	UC	SE	Z-value	P-value	SC	Cronbach's α	CR	AVE
Peer relationship (PR)	PR1	1.000				0.705			
	PR2	0.985	0.101	9.731	***	0.703			
	PR3	1.176	0.108	10.896	***	0.829	0.818	0.820	0.533
	PR4	0.939	0.100	9.377	***	0.674			
Self-efficacy (SE)	SE1	1.000				0.793			
	SE2	0.910	0.071	12.907	***	0.761			
	SE3	1.033	0.068	15.148	***	0.864	0.901	0.903	0.651
	SE4	1.011	0.074	13.682	***	0.797			
	SE5	0.985	0.070	14.099	***	0.816			
Academic resilience (AR)	AR1	1.000				0.706			
	AR2	1.024	0.099	10.383	***	0.722			
	AR3	1.223	0.105	11.680	***	0.827			
	AR4	1.064	0.101	10.533	***	0.734	0.850	0.853	0.539
	AR5	1.069	0.110	9.695	***	0.671			
Learning engagement (LE)	LE1	1.000				0.707			
	LE2	1.186	0.103	11.513	***	0.786			
	LE3	1.250	0.103	12.097	***	0.831	0.877	0.878	0.592
	LE4	1.165	0.108	10.787	***	0.734			
	LE5	1.231	0.107	11.467	***	0.783			

UC, Unstandardized Coefficients; SE, standard error; SC, standardized coefficients.

*** $p < 0.001$.

TABLE 4 The discriminate validity test of latent variables.

Latent variable	Peer relationship	Self-efficacy	Academic resilience	Learning engagement
Peer relationship	0.730			
Self-efficacy	0.437***	0.807		
Academic resilience	0.441***	0.557***	0.734	
Learning engagement	0.514	0.646	0.663	0.769

The square root of the AVE of four latent constructs is given in the diagonal, and the correlation coefficient is given on the below diagonal.

The bold values represent the square root of AVE.

*** $p < 0.001$.

H8, and H9 were also verified. In addition, the indirect effect percentage of self-efficacy and academic resilience as partial mediators were examined. As indicated in Table 7, the direct effect of peer relationship on learning engagement accounted for 37.5%, while the total indirect effect of peer relationship on learning engagement accounted for 62.5%, greater than the direct effect. Among the three significant indirect mediators, the indirect effect of self-efficacy is the greatest, accounting for 47.4% of the total indirect effect.

Discussion

This study aimed to examine the association between peer relationship and learning engagement. In parallel, it also aimed to examine the mediating roles of self-efficacy and academic resilience in the association between peer relationship and

learning engagement. The study tentatively proved that SCT can be used to explain the behaviors with regard to learning engagement. The findings are as follows.

Peer relationship is directly and positively associated with learning engagement which aligns with the research result of Juvonen et al. (2012) and Gremmen et al. (2018), that is, peer relationship contributes positively to learning engagement. One possible reason is that the classroom environment for peer interaction in school stimulates adolescents to improve their self-perception of efficacy, which is conducive to promoting learning engagement (Yang J. et al., 2021). In addition, peer relationship has been increasingly linked with different indicators of learning engagement (Ladd et al., 2009) and a stronger relationship with peers is related to higher classroom engagement (Fredricks et al., 2016). The results of this study further proved the prominent role of peer relationship in learning engagement.

TABLE 5 Goodness of fit index of the structural model.

Fit index	X ² /df	IFI	CFI	TLI	GFI	AGFI	SRMR	SMSEA
Suggested value	0–3	> 0.900	> 0.900	> 0.900	> 0.900	> 0.900	< 0.080	< 0.080
Value of this study	1.469	0.973	0.972	0.968	0.914	0.888	0.0483	0.043

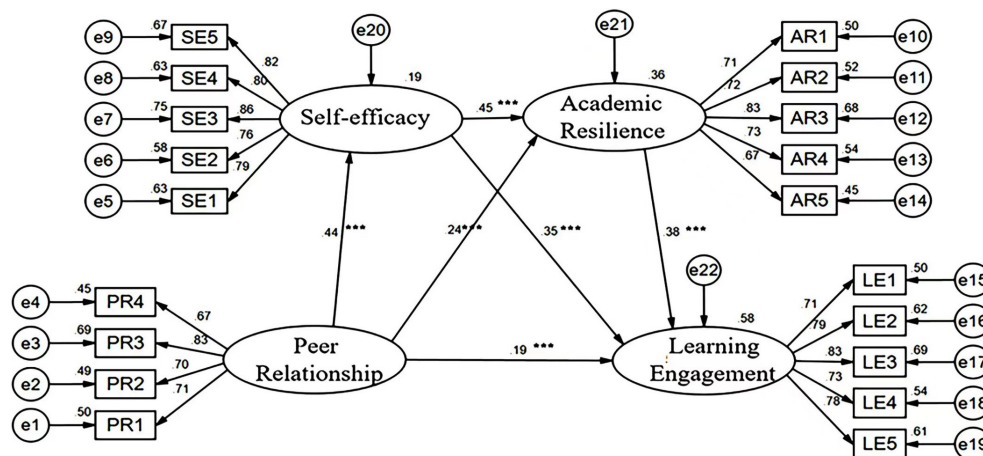


FIGURE 2
The structural modeling diagram. *** $p < 0.001$.

TABLE 6 The test results of path relationship.

Hypothesis	Path	Unstand estimates	Standard error	Z-value	Sig.	Stand estimates	Hypothesis test
H1	PR→LE	0.173	0.060	2.892	0.004	0.193	Supported
H2	PR→SE	0.447	0.078	5.715	***	0.437	Supported
H3	SE→LE	0.307	0.064	4.766	***	0.348	Supported
H5	PR→AR	0.230	0.071	3.212	0.001	0.244	Supported
H6	SE→AR	0.414	0.072	5.735	***	0.450	Supported
H7	AR→LE	0.367	0.075	4.918	***	0.384	Supported

PR, Peer Relationship; LE, Learning Engagement; SE, Self-efficacy; AR, Academic Resilience.

*** $p < 0.001$.

Consistent with SCT, the results of the study identified self-efficacy as one significant partial mediating role on the pathway from peer relationship to learning engagement, which is consistent with previous studies (Sahil and Hashim, 2011; Gairns et al., 2015). Self-efficacy is concerned with individuals' beliefs (Ritchie et al., 2021) and it is a premise of learning engagement (Shao and Kang, 2022). Students high in efficacy are more likely to show improvements in their effort and increase their engagement in learning activities (El-Sayad et al., 2021). The emergence of self-efficacy as a significant mediating role in the study further demonstrated the importance of self-efficacy in promoting adolescents' learning engagement.

The results of the study demonstrated that academic resilience is another significant partial mediating variable, which is congruent with the suggestion of Permatasari et al. (2021) that the importance of resilience is highlighted between peer relationship and learning engagement. Students with high academic resilience can show flexibility and persistence when facing challenges and show more endeavor in overcoming difficulties, thus actively participating in learning (Ahmed et al., 2018). Similarly, the finding is consistent with another research result that peer interactions can be helpful in creating a soothing and supportive social environment that makes it possible for students to strengthen their academic resilience and stay engaged in learning (Gillham et al., 2013). In sum, the finding once indicated the role of academic resilience between peer relationship and learning engagement.

The results of the study also showed that self-efficacy and academic resilience functioned as a chain mediating

role, which is one of the most striking findings. This means that self-efficacy and academic resilience sequentially played a mediating role in the association between peer relationship and learning engagement. The results of the study also revealed that among the three significant mediating roles, the mediating role of self-efficacy is the greatest, which is in line with the view that self-efficacy is the most important factor to change behaviors (Komendantova et al., 2018). In addition, the finding is similar to the result of Chu and Chu (2010) that self-efficacy plays the most important role in the relationship between peer support and learning engagement. Furthermore, it revealed that compared with peer relationship ($\beta = 0.244$, $P < 0.01$), adolescents' self-efficacy contributed more to academic resilience ($\beta = 0.450$, $P < 0.001$). This may indicate that academic resilience was mainly derived from the self-efficacy of adolescents in the learning process due to their perceived ability to overcome difficulties in learning activities (Warshawski, 2022). Generally, the results of this study may enrich the research on learning behaviors to a certain extent by analyzing the complicated relations among peer relationship, self-efficacy, academic resilience, and learning engagement based on Social Cognitive Theory.

The theoretical and practical implications

The study can make both theoretical and practical implications. Theoretically, this study has contributed to the

TABLE 7 Direct, indirect and total effects of the hypothesized model.

Path relationship		Point estimate	Product of coefficient		Bootstrapping			
					Bias-corrected 95% CI		Percentile 95% CI	
			SE	Z-value	Lower	Upper	Lower	Upper
Test of indirect, direct and total effects								
DistalIE	PR→SE→AR→LE	0.068	0.022	3.091	0.036	0.132	0.032	0.120
SEIE	PR→SE→LE	0.137	0.046	2.978	0.067	0.252	0.063	0.245
ARIE	PR→AR→LE	0.084	0.037	2.270	0.028	0.175	0.024	0.166
TIE	Total indirect effect	0.289	0.055	5.255	0.198	0.412	0.196	0.407
DE	PR→LE	0.173	0.070	2.471	0.043	0.316	0.042	0.316
TE	Total effect	0.462	0.088	5.250	0.307	0.657	0.305	0.652
Comparison of indirect effects								
SEDIEdiff	SE VS. DistalIE	0.069	0.049	1.408	−0.013	0.186	−0.015	0.184
ARDIEdiff	AR VS. DistalIE	0.016	0.041	0.390	−0.070	0.105	−0.069	0.106
SEARdiff	SE VS. AR	0.053	0.069	0.768	−0.084	0.200	−0.083	0.203
Percentage of indirect effects								
P1	DistalIE/TIE	0.235	0.065	3.615	0.141	0.404	0.126	0.376
P2	SEIE/TIE	0.474	0.121	3.917	0.237	0.715	0.242	0.720
P3	ARIE/TIE	0.291	0.114	2.553	0.098	0.553	0.084	0.538
P4	TIE/TE	0.625	0.109	5.734	0.448	0.878	0.451	0.882
P5	DE/TE	0.375	0.109	3.440	0.122	0.552	0.118	0.549

literature in two aspects. On one hand, the findings of this study indicate that the peer relationship has a positive impact on learning engagement, which may offer extended knowledge in understanding the mechanism between peer relationship and learning engagement. Specifically, individuals who can get support from their peers may change their learning behaviors and improve their learning engagement (Kiefer et al., 2015). On the other hand, the study has shown that the mediating roles of self-efficacy and academic resilience may explain how peer relationship is associated with learning engagement, which enriches the literature about learning engagement (Juvonen et al., 2012; Gremmen et al., 2018; Fredricks et al., 2019). The study tentatively proves that self-efficacy and academic resilience can significantly transmit the positive impact of peer relationship on learning engagement. In learning, adolescents with stronger self-efficacy and academic resilience will hold better psychological state of mind concerning learning behaviors. Learning context with positive peer relationship can foster adolescents' personal factors—self-efficacy and academic resilience, which in turn facilitates their learning engagement. Practically, the study can help educational practitioners understand students' learning engagement better from the perspective of environmental aspect (e.g., peer relationship) and learner factors such as self-efficacy and academic resilience. Concerning peer relationship, adolescents should be provided with necessary training, lectures, and symposiums that may help them realize the importance of developing sound peer relationship and improve their skills in building friendships with peers (Doumen et al., 2012). Besides, adolescents' group work and cooperation with peers should be strengthened in learning contexts so as to promote their learning engagement (Yang J. et al., 2021). In terms of self-efficacy, strategies should be offered to help adolescents develop self-efficacy and approach their learning actively. In addition, adolescents' confidence should be enhanced through educational programs to make them get over any difficulties in learning activities. With regard to academic resilience, teachers should develop adolescents' strategies and skills to enhance their persistence and flexibility through purposeful projects and activities in classroom teaching and/or relevant training programs.

Limitations and future research directions

Limitations in the study should be stated. First, the proposed theoretical model was tested only in connection with the sample selected from one school, which may limit the generalizability of the findings. Further validation of the model with diverse samples from more schools is needed in the future. Second, this study explores the mechanism between peer relationship and learning engagement with the mediating roles of self-efficacy and academic resilience. However, there are more

factors affecting learning engagement, such as academic stress, learning motivation, self-assessment, and so on. Future studies should take more variables into consideration so as to derive more convincing results and suggestions for practice. Third, the study focused on the cross-sectional study design, so it may make us unable to infer causal relations among the variables. Future studies could focus on longitudinal studies to explore the relationship between peer relationship and learning engagement.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding author.

Author contributions

YS analyzed the data and wrote the manuscript. SK developed the conceptual framework and revised the manuscript. Both authors contributed to the article and approved the submitted version.

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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.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.938756/full#supplementary-material>

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The relationship between perceived classroom climate and academic performance among English-major teacher education students in Guangxi, China: The mediating role of student engagement

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The academic performance of teacher education students predicts their future career development and it is also a significant factor related to their future students' academic performance. However, little is known about the associations between perceived classroom climate, student engagement and academic performance, especially for English-major teacher education students. This study was to examine English-major teacher education students' academic performance in relation to perceived classroom climate, student engagement. The questionnaire consisted of the Emotional Classroom Climate Scale, the Utrecht Work Engagement Scale – Student Form-3 Item (UWES-SF-3), and the 5-item Academic Performance Scale. This study investigated 307 English-major teacher education students in Guangxi, China. Among them, 280 (91.2%) were females, and 27 (8.8%) were males, aged between 18 and 24 ($M = 20.34$, $SD = 1.26$). Results indicated that perceived classroom climate was positively associated with student engagement and academic performance among English-major teacher education students; their student engagement was positively associated with their academic performance, and student engagement partially mediated the relationship between perceived classroom climate and academic performance. The findings supported the motivational process of study demands-resources (SD-R) model and revealed that perceived classroom climate and student engagement were significant factors linked to academic performance, and practical suggestions were discussed.

KEYWORDS

perceived classroom climate, student engagement, academic performance, English-major teacher education students, SD-R model

Introduction

China began to carry out teacher education professional certification in 2017 (MOE of PRC, 2017b). In the context of teacher education reform, teacher education colleges have been trying to explore practical ways for the cultivation and training of teacher education students (Zhou and Chen, 2021). Studies have demonstrated that excellent teachers are crucial to students' academic success (Hanushek, 2011; Goldring et al., 2014). Recently, domestic studies also revealed that the quality and skills of teachers are associated with students' academic performance. For example, teachers' emotional intelligence, job engagement and self-efficacy (Wang, 2022), perceived teacher support (Tao et al., 2022), and teacher feedback (Ma et al., 2022) are related to students' academic performance. As future teachers, teacher education students need to learn relevant professional knowledge systematically and make corresponding professional learning and skill preparation according to the professional requirements (Zhang et al., 2011). In addition, as academic performance can predict students' future career development (Negru-Subtirica and Pop, 2016; Van der Aar et al., 2019), teacher education students' academic performance deserves attention.

From the existing domestic research, there is no operational definition of academic performance for Chinese teacher education students. The Ministry of Education of China has set clear accreditation standards for secondary education majors (MOE of PRC, 2017a) and teachers' professional competence standards for secondary education majors (MOE of PRC, 2021). According to the purpose of this study, we defined teacher education students' *academic performance* as students' performance in educational and subject knowledge and professional competence concerning professional ethics values, teaching practice competence, comprehensive education competence, and competence in reflection and professional growth. There have been plenty of studies on the academic performance of college students both in China and abroad (May and Elder, 2018; Mao et al., 2022; March-Amengual et al., 2022; Tafesse, 2022; Wang, 2022). However, studies on teacher education students' academic performance seem insufficient, especially those of English-major teacher education students. In the context of teacher education reform in China, it is necessary to pay attention to the academic performance of teacher education students. Therefore, this study took a sample of English-major teacher education students to explore the characteristics of their academic performance and its associations with perceived classroom climate and student engagement.

As Moos (1980) asserted, the classroom is an essential locus for student personal and academic growth, and classrooms have distinct climates that mediate student growth. Therefore, classroom climate may be one of the factors associated

with students' academic performance. Researchers have proposed diverse operational definitions of classroom climate. Nevertheless, these definitions all relate to teacher-student interactions (Wang et al., 2020). According to Hong et al. (2021), classroom emotional climate should include four dimensions regarding academic support from teachers, promoting interaction, promoting mutual respect, and respect for viewpoints. Based on this concept, we defined *perceived classroom climate* as students' perception of the classroom climate concerning these four dimensions. Many studies have shown that classroom climate predicts academic performance (Johnson, 2006; Gutiérrez et al., 2019; Jafari and Asgari, 2020). Similarly, some domestic studies also revealed that classroom climate is an important factor related to academic performance. For example, a recent study of Chinese adolescents in Shandong province revealed that the teacher-student relationship is positively associated with students' academic performance (Ma et al., 2022). Li et al. (2021a) argued that teacher-support and good teacher-student relationships are related to better self-control, which promotes academic performance. Nonetheless, another study by Mohamed et al. (2018) reported that classroom climate has no significant association with academic performance. This finding suggests that other factors may mediate the relationship between classroom climate and academic performance. Therefore, this study intended to explore student engagement as a mediator between perceived classroom climate and academic performance.

Student engagement is "a positive and satisfactory state of mind described as vigor, dedication, and absorption" (Schaufeli et al., 2002). It has been seen as an essential factor related to positive academic performance (Vahala and Winston, 1994; Mirzaei-Alavijeh et al., 2016; Ayala and Manzano, 2018; Jafari and Asgari, 2020; Tomaszewski et al., 2020). According to Dimitriadou et al. (2021), student engagement promotes academic performance and is positively associated with on-time graduation. Meanwhile, studies both in China and abroad have revealed that the perceived classroom climate is positively associated with student engagement (Rubie-Davies, 2015; Gutiérrez et al., 2019; Lu et al., 2022). In addition, it has been demonstrated that student engagement often plays a partial or complete mediating effect on the association between academic performance and other variables, such as social support (Chen and Chen, 2021; Siu et al., in press), perceived efficacy (Chong et al., 2018; Wang, 2022), teaching style, learning environment and socioeconomic status (Simpson and Burnett, 2019; Tomaszewski et al., 2020; Song et al., 2022). However, little is known about the mediating effect of student engagement on the association between perceived classroom climate and academic performance. Therefore, this study intended to examine student engagement as a mediator between these two variables.

Research framework and hypotheses

Research framework

According to the study demands-resources (SD-R) model, study resources promote student engagement and produce positive study outcomes (Lesener et al., 2020). Study resources include personal resources (such as self-efficacy, psychological resilience, etc.) and environmental resources (such as perceived social support, perceived class atmosphere, etc.). Study outcomes include growth and development in academic performance, mental health, and other areas of growth and development. In the present study, perceived classroom climate can be regarded as one of the environmental resources, student engagement as one of the personal resources, and academic performance as one of the study outcomes. According to Li et al. (2021a), as one of the facets of school environments, school discipline (e.g., good structure, teacher-support, and good teacher-student relationship) is related to better personal resources such as self-control. It follows that perceived classroom climate (environment resource) may promote student engagement (personal resource) and produce positive academic performance (study outcome). Therefore, this study aimed to explore English-major teacher education students' academic performance (study outcome) in relation to perceived classroom climate (study resource) and further examine student engagement as a mediator between these two variables. The research framework is presented in Figure 1.

Research hypotheses

Perceived classroom climate and academic performance

Researchers have proposed diverse operational definitions of classroom climate. Nevertheless, these definitions all relate to teacher-student interactions (Wang et al., 2020). According to Li et al. (2021b), good teacher-student relationships are associated with high levels of freshmen's sense of meaning in life, which facilitate their academic adaption. He argued in a recent study that close, supportive, satisfying teacher-student relationships are crucial to college freshmen's academic adaptation (Li, 2022). According to Vahala and Winston (1994), different perceptions of classroom climate lead to different academic achievements. Namely, perceived classroom climate has a significant association with students' academic performance (Jafari and Asgari, 2020). For example, a classroom climate focusing on the learning process is beneficial to students' academic performance, while a classroom climate focusing on learning results is detrimental to students' academic performance; a supportive, autonomous classroom

climate has a positive association with academic performance (Gutiérrez et al., 2019). Other studies have shown that the classrooms constructed with mastery goals (Mirzaei-Alavijeh et al., 2016), more engaging classrooms (Fuqua et al., 2019), and task-centered classrooms that support student autonomy (Lüftenegger et al., 2015) have a significant positive association with academic performance. In addition, in online classrooms and flipped classrooms, independent and cooperative classroom climates are positively related to college students' academic performance (Estrada et al., 2019; Gao, 2021). Based on the previous studies, we proposed hypothesis 1 of this study:

H1: Perceived classroom climate is positively associated with academic performance.

Perceived classroom climate and student engagement

According to Guangbao and Timothy (2021), classroom climate is positively associated with student engagement. Students reported in a recent study that a caring, varied, engaging, and well-organized classroom climate with positive and personalized feedback and timely assessment of progress, more actively engages them in their study (Weeldenburg et al., 2021). The perceived classroom climate focusing on the learning process, which pays more attention to interaction, is beneficial to student engagement, while a classroom climate focusing on learning results is detrimental to student engagement (Gutiérrez et al., 2019). The collaborative and inclusive classroom climate makes students more engaged in learning (Sánchez-Hernández et al., 2018). In addition, positive classroom environments, such as engaging students in learning activities (Sakellariou and Tsiara, 2020) and a caring classroom climate (Song and Kim, 2016), help promote student engagement by developing their self-efficacy and sense of belonging (Dogan, 2015). Based on these studies, we proposed hypothesis 2 of this study:

H2: Perceived classroom climate is positively associated with student engagement.

Student engagement and academic performance

It has been demonstrated that student engagement is positively associated with academic performance. Overall student engagement, emotional engagement, and cognitive engagement are positively associated with academic performance, and emotional engagement has the most explanatory power for academic performance (Sukor et al., 2021). Academic performance, in turn, has a positive association with student engagement. For example, Palos et al. (2019) argued that high academic performance is associated with high student engagement. In addition, the relationship between

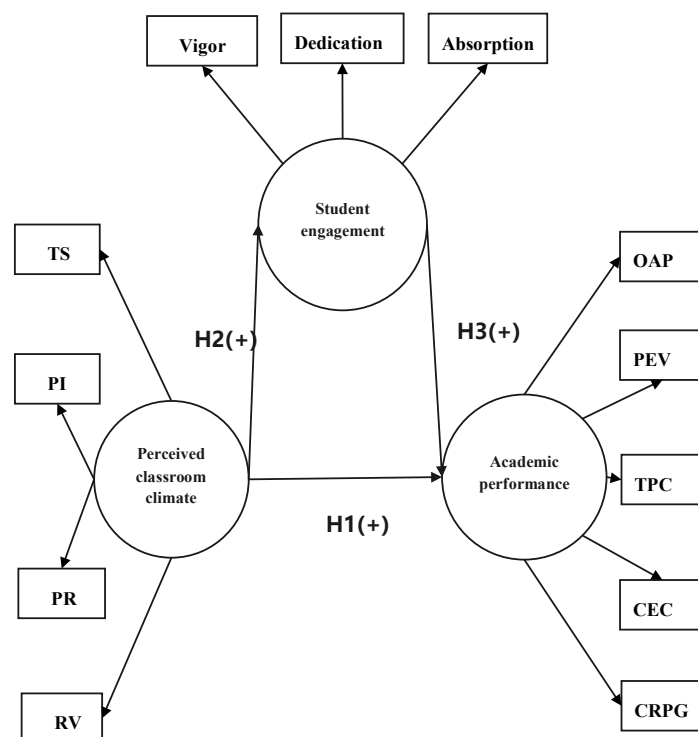


FIGURE 1

Research hypotheses. TS-academic support from teachers, PI-promoting interaction, PR-promoting mutual respect, RV-respect for viewpoints, OAP-overall academic performance, PEV-professional ethics values, TPC-teaching practice competence, CEC-comprehensive education competence, CRPG-competence in reflection and professional growth.

teaching methods, learning environment, socioeconomic status and academic performance are all mediated by student engagement. For example, the case method of instruction improves students' academic performance by enhancing their engagement (Song et al., 2022). A study on day or boarding students' academic performance shows that whether students live in school or not, the critical factor related to their academic performance is student engagement (Simpson and Burnett, 2019). Student engagement has a mediating effect on the relationship between socioeconomic status and academic achievement, so it is an essential factor related to academic performance (Tomaszewski et al., 2020). Based on the previous studies, we proposed hypothesis 3 of this study:

H3: Student engagement is positively associated with academic performance.

As mentioned above, perceived classroom climate promotes student engagement, which in turn improves academic performance. Therefore, it is reasonable to assume that student engagement may act as a mediator between perceived classroom climate and academic performance. Though few studies have explored the mediating effect of student engagement on the relationship between perceived classroom climate and academic

performance, some studies have indirectly suggested that student engagement may act as a mediator between perceived classroom climate and academic performance. According to Palos (2018), teachers can promote student engagement and ultimately improve students' academic performance by optimizing the learning process. Promoting perceived classroom climate may be considered one of the optimization tactics. Therefore, we proposed hypothesis 4 of this study:

H4: Student engagement mediates the association between perceived classroom climate and academic performance.

Materials and methods

Participants

We investigated English-major teacher education students in Hezhou University in Guangxi, China, and in total, 334 questionnaires were collected, and internal consistency checks failed 27 invalid questionnaires, leaving 307 valid samples (91.9%). Among them, 280 (91.2%) were females, and 27 (8.8%) were males, aged 18 to 24 years ($M = 20.34$, $SD = 1.26$).

Procedures

A convenience sampling method was adopted to survey English-major teacher education students at Hezhou University in Guangxi, China. The instructor sent the questionnaire link to the students and guided them to complete the questionnaire. An online questionnaire was employed to limit common method variance (CMV) (Tehseen et al., 2017). Informed consent was given by completing and submitting the questionnaire. The cross-sectional survey was conducted anonymously on the platform of WENJUANXING from April 6 to 20.

Instruments

The measurements in this study contained scales measuring perceived classroom climate, student engagement, and academic performance. This part mainly discusses the composition and measurement of each variable. The questionnaire employed a 5-point Likert scale to measure perceived classroom climate and student engagement, with 1 = *strongly disagree* to 5 = *strongly agree*, and to measure academic performance, with 1 = *very poor* to 5 = *excellent*.

Perceived classroom climate

This study adopted the Classroom Emotional Climate Scale (Hong et al., 2021) to investigate perceived classroom climate. The perceived classroom climate scale (in English) was translated into Chinese and then translated back to ensure equivalence of meaning. The scale was used to measure students' perceptions of the supportive, interactive, and respectful climate created by teachers in the classroom. The questionnaire has 12 items with four constructs and three items for each construct. The four constructs are academic support from teachers, promoting interaction, promoting mutual respect, and respect for viewpoints. According to the criteria of Hair et al. (2010), the four constructs fitted the data well ($\chi^2/df = 2.65$, RMSEA = 0.07, GFI = 0.93, AGFI = 0.89). The Cronbach's alpha coefficient of this scale was 0.89 in the study of Hong et al. (2021), and 0.93 in the current study. Items were listed in Appendix.

Student engagement

This study focused on the overall student engagement, not on the sub-dimensions (vigor, dedication, and absorption), therefore, we chose the ultra-short version of the Utrecht Work Engagement Scale – Student Form (UWES-SF), which was a 3-item version developed by Gusy et al. (2019). Li and Huang (2010) revised the UWES-SF into a Chinese version, and the 3-item version by Gusy et al. (2019) was included in the Chinese

version. Therefore, this study adopted the 3-item scale of Gusy et al. translated by Li and Huang (2010). The Cronbach's α value of this scale was 0.86 in the study of Gusy et al. (2019), 0.61 in the study of Wissing et al. (2022), and 0.88 in this study. Items were listed in Appendix.

Academic performance

This study referred to the 5-item Academic performance scale of Chinese scholars (Liu et al., 2020) to measure the academic performance of English-major teacher education students, and specific subjects (such as Chinese, mathematics, English, physics, etc.) were replaced with overall academic performance, professional ethics values, teaching practice competence, comprehensive education competence and, competence in reflection and professional growth. The Cronbach's α value of the scale in this study was 0.89. Items were listed in Appendix.

Data analysis

AMOS23.0 and SPSS26.0 was used for statistical analyses, and a structural equation model (SEM) was used to evaluate the hypothesis model. After examining the common method variance (CMV), confirmatory factor analysis (CFA) was conducted to test the rationality of the measurement model if the CMV was not serious. The maximum likelihood estimation model parameters and fit indexes were used to test the relationship between the data and the measurement model. As suggested by Hair et al. (2010) for the CFA fitting index, the values of χ^2/df , GFI, AGFI, and RMSEA should be calculated. The reliability and validity of the measurement model was tested by the criteria suggested by Hair et al. (2013) for Cronbach's a reliability coefficient, average variance extracted (AVE), and composite reliability (CR). A bootstrap method was used to examine the mediating effect of student engagement on the relationship between perceived classroom climate and academic performance (Efron, 1992).

Common method variance

An online questionnaire was employed to limit Common method variance (CMV) (Tehseen et al., 2017). Single factor test suggested by Harman was conducted for CMV of the study variables (Podsakoff et al., 2003). Exploratory factor analysis was conducted for 20 items in the scale, and the results of non-rotated factor analysis were then tested. According to the results, 43% of the explanatory power of the first factor (threshold value: 50%) indicated that the CMV of the variables in this study was not serious.

Analysis of reliability

According to Hair et al. (2013), Cronbach's α and composite reliability (CR) values should be higher than 0.70. In this study, Cronbach's α values of the three scales for perceived classroom climate, student engagement, and academic performance were 0.93, 0.88, and 0.89, and CR values were 0.94, 0.89, and 0.89, respectively, which showed that the measurement tool had good reliability.

Analysis of validity

Based on the suggestions of Fornell and Larcker (1981), the criterion for evaluating convergent validity is that the higher the factor loading value is, the higher the convergent validity is. The factor loading value should be at least 0.50. In the current study, factor loadings ranged from 0.62 to 0.92. Factor loadings of items can be seen in Appendix.

As suggested by Hair et al. (2013), the acceptable value of average variation extraction (AVE) should be greater than 0.50. In this study, the AVE values of perceived classroom climate, student engagement, and academic performance scales were 0.57, 0.74, and 0.63, respectively, as shown in Table 1. According to Fornell and Larcker (1981), the square root of the average variation extraction (AVE) of a construct should be greater than its correlation coefficients, which indicates that the construct has good discriminant validity. In this study, the square root of each construct's AVE was greater than all its correlation coefficients, as shown in Table 2.

Results

Model fit analysis

According to Schreiber et al. (2006), in an acceptable model, χ^2/df should be less than 3, RMSEA should be less than 0.08, NFI, NNFI, and GFI higher than 0.95, and CFI, IFI higher than 0.95. The findings in this study were as follows: $\chi^2/df = 2.06$, RMSEA = 0.06, NFI = 0.96, NNFI = 0.97, GFI = 0.95, CFI = 0.98, IFI = 0.98, which indicated that the model fitting was acceptable.

Direct effects analysis

Bootstrapping technique was adopted to test the direct effect among the variables and 5,000 samples were repeated for testing (Efron, 1992). The bias-corrected percentile bootstrap method was used to test the 95% confidence interval. The confidence interval does not contain zero, indicating that there is a direct effect between variables, otherwise, indicating that the direct

effect is not significant. Direct effects can be seen in Figure 2 and Table 3.

Perceived classroom climate was not significantly associated with academic performance ($\beta = 0.07$, $P > 0.05$) because confidence intervals (-0.06 , 0.21) contained zero. After controlling the effect of student engagement, perceived classroom climate had a significant association with academic performance ($\beta = 0.28$, $p < 0.001$), as the confidence interval (0.16 , 0.39) did not contain zero. Thus, hypothesis 1 was supported. That is, perceived classroom climate was positively associated with academic performance.

Perceived classroom climate had a positively significant association with student engagement ($\beta = 0.52$, $p < 0.001$), as the confidence interval (0.41 , 0.62) did not contain zero. Thus, hypothesis 2 was supported. That is, perceived classroom climate was positively associated with student engagement.

The confidence interval (0.25 , 0.53) did not contain zero, indicating student engagement had a positively significant association with academic performance ($\beta = 0.39$, $p < 0.001$). Thus, hypothesis 3 was supported. That is, student engagement was positively associated with academic performance.

Hair et al. (2011) stated that the value of R^2 is explained as the exogenous latent variables' combined effects on the endogenous latent variable. R^2 -values of 0.75, 0.50, or 0.25 indicate significant, moderate, or weak determination coefficients, respectively. The explanatory power of perceived classroom climate for student engagement is 27%; the explanatory power of perceived classroom climate and student engagement for academic performance is 19%, as shown in Figure 2.

Furthermore, the f^2 effect size value represents the contribution of the exogenous variable to R^2 values of the endogenous variable ($f^2 = R^2/(1 - R^2)$) (Cohen, 1992). The f^2 effect size values of 0.02, 0.15, and 0.35 indicate small, moderate, and significant effects of the exogenous latent variable, respectively. Student engagement was explained by perceived classroom climate with an effect size f^2 of 0.37, thus indicating a significant effect size. Academic performance was explained by perceived classroom climate and student engagement with an effect size f^2 of 0.23, thus indicating a medium effect size, as shown in Figure 2.

Mediating effect analysis

Adopting the bootstrap method, this study examined the mediating effect of student engagement with 5000 repeated samples (see Figure 2). The indirect effect of student engagement as the mediating variable was 0.21 (95% CI = $[0.13, 0.31]$, $p = 0.000$), indicating that the mediating effect of student engagement was significant. The direct effect of perceived classroom climate on academic performance was 0.07 (95% CI = $[-0.05, 0.21]$, $p = 0.265$), indicating no direct effect

TABLE 1 Analysis of validity and reliability.

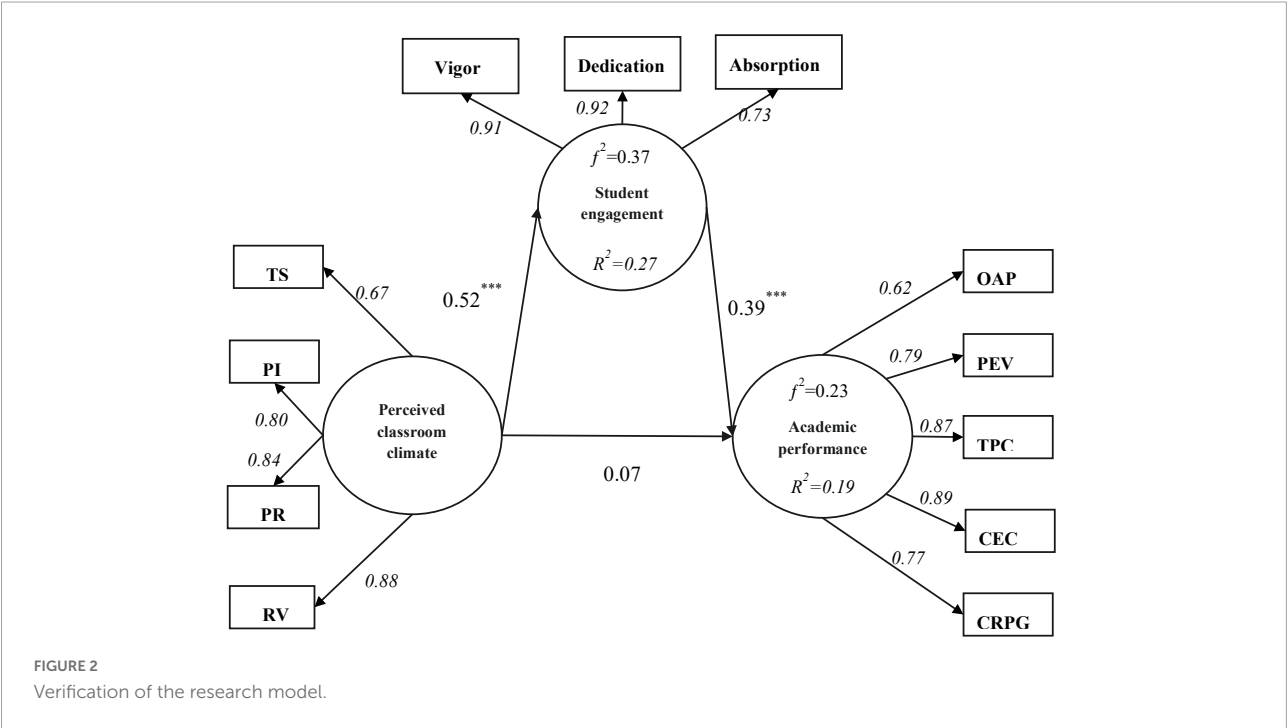
Contact	Cronbach α	CR	AVE	FL
Threshold	>0.70	>0.70	>0.50	>0.50
Perceived classroom climate	0.93	0.94	0.57	0.67~0.88
Student engagement	0.88	0.89	0.74	0.73~0.92
Academic performance	0.89	0.89	0.63	0.62~0.89

CR-composite reliability; AVE-average variation extraction; FL-factor loading.

TABLE 2 Correlation coefficients and discriminant validity analysis.

Construct	M \pm SD	Maximum	1	2	3
1 Perceived classroom climate	4.11 \pm 0.66	5	0.75		
2 Student engagement	3.61 \pm 0.77	5	0.50*	0.86	
3 Academic performance	3.52 \pm 0.63	5	0.26*	0.41*	0.79

*Represents $p < 0.001$; the figures in bold are the square root of the average variation extraction (SQAVE).



of perceived classroom climate on academic performance. As Preacher and Hayes (2004) suggested, complete or partial mediation rely on the simple mediation model ($X \rightarrow M \rightarrow Y$), constraining the $X \rightarrow Y$ path to zero. If the χ^2 statistic is significant, then constraining the $X \rightarrow Y$ path to zero is regarded as unreasonable given the data, ruling out the possibility of complete mediation by Baron and Kenny (1986). After constraining the perceived classroom climate (X) \rightarrow academic performance (Y) path to zero, the χ^2 statistic is significant ($\chi^2 = 106.06, p = 0.000$). Specifically, student engagement acted as a partial mediator in the relationship between perceived

classroom climate and academic performance. Thus, hypothesis 4 was supported.

Discussion

This study objective was to explore the characteristics of teacher education students' academic performance and its associations with perceived classroom climate and student engagement, and examine the effect of student engagement on the relationship between the other two variables.

TABLE 3 Direct and indirect effects analysis.

Parameter	Estimate	Lower bounds	Lower bounds
Standard direct effects			
PCC→AP	0.07	−0.06	0.21
PCC→SE	0.52*	0.42	0.62
SE→AP	0.39*	0.25	0.53
Standard indirect effects			
PCC→SE→AP	0.21*	0.13	0.31

*The empirical 95% confidence interval does not contain zero.

PCC, perceived classroom climate; SE, student engagement; AP, academic performance.

Perceived classroom climate and academic performance

We found that perceived classroom climate was positively associated with academic performance. Perceived classroom climate is an essential factor related to students' academic performance in various student groups (Vahala and Winston, 1994). Perceived classroom climate has been found to have a direct and significant relation with academic performance among undergraduates and postgraduates (Jafari and Asgari, 2020). Independent and cooperative classroom climate in an online and flipped classroom has a positive association with the academic performance of college students (Estrada et al., 2019; Gao, 2021). The academic performance of mathematics majors is positively associated with the supportive and task-centered classroom climate (Lüftenegger et al., 2015). A study among medical students reported that the class climate with mastery goal orientation is positively associated with their academic performance (Mirzaei-Alavijeh et al., 2016). It was also found among middle school students that class climate oriented by mastery goals is positively associated with students' academic performance (Gutiérrez et al., 2019). Fuqua et al. (2019) argued that a more engaging classroom climate for engineering students leads to better academic results. Consistent with these findings, this study also found that perceived classroom climate, such as academic support from teachers, promoting interaction and mutual respect, etc., improved academic performance of English-major teacher education students.

In terms of the status of perceived classroom climate, Hong et al. (2021) took students from three universities in northern Taiwan as research samples and found that their scores on perceived classroom climate were above the average. Wang et al. (2020) also found an above-average score on classroom climate among medical students in China. Consistent with the prior studies, the score of perceived classroom climate among English-major teacher education students was also above average. However, among nursing students of a university in Trabzon, Kurt et al. (2022) found that scores on classroom climate were below the average. This discrepancy may result from survey samples of different majors. Moreover, the

score on English-major teacher education students' academic performance was also above average. As the teacher education students' academic performance scale used in this study was newly developed, there is a lack of relevant data in previous studies. Thus, we look forward to more studies in the future using this tool to measure the academic performance of teacher education students.

Perceived classroom climate and student engagement

This study revealed that perceived classroom climate was positively associated with student engagement. Students prefer a caring, varied, challenging, fulfilling, engaging, well-organized classroom climate with positive and personalized feedback and timely assessment of progress (Weeldenburg et al., 2021). For example, teachers' cooperative and inclusive classroom climate makes students more engaged in learning (Sánchez-Hernández et al., 2018). In addition, positive classroom environments, such as engaging students in learning activities (Sakellariou and Tsiara, 2020) and a caring classroom climate (Song and Kim, 2016), help promote student engagement by developing their self-efficacy and sense of belonging (Dogan, 2015). Consistent with these findings, English-major teacher education students also preferred a supportive (academic support from teachers), interactive and cooperative (promoting interaction), and respectful and inclusive (promoting mutual respect and respecting viewpoints) classroom climate in which they showed higher levels of student engagement.

As for the status of student engagement, most of the studies have reported a moderate level of student engagement among university or college students. For example, Dimitriadou et al. (2021) found a moderate level of student engagement among university students in Greek. A survey of undergraduate medical students in Dutch indicated a moderate level of student engagement (Wissing et al., 2022). A moderate level of student engagement was also found among university students in Germany (Körner et al., 2021; Teuber et al., 2021). Not exactly the same as the above research results, the score on student engagement of our sample was above average. This discrepancy may result from the fact that our samples are teacher education students, who, as future teachers, are expected to be more engaged in their studies.

Student engagement as a mediator

The result of this study showed that student engagement was positively associated with academic performance, and the effect of perceived classroom climate on academic performance was partially mediated by student engagement. Studies have demonstrated that student engagement significantly predicts college students' academic performance (Sukor et al., 2021).

In addition, Tomaszewski et al. (2020) argued that student engagement mediates the relationship between students' socioeconomic status (SES) and academic achievement. Other studies have demonstrated that teaching methods and learning environment are factors related to academic performance, and the relationships between these variables and academic performance are mediated by student engagement (Simpson and Burnett, 2019; Song et al., 2022). This study found that classroom climate perceived by English-major teacher education students improved their academic performance by promoting their student engagement, suggesting that student engagement was an important factor associated with academic performance, which supported the findings of previous studies.

Contributions of this study

As discussed above, the findings of this study supported all the hypotheses. According to the motivation process of the study demands-resources (SD-R) model, study resources promote student engagement and produce positive study outcomes (Lesener et al., 2020). In the present study, perceived classroom climate was regarded as one of the environmental resources, student engagement as one of the personal resources, and academic performance as one of the study outcomes. The findings of this study revealed that perceived classroom climate (an environmental resource) promoted student engagement (a personal resource) and academic performance (a study outcome), and student engagement (a personal resource) improved academic performance (a study outcome). Specifically, student engagement partially mediated the relationship between perceived classroom climate and academic performance. These findings supported the motivation process of the SD-R model, which is in line with the results of Tomaszewski et al. (2020).

This study was conducted among the English-major teacher education students to explore their academic performance in relation to perceived classroom climate and student engagement. Although prior studies have adopted samples of different student groups, including secondary school students, to explore the mediating role of student engagement between various variables, few studies have examined its mediating role between perceived classroom climate and academic performance, especially among English-major teacher education students. Therefore, this study fills the gap in the research on the associations between these three variables, with a sample of English-major teacher education students.

Practical suggestions

As revealed in this study, perceived classroom climate and student engagement are significant factors related to students' academic performance. Therefore, teachers should

create a positive classroom climate and promote student engagement of teacher education students, so as to improve their academic performance. In teacher education reform, teachers and educators are encouraged to adopt effective strategies and technologies to create a supportive, interactive, cooperative, respectful, and inclusive classroom climate, in which students have positive classroom experiences and thus a high level of student engagement. Through their own learning experiences, English-major teacher education students become aware of the significance of classroom climate and student engagement for all students, including secondary school students. As teacher education students are future teachers, it is an important aspect of their academic performance to know how to create a positive classroom climate and promote student engagement. In the training of their teaching skills, teacher education students are encouraged to develop their competencies in teaching practice through professional learning or by imitating the way their teachers create an inclusive and respectful climate and express support and care in class (Tsai and Ku, 2021). In addition, teachers and educators should guide teacher education students to understand the factors linked to student engagement and grasp strategies to promote student engagement of secondary school students.

Limitations and future study

The samples selected in this study were only English-major teacher education students at Hezhou University in Guangxi, China, and therefore the research results are not representative enough. Future studies should adopt samples of teacher education students from different majors, colleges, and regions to enhance the generalization of results.

In addition, this cross-sectional study could not establish a causal relationship between perceived classroom climate, student engagement, and academic performance. Future research should carry out longitudinal studies to explore the causal relationship between these variables.

Moreover, although perceived classroom climate had a positive association with student engagement, there may be other factors related to student engagement in terms of classroom teaching, such as students' personality traits (ego, values, etc.). Therefore, future research should examine other factors in relation to perceived classroom climate and student engagement.

Conclusion

The findings of this study supported the hypotheses. That is, the perceived classroom climate was positively associated with student engagement and academic performance among

English-major teacher education students in Guangxi, China; their student engagement was positively associated with their academic performance, and student engagement partially mediated the association between perceived classroom climate and academic performance.

From the above findings, it is reasonable to conclude that perceived classroom climate and student engagement are critical factors related to the academic performance of English-major teacher education students. The former improves their academic performance through the mediating effect of the latter. The findings may help explore practical ways for teacher education reform; or rather, teacher educators are advised to find ways to promote students' academic performance by improving classroom climate and increasing student engagement.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval were not required for the study on human participants following the local legislation and institutional requirements. Informed consent of the participants was given by completing and submitting the questionnaire.

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Author contributions

YM and CW: concept and design, drafting of the manuscript, acquisition of data, statistical analysis, and critical revision of the manuscript. Both authors contributed to the article and approved the submitted version.

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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.

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Appendix

TABLE A1 Items and factor loadings of the perceived classroom climate scale, student engagement scale and academic performance scale.

Item	Factor loading
Perceived classroom climate scale (12 items)	
Factor 1→academic support from teachers	
(1). The teacher is concerned about how much I have actually learned (老师关心我到底学到了多少)	0.84
(2). The teacher wants me to do my best at my school work (老师想让我在学习上做到最好)	0.84
(3). The teacher wants to help me learn (老师想要在学习上帮助我)	0.87
Factor 2→promoting interaction	
(4). The teacher encourages us to share our views with other people in the classroom (老师鼓励我们在课堂上分享观点)	0.92
(5). The teacher encourages the classmates to understand each other (老师鼓励同学们相互理解)	0.83
(6). The teacher encourages us to help with the work of other classmates (老师鼓励我们帮助其他同学学习)	0.81
Factor 3→promoting mutual respect	
(7). The teacher does not allow students to laugh at the ideas of others (老师不允许同学们嘲笑他人想法)	0.84
(8). If someone answers a question incorrectly in class, the teacher will not let classmates laugh at him or her (老师不允许同学们嘲笑答错问题的人)	0.81
(9). The teacher does not permit classmates to say bad things about each other (老师不允许同学们说彼此坏话)	0.92
Factor 4→respecting viewpoints	
(10). The teacher will respect student views (老师会尊重学生的观点)	0.85
(11). In class, classmates will not obstruct the outstanding performance of others (在课堂上, 同学们不会妨碍他人的优秀表现)	0.81
(12). In class, classmates do not have to worry about the pressure of having to express opinions (在课堂上, 同学们不必担心必须发表意见)	0.70
Student engagement scale (3 items)	
(13). When I'm doing my work as a student, I feel bursting with energy (学习时, 我感到精力充沛)	0.91
(14). I am enthusiastic about my studies (我对学习充满热情)	0.92
(15). I am immersed in my studies (学习时, 我忘了周围的一切)	0.73
Academic performance scale (5 items)	
(16). Compared with my classmates, my overall academic achievement is (与我的同学相比, 我的总体学业成就)	0.62
(17). Compared with my classmates, my identification and practice of professional ethics values are (与我的同学相比, 我的师德践行能力)	0.79
(18). Compared with my classmates, my teaching practice competence is (与我的同学相比, 我的教学实践能力)	0.87
(19). Compared with my classmates, my comprehensive education competence is (与我的同学相比, 我的综合育人能力)	0.89
(20). Compared with my classmates, my competence in reflection and professional growth is (与我的同学相比, 我的反思发展能力)	0.77



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Analysis of school support: Systematic literature review of core Chinese- and English-language journals published in 2000–2021

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School support is of great significance to students' academic quality and overall physical and psychological development. However, there is still ambiguity in the English and Chinese studies on the concept and measurement tools of school support. The data for this study were sourced from the literature on school support included in the China National Knowledge Network (CNKI) and Web of Science (WOS) from 2000 to 2021. A systematic literature review was conducted through literature inclusion and data extraction according to the PRISMA guidelines. Finally, 36 core-journal articles with high academic reference value and authority are identified, including seven in Chinese and 29 in English. The following results were obtained: (1) Related research in both Chinese and English showed an overall increasing trend. (2) The concepts and measurement tools of school support were not clear, and most studies used concepts and measurement tools of "social support" or "school climate" as substitutes for school support. (3) Most of the previous studies were based on social support theory, ecological system theory, and school climate theory. (4) The research mainly adopts quantitative research methods and focuses on special student populations or students below the high school level. Overall, previous studies indicated that school support has a positive impact on student development. Therefore, future research should be broadly extended to the knowledge system in higher education. On the basis of clarifying the concept of school support, it is necessary to try to develop and validate school support measurement tools with great reliability, validity, and general applicability to provide a practical reference for educators around the world.

KEYWORDS

school support, systematic literature review, definition, measurement tools, articles

Introduction

According to ecological system theory, school is one of the most proximal and essential factors influencing individual development at the microsystem level (Bronfenbrenner, 1977, 1992; Axlund McBride and Lott, 2015). As a place where adolescents spend more than half of their adequate time every day, school plays an important role in the holistic development and healthy growth of adolescents (Eccles and Roeser, 2011; Tang et al., 2013). American scholars Sugai and Horner pointed out that positive behavioral support at the school level was conducive to the overall academic and social development of students. In particular, it has an effective preventive effect on students with severe problem behaviors (Warren et al., 2006; Sugai and Horner, 2009; Yang and Li, 2016). Based on previous research, school support has been shown to be a vital factor in the healthy development of adolescents (Gregory et al., 2010), which can not only buffer the adverse effects of academic stress (Torsheim and Wold, 2001) and enhance creativity and individual academic performance (Zhang et al., 2020) but also positively affect academic engagement, school participation, and emotional engagement (Bottiani et al., 2016; Yang et al., 2020). Therefore, research on school support is of great significance and value.

There are different views on the definition and measurement of school support depending on researchers' respective research scenarios. For example, Yang et al. (2020) defined school support as a combination of internal school values, school climate, and interpersonal relationships that reflects the quality of school life, and the school climate scale that measures the degree of school support for secondary school students with special needs. This definition and measurement have also been used in recent studies on school support (Fang et al., 2016; Zhang et al., 2020). Differently, Cornell et al. (2015) claimed that school support was only one aspect of school climate. Bottiani et al. (2016) agreed with Cornell et al. (2015) that school support was an emerging theoretical construct aimed at meeting adolescents' needs for belonging, competence, and autonomy. Based on this, they explored a 3D model for measuring school support (school equity, school care, and high expectations).

In addition, previous research argued that the concept of school support was derived from the application and development of organizational support theory in education (Eisenberger et al., 1997; Hu and Liu, 2019; Deng et al., 2020). In the complex social organization of schools, teachers and peers are two different sources of support (Moreira and Lee, 2020). Therefore, the social support from school (teacher and peer support) and autonomy support explain school support from the school level (Moreira and Lee, 2020). Other studies identified teachers and peers (classmates) as the primary sources of social support in schools. School support was measured through the integration of teacher support and peer support scales. In this view, school support is defined as the level of

support students feel from teachers and peers (Torsheim and Wold, 2001; Cupito et al., 2016; Zhang et al., 2020). Besides, some studies equated teacher support with school support. For example, in Corprew and Cunningham's (2011) study of African American male students aged 13–18, they pointed out that school support was the support students perceived from teachers and administrators. Among them, four teacher support items in the social support scale were used to measure school support. Moreover, based on the findings from recent interviews with black adolescents aged 12–18 on academic adjustment and mental health issues during the COVID-19 pandemic (Parker et al., 2021), school support specifically includes instrumental and emotional support from school staff and teachers.

For related domestic research, Luo and Xiang (2011) developed the "School Support System Questionnaire for Students with Cerebral Palsy" to investigate the 6–18-year-old students with cerebral palsy. The questionnaire contains five dimensions, namely environmental support, teacher support, peer support, examination and assessment support, and classroom teaching support. Ke et al. (2019) developed a school support scale (including two dimensions of course study resources and venue activity resources) to explore the impact of school support on the personalized growth of 5th-grade students in primary school.

In conclusion, there is inconsistency in the definition of school support, and the measurement tools also lack uniform and universal scales. Therefore, this study systematically combed Chinese and English literature from 2000 to 2021 in two highly acknowledged academic databases in China and around the globe, namely China National Knowledge Infrastructure (CNKI) and Web of Science (WOS), aiming to comprehensively understand the knowledge system, research status, and theoretical bases of school support and clarify its concept. Specifically, the following four research questions were focused on the following:

- (1) What is the current state of research on school support?
- (2) How do related studies define school support?
- (3) What is the theoretical basis of school support?
- (4) What are the measurement tools of school support?

Method

The present systematic literature review (SLR) was conducted following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (Moher et al., 2009). SLR is a method of assessing and clarifying all available studies related to a specific research question, topic, or area of interest (Brereton et al., 2007), with the advantages of comprehensiveness, rigor, and transparency. In more detail, straightforward research questions, comprehensive search strategies, explicit literature criteria, a high-quality assessment process, comprehensive data analysis, and reliable research

results can effectively overcome the subjectivity and bias of traditional research methods (Sutherland, 2004).

Eligibility criteria

Following PRISMA guidance on Eligibility Criteria (Moher et al., 2009), this study focused on the current status, theoretical basis, definitions (concepts), and measurement tools for school support in Chinese and English core-journal articles.

Inclusion criteria

- (1) Core-journal articles of authority and research value published in Chinese or English.
- (2) Published between January 1, 2000 and December 31, 2021.
- (3) Journal-type was academic articles with school support as the research theme, and the research participants were students.
- (4) Other relevant articles unearthed from the reference list can address this research question.

Exclusion criteria

- (1) Articles without explicit publication date restrictions.
- (2) Articles published in languages other than Chinese and English.
- (3) Documents identified as “gray literature” (Hopewell et al., 2007), such as degree dissertations, conference papers, reviews, newspapers, government policy papers, reports, videos, and unpublished data.
- (4) Articles that did not focus on school support or serve only as background or advice.

Data sources and search strategy

Based on the research questions, this study selected the CNKI (Beijing, PRC; <https://www.cnki.net/>), a highly recognized Chinese academic website, and WOS (Clarivate Analytics, Philadelphia, USA), a well-acknowledged international academic database, to ensure the quality and authority of the literature samples. A total of 1,035 documents in Chinese and 549 documents in English were retrieved with the time range from January 1, 2000 to December 31, 2021 and the theme of “school support.” The reason for this time restriction was the amount of research on school support in Chinese documents before 2000 was very limited. Furthermore, some references to the selected articles were reverse searched for more articles that contributed to this research topic.

Screening strategy and data collection

To ensure the validity of the sample literature, authors 1 (Li) and 2 (Hu) independently screened and collected data according to uniform selection criteria. Any disagreements between the two authors were discussed with author 3 (Pan). The PRISMA flowchart during the selection process (Moher et al., 2009) is shown in Figure 1, detailing the number of documents retained and excluded at each step as well as the corresponding reasons.

First, 1,035 documents in Chinese and 549 documents in English retrieved from the preliminary search were systematically screened.

The screening strategies for Chinese literature were as follows:

- (1) In the first step, the document type was an academic article. Six hundred thirty-four articles were retained and 401 documents, such as degree dissertations, conference papers, newspapers, and government documents, were excluded.
- (2) In the second step, only core journals were considered to maintain academic authority. One hundred seventy-five articles were retained, and 459 articles published in general journals were excluded. It should be noted that the journals on CNKI are divided into core journals and general journals, among which core journals are formally rated by Chinese research institutions with academic authority. Therefore, articles published in such journals have more academic reference value.

According to the screening strategy, 175 Chinese core-journal articles meeting the criteria were obtained and 860 documents were excluded.

The screening strategies for English literature were as follows:

- (1) In the first step, the document type was an academic article. Four hundred seventy-six articles were retained and 73 documents, such as degree dissertations, conference abstracts, book reviews, and letters, were excluded.
- (2) In the second step, 441 articles published in English were retained and 35 articles published in Spanish, French, German, Portuguese, and other languages were excluded.

According to the screening strategy, 441 English core-journal articles that met the criteria were obtained and 108 documents were excluded.

Second, the remaining 175 Chinese core-journal articles and 441 English core-journal articles were reviewed in detail according to the eligibility criteria. By reading the titles and abstracts, Author 1 (Li) and Author 2 (Hu) independently removed 154 Chinese articles and 399 English articles whose participants were non-student groups, such as teachers, parents, or who were not relevant to the topic of this study. Finally, 21 Chinese and 42 English articles were retained without disagreement between author 1 (Li) and Author 2 (Hu).

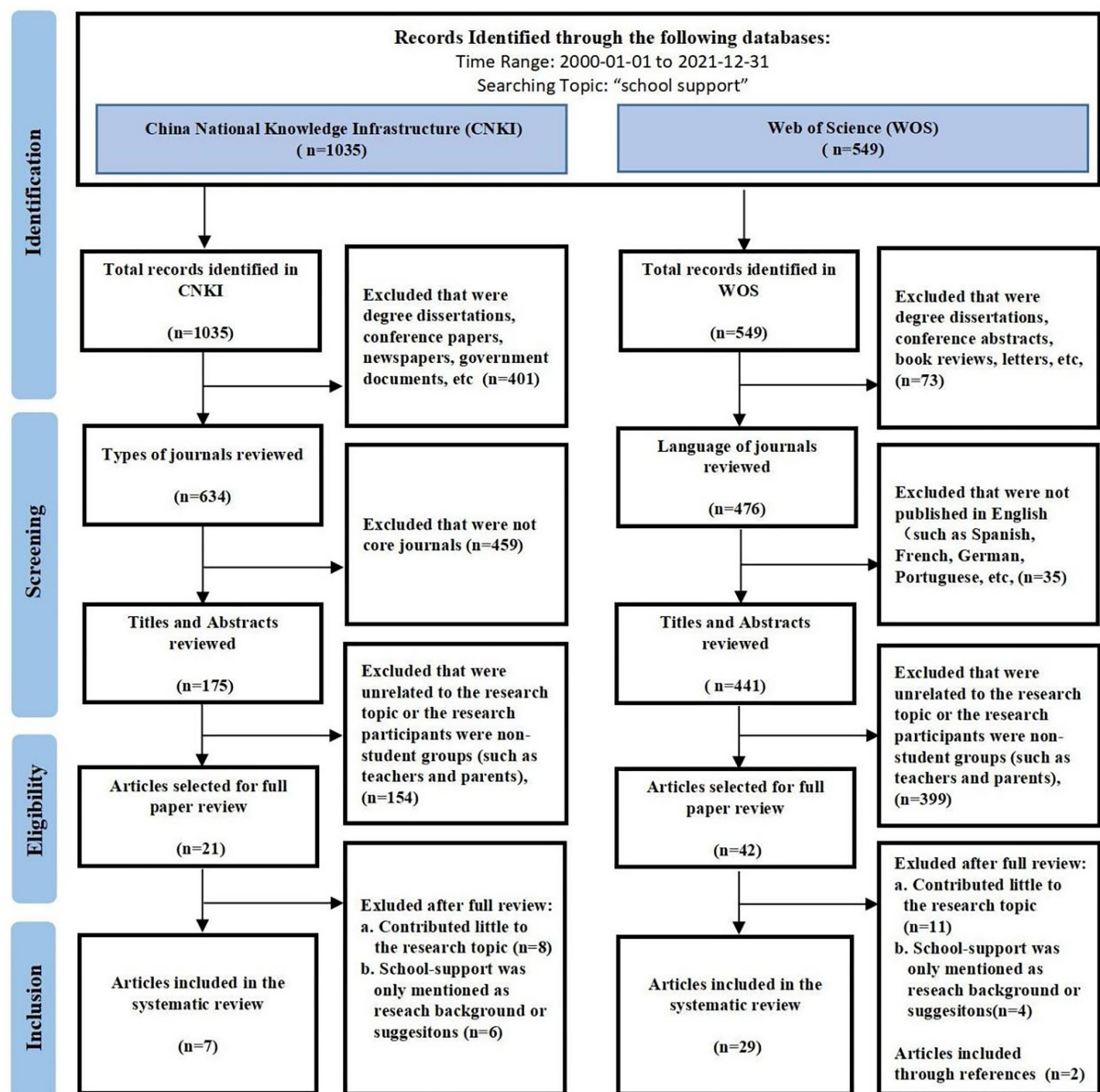


FIGURE 1
Flow chart based on PRISMA guidelines.

In total, 21 Chinese and 42 English articles were loaded into two separate folders through the EndNote X8 reference management software (Thomson Reuters, New York City, NY, USA). Duplicates were queried, and the full articles were exported. The full text that cannot be downloaded through EndNote X8 was downloaded manually. Through the further full-text intensive reading of 21 Chinese articles and 42 English articles, articles that did not significantly contribute to this research question were excluded. A total of 7 Chinese articles and 27 English articles were selected. Finally, the reference lists

of the selected English articles were reverse searched so that two valuable articles (Jia et al., 2009; Cornell et al., 2015) that were also included in the review were obtained. In this session, authors 1 (Li) and 2 (Hu) disputed the inclusion and exclusion of four of the articles, which then was discussed with author 3 (Pan). Three authors used the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart Lung Blood Institute, 2019) to examine the content and agreed on the final sample collection (seven Chinese articles and 29 English articles).

Data analysis

The search, collection, and sample analysis for this study were conducted during 20–28 June 2022. The Quality Assessment Tool developed by the National Institutes of Health (National Heart Lung Blood Institute, 2019) was used to assess quality and risk of bias. In recent years, this tool has been widely used in SLR studies to assess the quality of articles and the risk of bias in studies (Carbia et al., 2018; Amit et al., 2020; Putra et al., 2020; Costa Cordella et al., 2021). Similar to article screening and data extraction, quality assessment was performed independently by two authors. Furthermore, any disputes were discussed with a third author.

Statistical analysis and content analysis were performed on the sample. Through the statistical analysis of 1,035 documents in Chinese and 549 documents in English retrieved from the initial search, the research trends supported by the school from 2000 to 2021 were visually reflected. For the authoritatively indexed 7 Chinese core-journal articles and 29 English core-journal articles, analysis of content with general characteristics and evaluation of research quality were carried out to explore definitions, theoretical bases, and measurement tools of school support. In addition, the findings were then discussed to make follow-up research directions and recommendations.

Results

Quality assessment and risk of bias

In this study, methodological quality was assessed using the Quality Assessment Tool of Systematic Reviews and Meta-Analyses (National Heart Lung Blood Institute, 2019). As shown in Table 1, authors 1 (Li) and 3 (Pan) were satisfied with the methodological assessment of the Chinese literature. Author 2 (Hu) suggested that subsequent studies could include other Chinese databases besides CNKI. In general, the three authors agreed on the assessment of methodological quality.

The definitive collection of 7 Chinese core-journal articles and 29 English core-journal articles were assessed for content quality through the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart Lung Blood Institute, 2019). As shown in Tables 3, 4, the three authors rated four (57.14%) Chinese core-journal articles as Good and three (42.86%) as Fair, with consistent evaluation results. For English core-journal articles, the three authors agreed that 24 (82.76%) were Good and 5 (17.24%) were Fair.

Search results

This study adopted the above rigorous and systematic search and screening to initially identify 1,035 Chinese documents

and 549 English documents. Through the unified screening criteria, 175 Chinese core-journal articles and 441 English core journal articles were retrieved. Twenty-one Chinese and 42 English core-journal articles focused on school support for the student population were retained after reviewing the titles and abstracts. Through the full-text review, seven Chinese core-journal articles and 29 English core-journal articles that significantly contributed to the school-supported research were finally extracted (Figure 1; Tables 3, 4).

Study status

Research trends

To visualize the research trends on school support, 1,035 Chinese literature and 549 English literature were initially identified for statistical analysis. As shown in Figure 2, the number of publications on school support in both Chinese and English showed an overall growth trend from 2000 to 2021, which indicated that both Chinese and Western researchers were paying more attention to school support.

Research discipline areas

As shown in Table 2, this study compared the five most common research disciplines in the 1,035 Chinese and 549 English documents initially identified, which identified that research on school support was mainly concentrated in the two disciplines of education and psychology.

Study characteristics

Tables 3, 4 present the details of the specific characteristics of seven Chinese and 29 English core journal articles, including basic information, name of the lead author, year of publication, study design and objectives, participants, sample size, research methods, findings, and article quality.

Theoretical bases and conceptual definition of school support

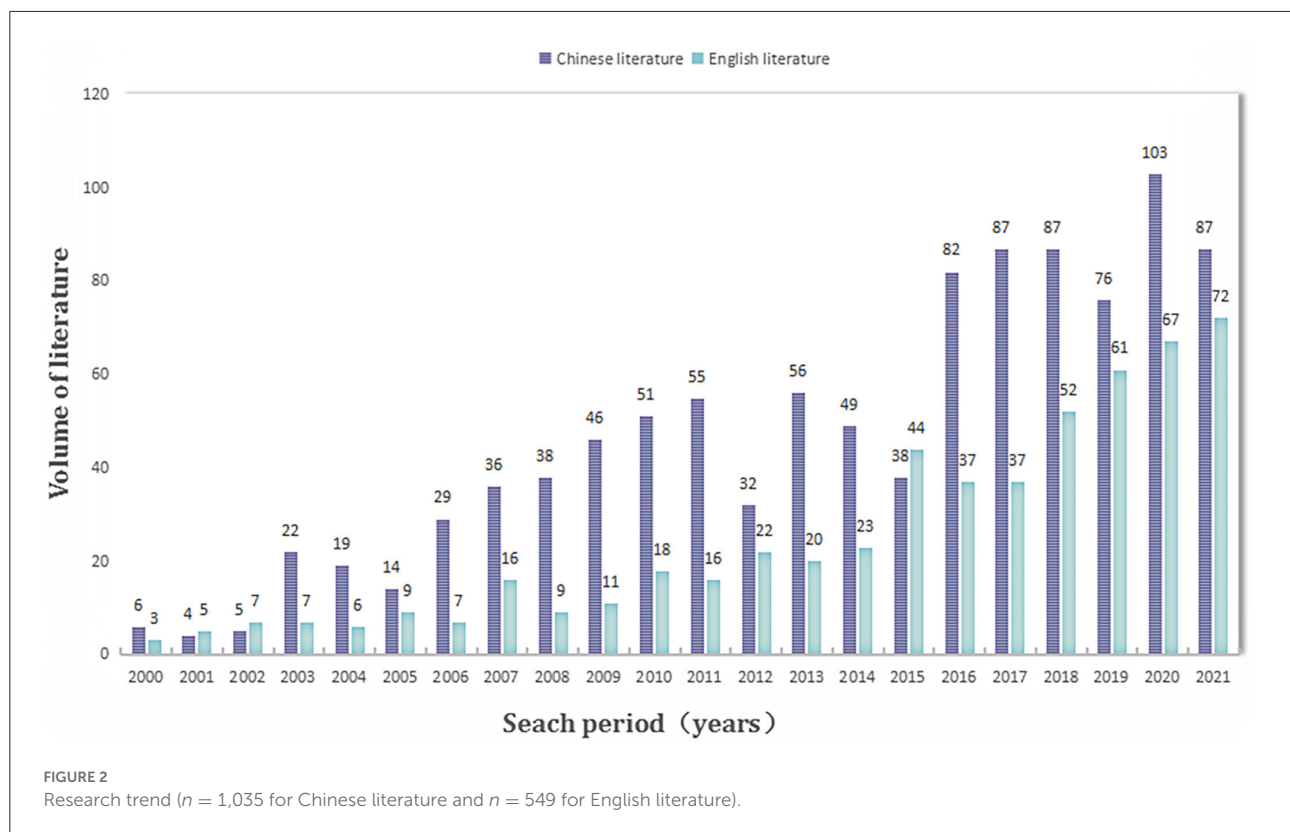
Figure 3 presents the research theories of the Chinese and English core-journals articles (listed in Tables 3, 4). The theoretical basis of school support mainly includes social support theory, ecological system theory, and school climate theory.

First, social support theory explains that supportive behaviors that individuals receive or perceive from social relationships have universal meaning and benefits and contribute to an individual's psychological health and positive development (Berkman and Syme, 1979). This theory is widely

TABLE 1 Summary of quality assessment and risk of bias.

Category	Author	Criteria								Quality rating
		1	2	3	4	5	6	7	8	
Chinese core journals	Author 1 (Li)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Good
	Author 2 (Hu)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Fair
	Author 3 (Pan)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Good
English core journals	Author 1 (Li)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Good
	Author 2 (Hu)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Good
	Author 3 (Pan)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Good

NA, not applicable; Criteria, 1, Is the review based on a focused question that is adequately formulated and described? 2, Were eligibility criteria for included and excluded studies predefined and specified? 3, Did the literature search strategy use a comprehensive, systematic approach? 4, Were titles, abstracts, and full-text articles dually and independently reviewed for inclusion and exclusion to minimize bias? 5, Was the quality of each included study rated independently by two or more reviewers using a standard method to appraise its internal validity? 6, Were the included studies listed along with important characteristics and results of each study? 7, Was publication bias assessed? 8, Was heterogeneity assessed? (This question applies only to meta-analyses.); You can see the criteria at the following link <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>.



used, which underlies much of the current research on school support in Chinese and British academic circles. Most studies that draw on social support theory consider school support as a subsystem of the social support system. Teachers and peers at school are the primary sources of social support that influence individual growth. Teacher behavior and support influence the formation of individual values and students' adaptation to the school environment (Chen et al., 2020; Moreira and Lee, 2020). Peer or classmate support is also the main interpersonal support in the social support system, where positive peer

relationships can be effective in relieving academic stress and dysphoria (Torsheim and Wold, 2001; Moreira et al., 2018). Therefore, adequate support from teachers and peers can prevent psychological crises (Torsheim et al., 2000; Sun et al., 2021). Research based on social support theory defines school support as the sense of support, security, and recognition that individuals develop in school through interaction with teachers and peers and participation in school activities (Corprew and Cunningham, 2011; Berkowitz and Benbenishty, 2012; Cao, 2016; Moreira and Lee, 2020; Zhang et al., 2020).

TABLE 2 Research discipline areas (top 5).

Classify	CNKI <i>n</i> = 1,035		WOS <i>n</i> = 549	
	Discipline areas	Volume of documents (Percentage)	Discipline areas	Volume of documents (Percentage)
1	Educational theory and management	376 (36.33%)	Educational research	210 (38.25%)
2	Higher education	158 (15.27%)	Psychology	139 (25.32%)
3	Secondary education	127 (12.27%)	Public environmental occupational health	63 (11.48%)
4	Adult and education for special population	121 (11.69%)	Pediatrics	36 (6.56%)
5	Psychology	76 (7.34%)	Psychiatry	24 (4.37%)

The data in the table were collated from the relevant data of CNKI and Web of Science.

Second, ecological system theory emphasizes that individual development is nested within a series of environmental systems that interact with individuals and influence their development, among which microsystems such as family, school, and community are the closest factors that affect individual development (Bronfenbrenner, 1977; Chen et al., 2019; Zhao and Zhou, 2019). Research that draws on ecosystem theory focuses on the environment that supports individual development and emphasizes the interaction of home and school support. Moreover, these studies also demonstrated that school support can mutually complement the role of family support in protecting adolescents' value formation (Cupito et al., 2016). In addition, environmental support provided by family, school, and community can shape an individual's learning cognition, emotion, and behavior (Chen et al., 2019, 2020). Since most studies of school support based on ecosystem theory treat schools as a systematic environmental factor, the conceptual definition of school support is not clearly constructed.

Third, school climate theory holds that school support is a comprehensive reflection of the internal values, school climate, and interpersonal relationships that reflect the quality of school life. Therefore, school climate concept and scale were usually employed to measure school support (Fang et al., 2016; Yang et al., 2020; Fredrick et al., 2021).

Research methods and participants

Among the seven Chinese core-journal articles, four were quantitative, two were qualitative, and one was a mixed study (Figure 4). Among the 29 English core-journal articles, 26 were quantitative, two were qualitative, and one was a mixed study (Figure 5). Overall, research on school support mostly employed the quantitative research method.

As shown in Figure 6, the participants of the seven Chinese core-journal articles (listed in Table 3) were mainly college and primary school students. Luo and Xiang (2011) focused on the

effect of school support on the school adaptation of elementary-school students with cerebral palsy. Based on 15 research cases, Chen (2014) explored the comprehensive influence of school, family, and peer groups on Chinese college students facing a psychological crisis. Hu and Liu (2019) conducted an experimental study on school support for college students with depression. Zhao and Zhou (2019) conducted a questionnaire survey on 5,855 college students from 35 domestic colleges and universities and concluded that school support could significantly improve college students' school identities. Ke et al. (2019) developed a scale for school support (including two dimensions of course study resources and venue activity resources) to explore the impact of school support on the personalized growth of 5th-grade students in primary school. Zhang et al. (2020) studied the effects of school support on students in the senior grades of elementary school.

As shown in Figure 6, the participants of the 29 English core-journal articles (listed in Table 4), who mainly were special student groups or groups of students below high school. Torsheim and Wold (2001) conducted a questionnaire on school stress and school support with a sample of 4,952 Norwegian students aged 11–15. In a study of 139 adolescents with diabetes, Tang et al. (2013) found that school support had a significant positive effect on life satisfaction. Asikhia Olubusayo and Mohangi (2015) explored the impact of school support on the psychology and behavior of HIV-infected orphans aged 15–18 through a case study. Through a longitudinal study of survivors who experienced a gun shooting incidence, Strøm et al. (2016) explored the impact of school support on academic performance and absenteeism. Bottiani et al. (2016) focused on the impact of school support on racially diverse high school students. By conducting a study involving 4,733 Israeli high school students, Fang et al. (2016) explored the relationship between youth violence and school support. Carney et al. (2018) tested the hypothesis that bullying is related to school support through a study of 973 elementary school students in grades 3–6 in two public school districts in the northeastern United States.

TABLE 3 Summary of included Chinese core-journal articles ($n = 7$).

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
Luo and Xiang (2011)	Cross-sectional study	None	Exploring school adjustment and school support systems related to students with cerebral palsy	Elementary school students with cerebral palsy (the average age of 10.03 years)	113	Quantitative	Developing the school support system questionnaire for students with cerebral palsy	1. School support consisted of five dimensions, which were environmental support, teacher support, peer support, examination and assessment support, and classroom teaching support. 2. School support had a significant positive predictive effect on the school adjustment for students with cerebral palsy.	Good
Chen (2014)	Case study	None	Exploring the comprehensive influence of school, family and peers on the psychological crisis faced by Chinese college students	College students	15	Qualitative	–	School support, family support and peer support complemented and cooperated with each other to form synergy and produce positive effects on the resolution of the psychological crisis of college students.	Fair
Yang and Li (2016)	Policies study	Positive behavioral support	Exploring school-level positive behavior support in the United States and its implications for China	–	–	Qualitative	–	Positive behavioral support at the school level enabled all students to achieve academic and social development.	Fair
Hu and Liu (2019)	Experimental study	Organizational support theory	1. Designing a mental health intervention study for college students with depression 2. Exploring the differential impact of different types of school support	First-year depressed college students	50	Mixed	–	School support could effectively reduce the negative depression of college students who were prone to depression, and significantly improved the mental health of depressed college students. Compared with peer support, teacher support and friend support had a greater positive impact on depressed students.	Good
Ke et al. (2019)	Cross-sectional study	None	Exploring the status on school resource support from the perspective of students' individualized growth	Elementary school students in grade 5	2,161	Quantitative	Developing a scale of school support with two dimensions of course study resources and venue activity resources	Course study resources and venue activity resources had a high degree of support for students' individualized growth.	Fair

(Continued)

TABLE 3 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
Zhao and Zhou (2019)	Cross-sectional study	Ecological system theory	Exploring the influencing factors of college students' school identity	University students aged 21–23	5,855 (From 35 colleges)	Quantitative	National Survey of Student Engagement in Learning (2014 Edition), USA.	1. School support for college students included 6 kinds of support resources, which were academic support, social interaction support, economic life support, social practice support, health care support, and physical and artistic activity support. 2. School support could significantly enhance school identity.	Good
Zhang et al. (2020)	Longitudinal study	Creativity component theory	1. Exploring the development of creativity in the upper elementary school students 2. Exploring the gender differences in the role of school support	Elementary school students in grades 4–6 (with the average age of 10.43 years)	203	Quantitative	Perceived school climate scale adapted by Jia et al. (2009)	School support was a significant contributor to the development of creativity in the upper primary grades. There were gender differences in perceived school support.	Good

TABLE 4 Summary of included English core-journal articles ($n = 29$).

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
1. Torsheim et al. (2000) (Norway)	Reliability and validity test of the scale	Social support theory	Presenting results on the factor structure, test-retest reliability, and external validity of the Teacher and Classmate Support Scale, a brief self-report measure on perceived support from teachers and classmates.	Teenagers aged 13–15	681	Quantitative	Developing a scale for measuring teacher support and classmates' support in this study.	The scale offered a parsimonious self-report measure of classmate and teacher support, but more evidence was needed before the scale could be recommended for broader research purposes.	Good
2. Torsheim and Wold (2001) (Norway)	Cross-sectional study	Cognitive activation theory	Examining the relationship between school-related stress, social support from teachers and classmates, and somatic complaints in the general population of Norwegian adolescents.	Students aged 11–16	4,952	Quantitative	1. Social support from teachers was measured with a three-item questionnaire. Items were rated on a 5-point Likert-type scale from strongly agree to disagree strongly. 2. Social support from classmates was measured with a three-item questionnaire. Items were rated on a 5-point frequency scale from always to never.	1. Low classmate support was associated with higher OR of weekly headache and weekly dizziness but not with higher odds for abdominal pain and backache. 2. Low teacher support was associated with higher OR of weekly abdominal pain and weekly dizziness but not with higher OR for weekly headache and backache. 3. The strongest associations of low social support were shown for coexisting symptoms, with an OR of 1.47 for low classmate support and 1.36 for low teacher support.	Fair
3. Chong et al. (2006) (Singapore)	Cross-sectional study	None	Examining the respective contributions of perceived support from parents, peers, and school and the mediating role dispositional optimism plays in these relationships.	Asian adolescents (with the average age of 13.5years)	519	Quantitative	Three scales of the Personality Self-Report (SRP-A) taken from Behavior Assessment System for important contextual factors influencing Children (BASC) were used to measure the adolescents' perceptions of themselves, support received, and their adjustment to the environment.	Positive supportive relationships with parents, peers, and the school were important contextual factors influencing the psychological wellbeing of these adolescents, and dispositional optimism partially mediated support from each of these three sources and psychological adjustment.	Good

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
4. Jia et al. (2009) (China; USA)	Cross-sectional study	Ecological theories of development	Exploring students' perceptions of 3 dimensions of school climate (teacher support, student-student support, and opportunities for autonomy in the classroom) and the associations between these dimensions and adolescent psychological and academic adjustment in China and the United States.	Students (with the average age of 12.34 years)	1,412	Quantitative	Perceived school climate. The school climate measure used in this study was a revised 25-item version of two school climate measures (Emmons et al., 2002; Brand et al., 2003).	1. Students in China perceived higher levels of teacher support, student-student support, and opportunities for autonomy in the classroom than students in the United States. 2. Students' perceptions of teacher support and student-student support were positively associated with adolescents' self-esteem and grade point average but negatively associated with depressive symptoms for both Chinese and American adolescents.	Good
5. Stadler et al. (2010) (Germany)	Cross-sectional study	School climate theory	Investigating the frequency and effects of peer victimization on mental health problems among adolescents.	Females (with an average age of 14.68 years) and males (with an average age of 14.69 years).	986	Quantitative	School support comprised the composite of three school support scales: Negative school climate (seven items), perceived teacher support (eight items), and attachment to school (five items).	School support was effective in both male and female adolescents by acting as a buffer against the effect of victimization, and school support gained increasing importance in more senior students.	Good
6. Corprew and Cunningham (2011) (USA)	Cross-sectional study	Phenomenological Variant of the Ecological Systems Theory (PVEST)	Exploring the association between negative youth experiences and bravado attitudes in African American urban males. In addition, positive factors, such as school social support, were examined to understand potential resilient pathways.	African American male students aged 13–18	126	Quantitative	The <i>School Social Support</i> scale comprised four questions from a more extensive social support scale (Munsch and Blyth, 1993; Munsch and Wampler, 1993).	The results highlighted the importance of adolescent perceptions of support in the school context and how this perceived support may decrease bravado attitudes.	Good
7. Tang et al. (2013) (Taiwan, China)	Cross-sectional study	None	Constructing a model that assesses the effects of school T1DM support and self-care behaviors on life satisfaction in adolescents with type 1 diabetes in Taiwan.	Adolescents with aged 10–18	139	Quantitative	Developing a scale in this study.	School support and self-care behaviors positively influenced adolescents' life satisfaction with type 1 diabetes.	Fair

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
8. Asikhia Olubusayo and Mohangi (2015) (South Africa)	Interview study	None	Researching the experiences of 11 orphaned adolescents (5 boys and 6 girls aged between 15 and 18 years) affected by HIV and AIDS in a secondary school (in Atteridgeville, Pretoria, South Africa) and the school support provided by them.	Students aged 15–18	11	Qualitative		Participants had a high prevalence of psychological, behavioral, and emotional problems, and the school support provided to them (teacher support, the general school environment, the degree of discrimination, labeling, and bullying in the school) was not insufficient.	Good
9. Cornell et al. (2015) (China)	Cross-sectional study	School climate theory	Examining how school climate theory provides a framework for conceptualizing 2 key features of school climate disciplinary structure and student support that are associated with 3 measures of peer victimization.	Students in grades 7–8	39,364	Quantitative	An eight-item scale was designed to measure the perceived supportiveness of teacher-student relationships with items such as how much they agree that adults in their school “really care about all students” and whether they would seek help from an adult in their school if “another student was bullying me” (Konold et al., 2014).	Higher student support was associated with a lower prevalence of teasing, bullying and general victimization.	Good
10. Babey et al. (2016) (USA)	Cross-sectional study	Social cognitive theory	Exploring the roles of school support, role models, and social participation on adolescent physical activity in racial and income disparities.	Teenagers aged 12–17	2,799	Quantitative	A modified sub-scale of the Resilience Youth Development Module from the California Healthy Kids Survey (Hanson and Kim, 2007; Furlong et al., 2009).	School support might help promote physical activity among Latino, African American, and low-income youth.	Good
11. Bottiani et al. (2016) (USA)	Cross-sectional study	School climate theory	Examining perceptions of school support and variation in perceived caring, equity, and high expectations by student race, school diversity, and socioeconomic context.	Black and white high school students (with the average age of 15.9 years)	19,726	Quantitative	Twelve survey items using a four-point Likert scale were selected from the California Healthy Kids Survey (Hanson and Kim, 2007) and the School Development School Climate Survey (Haynes et al., 2001) to assess school support.	The findings pointed to the need for intervention to improve perceptions of school support for Black youth and all students in lower-income and more diverse schools.	Good

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
12. Cupito et al. (2016) (USA)	Cross-sectional study	Ecological theory	Examining the relationship between familism and depressive symptoms across relational contexts in adolescence, and whether maternal warmth and support, as well as school support moderated the relationship between familism and depressive symptoms.	Adolescents (with the average age of 14 years)	180	Quantitative	These 23 items were taken from the Child and Adolescent Social Support Scale (CASSS) Version 2 (designed for children from 6th to 12th grade) to measure adolescents' perceived social support from classmates and teachers (Malecki and Demary, 2002).	School support moderated the relationship between familism and adolescent depressive symptoms.	Good
13. Fang et al. (2016) (Canada; Israel)	Cross-sectional study	General Strain Theory	Guiding by the Deterioration Deterrence Model and General Strain Theory, the present study assessed the mediating role of school support and posttraumatic stress (PTS) on two adolescent risk behaviors (i.e., school violence and drug use) among Arab and Jewish Israeli adolescents.	Students in grades 10–11	4,733	Quantitative	The 8-item scale was a sub-scale of an adapted Hebrew version of the California School Climate Survey developed by Furlong (Rosenblatt and Furlong, 1997).	The findings of this study provide evidence for the theorized mediated pathways between political violence exposure and adolescent risk behaviors by posttraumatic stress (PTS) and school support.	Good
14. Strøm et al. (2016) (Norway)	Longitudinal interview study	School climate	Investigating academic performance, absenteeism, and school support amongst survivors of a terrorist attack in Norway.	Students older than 13	490	Mixed		The findings underscored the importance of keeping trauma-exposed students in school and providing support over time.	Good

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
15. Arslan (2018) (Turkey)	Cross-sectional study	Social Support Theory	Investigating whether social support mediated and moderated the relation between social exclusion and psychological wellbeing at school.	Teenagers aged 11–18	407	Quantitative	1. Social support was measured using the Social and Emotional Health Survey (SEHS; You et al., 2014), which is a 36-item self-report rating instrument developed to measure youths' social and emotional competencies based on the covitality model (Furlong et al., 2014). 2. The SEHS was comprised of 12 sub-scales (three items for each sub-scale) that refer to four latent traits: belief-in-self (self-awareness, self-efficacy, and persistence), belief-in-others (peer support, school support, and family support).	1. Social support sources from family, peers, and school mediated the relationship between social exclusion and youths' psychological wellbeing. Additionally, regression analyses showed that social support also had a moderator role in this association. 2. The role of these resources (family, school, and peer support) varied concerning gender, and the effect of social support was greater in female students.	Good
16. Bennefield (2018) (USA)	Cross-sectional study	Theories of counseling and psychotherapy	Examining the correlates of one measure of psychological wellbeing, positive affect, in the adolescent population, two dimensions of school support (teacher-student relationship and student engagement) and family support (family communication and family closeness) were examined.	Adolescents	10,148	Quantitative	Four questions were used to assess school attachment. Response choices included "Very", "Somewhat", "Not very", "Not at all".	1. Among the total sample, all dimensions of school and family support measured were correlates of positive affect. When the total sample was divided by gender and race, there were marked differences in the relationship between school and family support across sub-populations. 2. Males and Whites most closely resembled the total sample, while the relationship between dimensions of school and family support was distinct for females and racial and ethnic minorities.	Fair

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
17. Carney et al. (2018) (USA)	Cross-sectional study	Social Support Theory	Addressing the complexity of relations among bullying perpetrating, victimization, by standing and students perceived school support, acceptance of diversity at school, and perceived school connectedness.	Students in grades 3–6	973	Quantitative	The original perception of support sub-scale of the CAYCI SES (Anderson-Butcher et al., 2013) contained four items, and three aimed at measure support received at school and one targeted for family support.	Bullying perpetrating had direct and indirect negative effects on perceived school support, acceptance of diversity, and school connectedness.	Good
18. Chen et al. (2019) (China; Norway; Sweden)	Cross-sectional study	Ecological system theory	Examining the relationships between support and boundaries from family, school, and community and student engagement among Chinese adolescents.	Adolescents (with the average age of 14.56 years)	577	Quantitative	Developing a scale in this study.	Family, school, and community support and boundaries were positively related to two dimensions of student engagement (i.e., behavioral and affective).	Fair
19. Ross-Reed et al. (2019) (USA)	Cross-sectional study	None	Determining how family, school, peer, and community support influenced rates of violence victimization and self-harm among Gender minority (GM) and cisgender adolescents.	Middle school students	14,188	Quantitative	The 14 resiliency questions were divided into four domains (family, peer, school, and community).	1. School support was associated with lower odds of dating violence and non-suicidal self-injury. 2. There were significant interactions between gender, violence, and support.	Good
20. McCoy et al. (2020) (USA)	Cross-sectional study	Ecological system theory	Understanding the cumulative impact of household dysfunction adverse childhood experiences (ACEs) on adolescent alcohol and marijuana use and examining how family, school, and community support mitigate these relationships.	Middle school students file:///C:/Users/\\alop\\AppData\\Local\\youdao\\dict\\Application\\9.0.1.1\\resultui\\html\\index.html - /javascript;	26,476	Quantitative	Adolescents were asked a range of questions related to support in school.	1. Results showed that community support moderated the relationship between adverse childhood experiences (ACEs) and alcohol and marijuana use. 2. School support did not moderate the relationship between adverse childhood experiences (ACEs) and alcohol or marijuana use.	Fair

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TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
21. Moreira and Lee (2020) (Portugal;USA)	Longitudinal studies	Self-determination theory	Examining the influences of social support from teachers and peers, as well as autonomy support, on students' trajectories of cognitive engagement.	Students aged 6–18	4,054	Quantitative	Students' perceptions of social support at school were measured from two distinct sources: teachers and peers, by two scales from the Portuguese SEI (Moreira et al., 2009).	Cognitive engagement declined over time. Good This decline was less pronounced in schools where social support from peers and autonomy support was more prevalent.	
22. Smith et al. (2020) (USA)	Longitudinal studies	School climate theory	Exploring the relationship between Black students' perceptions of school support for cultural pluralism and perceptions of school climate.	Black teenagers (with an average age of 13.74 years)	336	Quantitative	Four measures captured perceptions of school climate: 1. Psychological Sense of School Membership (PSSM; Goodenow, 1993) for school belonging. 2. The ICS-S (Brand et al., 2003) for teacher-student interactions. 1. The ICS-S (Brand et al., 2003) for student peer interactions. 2. The Psychosocial Climate Scales of the Effective Schools Battery (Gottfredson and Gottfredson, 1999) to measure fairness.	Black youth who rated their school as being supportive of culturally pluralism had more positive ratings of school climate during the following school year after controlling for the previous year's school climate ratings.	Good
23. Yang et al. (2020) (Hong Kong, China)	Cross-sectional study	Self-determination theory	Testing the relationships between peer support, school support, self-determination, and school engagement in 118 secondary school students with special needs integrated into mainstream schools in Hong Kong.	Secondary school students	118	Quantitative	Five items from the Delaware School Climate Survey (general factor; Bear et al., 2011).	1. School support significantly indirectly affected school engagement <i>via</i> self-determination as a mediator. 2. The correlations between school support, self-determination, and school engagement were all positive and significant.	Good

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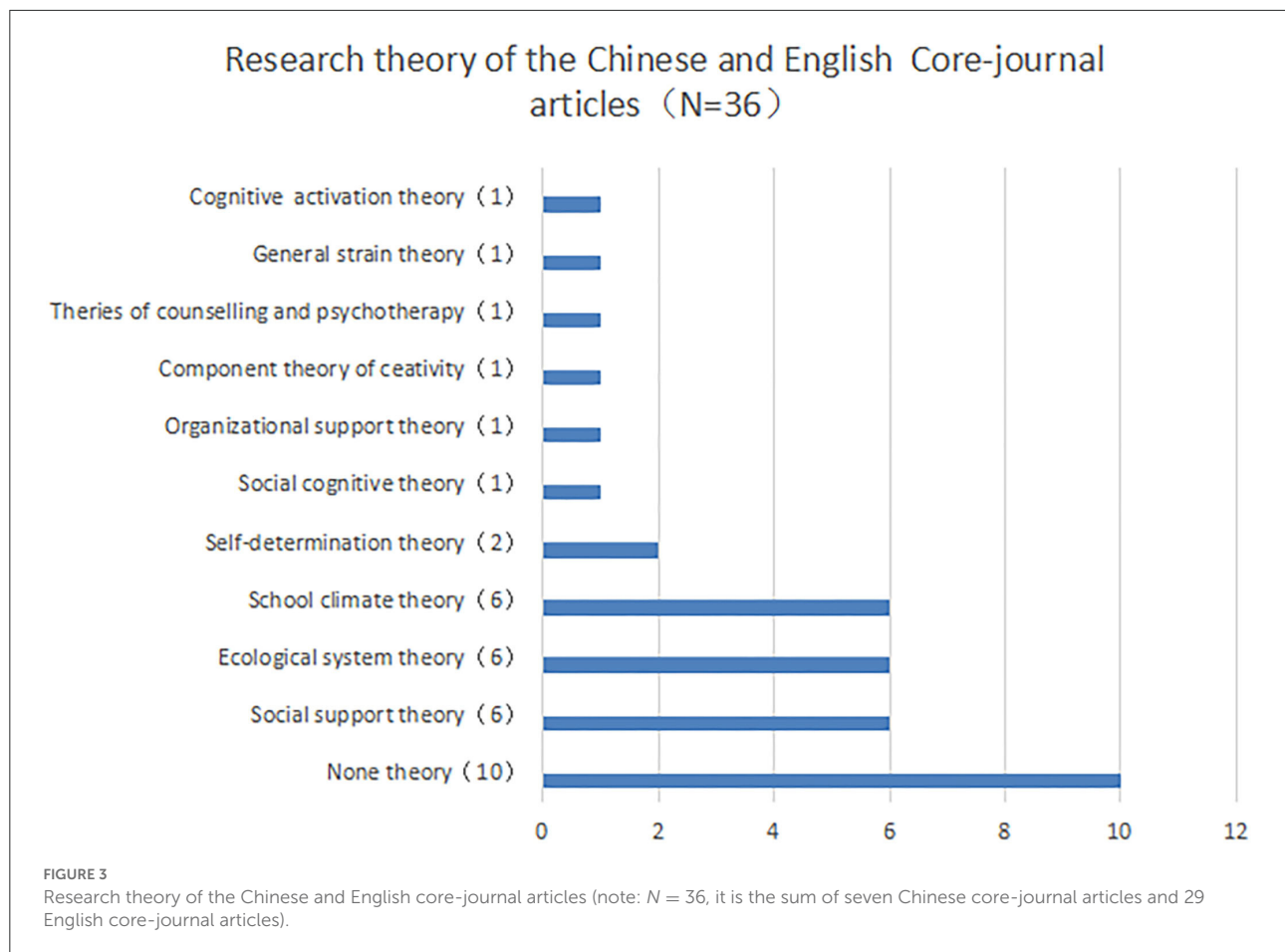
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References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
24. Delaruelle et al. (2021) (Belgium)	Cross-sectional study	None	Examining the relationship between adolescents' sleep quality and peer, family, and school factors.	Adolescents aged 11–18	8,153	Quantitative	1. Teacher support was defined as the mean score of the following items: I feel that my teachers accept me as I am; I feel that my teachers care about me as a person; I feel a lot of trust in my teachers. 2. Student support consisted of the average score on 3 items: The students in my class enjoy being together; most of the students in my class are kind and helpful; other students accept me as I am. Response options were similar to those for teacher support. 3. School pressure was measured by a single item.	The individual-level results indicated that adolescents' sleep quality was positively related to family support, teacher support, student support, and perceived family wealth.	Good
25. Despoti et al. (2021) (Greece: Cyprus)	Cross-sectional study	Social support theory	Exploring the potential moderating role of perceived social support (school personnel, friends) and gender in the association between distinct psychopathic traits (callous-unemotional traits).	Students aged 9–12	1,442	Quantitative	Social Support was assessed with the 12-item Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988) MSPSS consists of three sub-scales, assessing supportive relationships within 3 contexts: family, friends, and school.	1. School and friend perceived social support acted as protective factors against victimization. 2. School and friends perceived social support moderated the link between narcissism and bullying.	Good
26. Esposito et al. (2021) (Italy)	Cross-sectional study	Social support theory	Testing the unique contribution of homophobic victimization on adolescent non-suicidal self-injury (NSSI) and analyzing the buffering role of teachers and classmates' support.	Students aged 13–19	770	Quantitative	This study used the Classroom Life Scale to measure students' perceptions of teachers' and classmates' support (Johnson et al., 1985).	High classmates' support was negatively associated with adolescents' engagement in non-suicidal self-injury (NSSI). Furthermore, higher levels of classmates' support were associated with a lower NSSI frequency only for youth who reported low levels of homophobic victimization.	Good

(Continued)

TABLE 4 Continued

References	Research design	Theoretical bases	Research objectives	Participants (age range)	Sample size	Research methodology	Measurement tools	Findings	Article quality
27. Fredrick et al. (2021) (USA)	Cross-sectional study	School climate theory	Testing whether peer difficulties (specifically social competence and peer victimization) interacted with school support (a component of school climate) in relation to adolescents' sluggish cognitive tempo (SCT) symptoms.	Teenagers aged 13–15	288	Quantitative	The ASCS (Cornell et al., 2015) is a self-report measure of the quality and experience of an authoritative school climate.	1. Adolescent and parent ratings of lower social competence were both associated with higher adolescent-reported sluggish cognitive tempo (SCT) symptoms in the context of low, but not high, school support. 2. Relational and nonphysical victimization was associated with higher self-reported sluggish cognitive tempo (SCT) symptoms in the context of low school support.	Good
28. Parker et al. (2021) (USA)	Interview study	None	Investigating Black adolescents' perceptions of their experiences with COVID-19, including the challenges they encountered, their coping strategies, and their use of religious/spiritual and school-based support.	Black or African American aged 12–17	12	Qualitative		Findings from this research supported calls for mental health providers to employ culturally affirming mental health services and engage in interagency collaboration to support Black youth.	Good
29. Standley and Foster-Fishman (2021) (USA)	Cross-sectional study	Social support theory	Examining the relationship between social support and suicidality among youth from a public health perspective by using (1) a socioecological framework and (2) an intersectional approach to social identity.	Students aged 13–18	5,058	Quantitative	Social support items were derived from the Communities that Care Youth Survey portion of the MIPHY (CTCYS; Arthur et al., 2002). Nine items measured school-level support (e.g., opportunities to engage in activities, provide input at school, and rewards for achievement).	Social support at the family, school, and community levels was significantly associated with lower suicidality scores, and the combination of family and school support was associated with the lowest suicidality scores.	Good



Measurement tools of school support

The primary measurement instruments used in the Chinese and English core-journal articles are shown in [Tables 3, 4](#). Most empirical studies use subscales or indicators related to the source of support (such as teacher support, classmate support, or peer support) to measure school support. Measurement items assessed students' responses to statements such as "Overall, adults at my school treat students fairly," "Students here respect what I have to say," "My teachers are there for me when I need them," and "Other students at school care about me" ([Torsheim et al., 2000](#); [Litwin, 2001](#); [Torsheim and Wold, 2001](#); [Moreira et al., 2009](#); [Moreira and Lee, 2020](#); [Zhang et al., 2020](#)).

Other studies measured school support using the school climate scale ([Bear et al., 2011](#); [Fang et al., 2016](#); [Yang et al., 2020](#); [Zhang et al., 2020](#)). Measurement items assessed students' agreement with statements such as "My teachers care about me," "Students help one another," "Students are given the chance to help make decisions," "Students feel safe at school," and "School rules are fair to each student." [Bottiani et al. \(2016\)](#) measured school support in the dimensions of caring, high expectations, and equity by using indicators, such as "My teachers respect

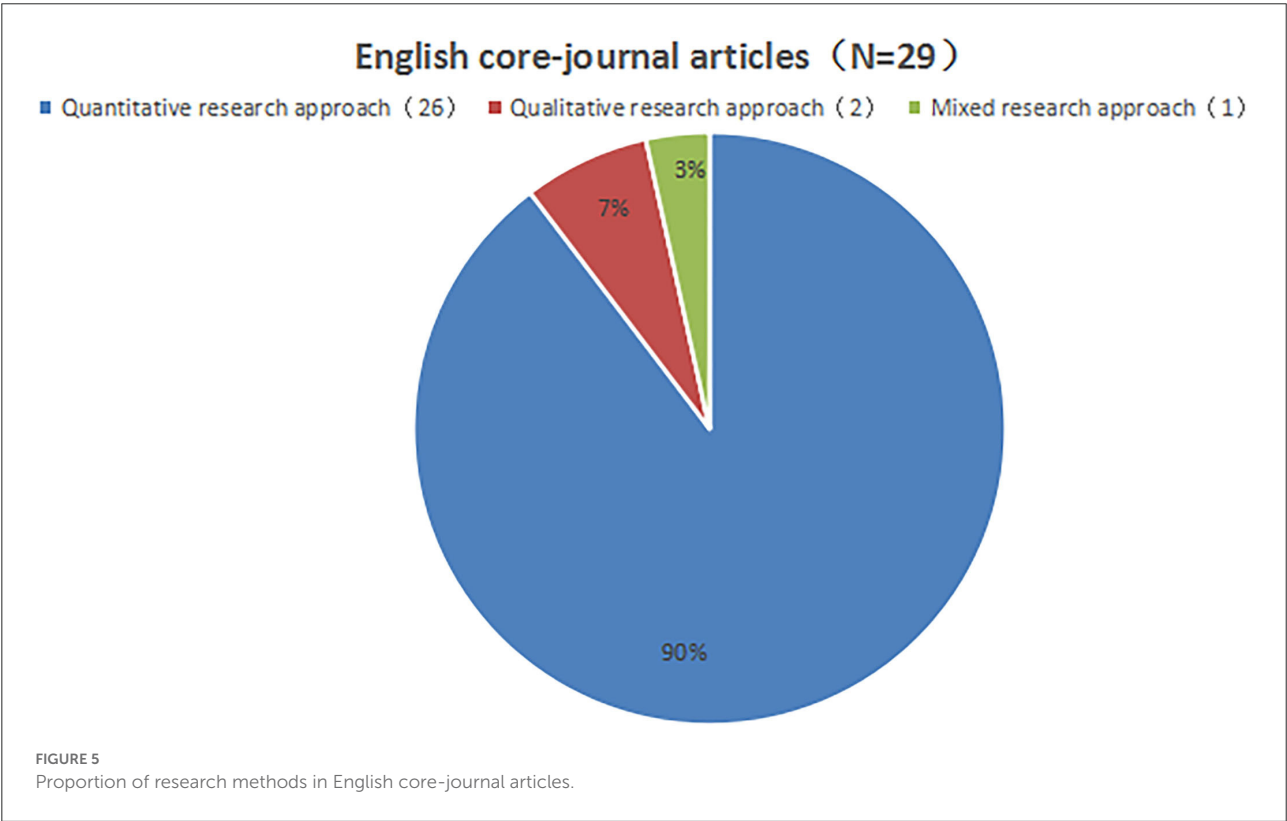
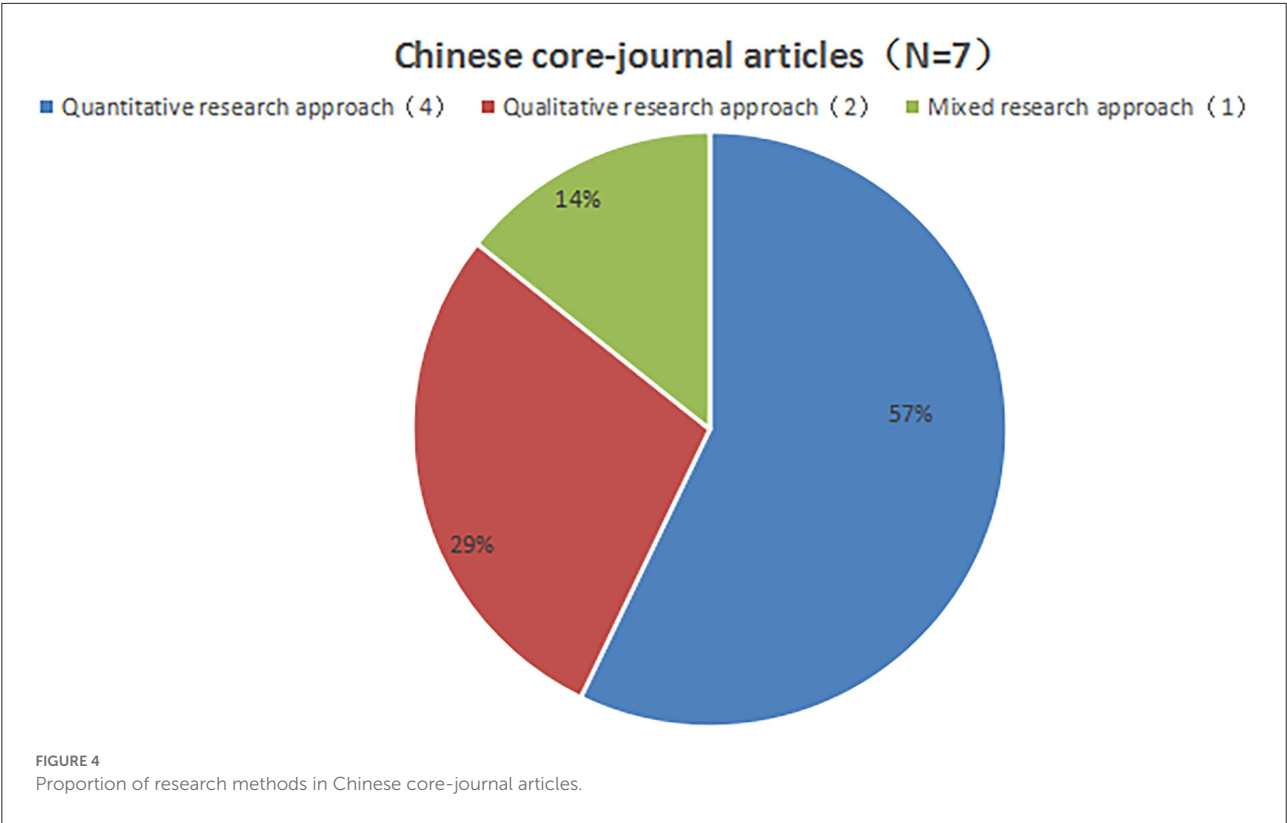
students," "My teachers encourage me to work hard in my class," and "At this school, students of all races (whether boys or girls and whether parents are rich or poor) are treated the same."

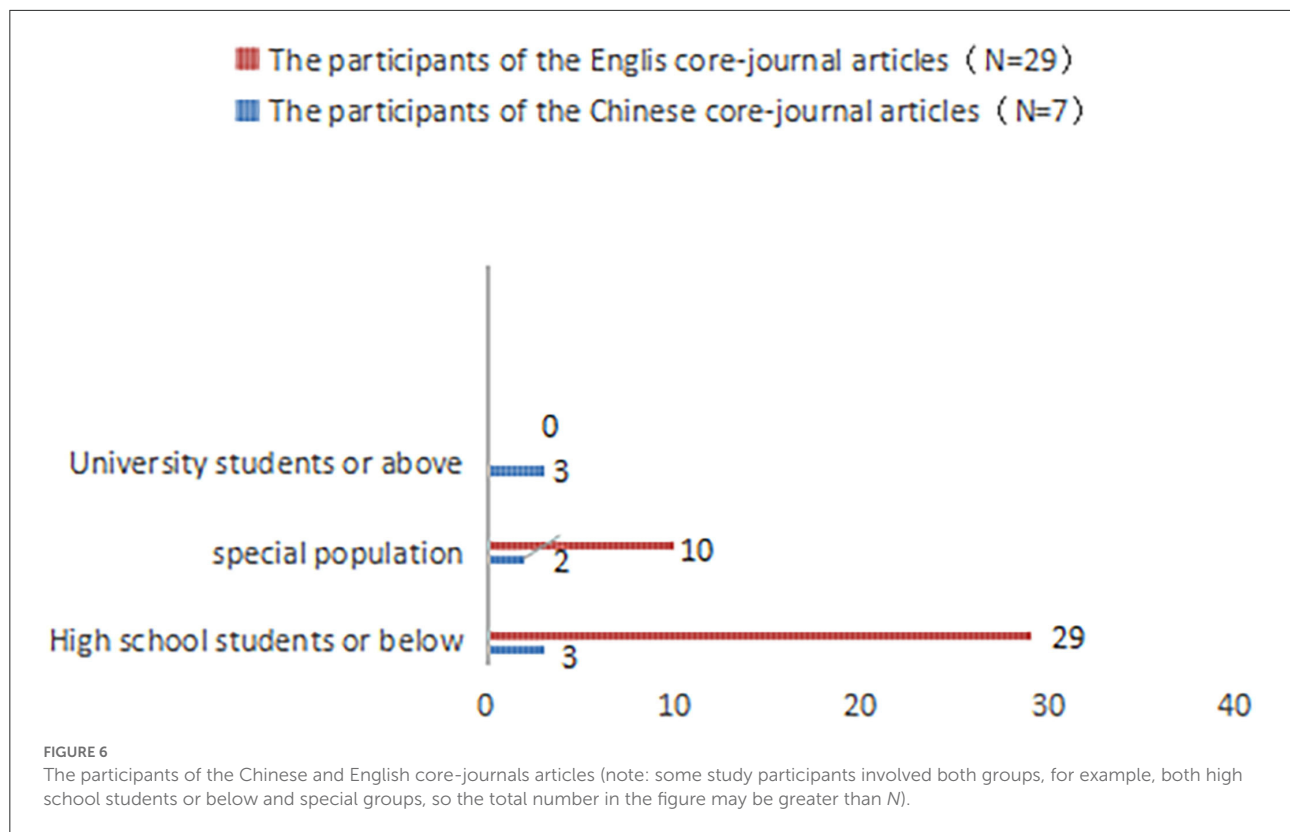
Chinese researchers ([Luo and Xiang, 2011](#)) suggested that school support includes five dimensions, namely environmental support, teacher support, peer support, examination and assessment support, and classroom teaching support. By synthesizing interpersonal support theory and social support theory, [Cao \(2016\)](#) proposed that school support includes three dimensions, namely teacher support, peer support, and student associations support. Based on [Tinto's \(2012\)](#) research on the definition of school support in colleges and universities, [Ying \(2016\)](#) concluded that school support comprised majors and curricular support, teacher teaching support, social support, learning facility support, and living facility support.

Discussion

Theoretical implications

First, this study shows the research trend of academic support for schools in Chinese and English academia from





2000 to 2021 through statistical analysis. The results show an overall increasing trend of Chinese and English literature on school support, indicating that more and more researchers pay attention to the importance of school support to adolescents' learning and growth and conduct academic explorations. However, the relevant literature declined in some years, possibly due to a lack of solid theoretical frameworks and measurement tools for school support. According to the research trend chart of the initial search (Figure 2), it can be seen that the number of Chinese literature ($n = 1,035$) seems to be more dominant than the number of English literature ($n = 549$), which may be because the English literature on WOS already belongs to the "core literature." In contrast, Chinese literature on CNKI includes two categories: non-core journal and core journal. Among them, non-core journal articles were included in the initial steps of identification, which required further screening.

Besides, the identified literature (in both Chinese and English) is concentrated on two disciplines of education and psychology. In other words, the knowledge system of school support involves not only pedagogy but also psychology. Therefore, it is necessary for researchers to integrate a wide range of disciplines to construct a reasonable new system of school support.

Second, this study finds that social support theory, ecosystem theory, and school climate theory are the three theoretical foundations of school support. Other theoretical

foundations, shown in Table 3, such as organizational support theory and self-determination theory, remain important for further exploration of school support. There are multiple interpretations of the conceptual definition of school support, each of which has its own advantages. In particular, the seven Chinese core-journal articles lack a clear conceptual definition (Luo and Xiang, 2011; Zhang et al., 2020). Conversely, the concept of school support was clearly defined in the 29 English core-journal articles, which varied according to different research needs (Fang et al., 2016; Strøm et al., 2016; Yang et al., 2020). For example, Fang et al. (2016) agreed with the definition of Berkowitz and Benbenishty (2012) that school support was the degree to which students receive teacher support and a sense of security in school. Yang et al. (2020) defined school support as school values, school climate, and interpersonal relationships that comprehensively reflect the quality of school life. Some scholars defined school support under the particular research background of "school shooting" as sustainable efforts by schools to support traumatized youth (Strøm et al., 2016). With the continuous change and development of new technologies and knowledge systems (Nica, 2018), especially since the outbreak of COVID-19, a large number of studies pointed out that school teaching methods need to be continuously integrated with technology (Erfayliana et al., 2022; Khasawneh, 2022; Pallavi et al., 2022; Warden et al., 2022). At the same time, the concept of school support should also be constantly broadened

and deepened. For future related research, whether the concept of school support should be limited to the support of teachers or peers is also topics worth exploring.

Third, the findings indicate that studies in both Chinese and English academia are dominated by quantitative research methods, and there is a lack of qualitative or mixed research methods, especially SLR research. Besides, most of the respondents are special student groups or students below high school, and although three of the seven Chinese core-journal articles have focused on college students, such researches are still very limited. According to this study, schools are important places for adolescents' growth and school support is significant for +academic development, as well as the physical and mental health of all students (Eccles and Roeser, 2011; Tang et al., 2013; Strøm et al., 2016). For college students, higher education is of vital importance for their transformation into society (Padgett et al., 2010). Therefore, it is necessary to pay extensive attention to the school support of college students.

Fourth, the findings discover the lack of internationally recognized scales for measuring school support. The Chinese and English core-journals articles employ or integrate different measurement tools, which are not developed explicitly for school support (Torsheim and Wold, 2001; Yang et al., 2020; Zhang et al., 2020). Specifically, English core-journal articles showed high overlap in measuring social support (Torsheim and Wold, 2001; Cupito et al., 2016; Moreira and Lee, 2020) and school climate (Fang et al., 2016; Yang et al., 2020). For example, scales for teacher support and peer support were integrated or used to measure school support (Torsheim and Wold, 2001). In contrast, Chinese core-journal articles attempted to develop scales for school support but lacked global academic recognition. For example, some researchers (Luo and Xiang, 2011) measured school support from five dimensions, which were environmental support, teacher support, peer support, examination and assessment support, and classroom teaching support, and other researchers (Ke et al., 2019) compiled scales with two dimensions of course study resources and venue activity resources, such as libraries, sports venues, and school buildings. Based on the results, most studies agree that teachers and peers are the two most critical components of school support while the measures of some Chinese studies are more comprehensive.

Practical implications

First, the findings indicate a possible research space for exploring school support for college students. Considering the irreplaceable positive significance of school support for all students (Sugai and Horner, 2009; Yang and Li, 2016), it is suggested that future research on school support should focus more on college students to enhance the generalizability of the findings.

Second, it reveals that most studies on school support are quantitative and cross-sectional, which suggests that further qualitative or mixed research methods could be employed. Furthermore, it is recommended to conduct more comparative studies in future empirical studies. For example, future researchers can explore the impact of school support on urban migrants and urban children, or on students from different countries or cultural backgrounds.

Third, the results show that among different definitions of school support, most studies use the concept of teacher support or peer support as a substitute for school support. In contrast, school support in a broader sense is less considered. Thus, future research should explore broader aspects, such as whether the resource support on hardware (school libraries, sports venues, and canteen construction) is an aspect of school support.

Finally, this study points to the urgent need to develop new theoretical models and develop specific school support measurement tools. Authoritative and internationally applicable measurement tools are keys to the school's support for the long-term development of research. By further constructing a conceptual system supported by schools and developing scales with better reliability and validity, this topic can be further developed, thus providing a practical reference for educational management.

Research limitations and future directions for SLR studies on school support

First, only two academic databases (CNKI and WOS) were used in the present study. Future directions regarding SLR studies on school support could be expanded to sample searches in different databases, such as PubMed (US National Library of Medicine, Maryland, USA), Scopus, ScienceDirect (Elsevier, Amsterdam, Netherlands), and Cochrane Library (John Wiley & Sons, New Jersey, USA). Second, this study only selected journals published in Chinese and English. Subsequent SLR studies on school support should take into account publications in other languages. Third, although the risk of bias in methodology and article quality was evaluated, there were only three investigators that had unavoidable personal biases. In follow-up studies, other research methods should be comprehensively considered to reduce bias. Finally, most of the articles in this study were conducted in groups below high school and special student groups, which cannot guarantee a broad representation of the results. Is the positive impact of school support on AIDS orphans aged 15–18 years or on children with cerebral palsy widely applicable to other groups of students with chronic conditions? Does the positive impact of school support on elementary and middle school students apply to college students? The above issues deserve to be further explored in subsequent studies.

Conclusion

Based on the Chinese and English core-journal articles on research about school support from 2000 to 2021 included in the widely acknowledged academic database CNKI and WOS, this study is the first SLR on school support in Chinese and English academia. Through systematic retrieval and unified screening, seven Chinese core-journals articles and 29 English core-journal articles were retrieved for full-text intensive reading and literature analysis. The results of the study are as follows.

- (1) There is an overall upward trend in research on school support.
- (2) The two main disciplines are education and psychology.
- (3) The theoretical basis of the research is social support theory, ecosystem theory, and school climate theory.
- (4) Most of the studies adopt a quantitative approach, and the research objects are mainly focused on special student groups or students below high school.
- (5) There is a lack of unified concept and measurement tools for school support.

Relevant studies suggest that school support has obvious positive significance, which deserves further exploration. This study provides a reference for the future development of school support.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

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Author contributions

JL contributed to the conception of the study and drafted the manuscript. ZH assisted in revising the manuscript. JL, ZH, and LP contributed significantly to the data analysis. LP worked as the writer's assistant. All authors contributed to the article and approved the submitted version.

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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.

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Peers and teachers as the best source of social support for school engagement for both advantaged and priority education area students

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Promoting student's school engagement is a major goal in our society. The literature has shown that students' proximal sources of social support can play a fundamental role in facilitating this engagement. The purpose of this study was (1) to compare perceived support from four sources (mother, father, teacher, and peers) as a function of two different middle-school student backgrounds, a priority education area and a privileged area; (2) and (3) to examine the contribution of these main sources of social support, either directly or indirectly (through sense of school belonging) to school engagement; and (4) to test whether perceived social support is more strongly related to school engagement, directly or indirectly, among students from priority education school compared to students from the advantaged area. In all, 623 middle-school students (aged 11–16) from either a privileged or priority education area participated in this study. The results showed that the mother was perceived as providing more support, followed by the father, the teachers, and the peers. Students from the priority education area perceived more support from their teachers than their counterparts from the more privileged area did. A path analysis showed that each source of social support, except for maternal support, contributed to school engagement. Peers and teachers emerged as the best source of support for school engagement, having significant direct effects among students from the priority education area and both direct and indirect (through the sense of school belonging) effects among students from the advantaged area. Peer support also appears to have a double-edged effect on school engagement among students in the priority education area. This study contributes to enlightening the phenomenon of school engagement in adolescence by clarifying the role

of social support and the related mediating process. Being perceived as an important source of social support by students is not enough to contribute to their sense of school belonging and school engagement.

KEYWORDS

perceived social support, school engagement, sense of school belonging, middle school students, type of school

Introduction

Parents, educators, policymakers, and researchers share a major concern about school engagement as a key factor linked to a variety of important outcomes in the lives of youth with potentially long-term consequences. School engagement, which refers to students' directed and sustained participation in school (Skinner and Pitzer, 2011), predicts positive academic experiences such as learning and achievement, graduation from high school, and entry into and success in higher education (Fredricks et al., 2004). It also contributes to minimizing negative outcomes, such as academic underperformance, grade retention, and school dropout (e.g., Janosz et al., 2000; Archambault et al., 2009). Decades of research have, therefore, shown great interest in the study of factors that foster the development and persistence of school engagement. Perceived social support is one of these factors (e.g., Eccles and Wigfield, 2002; Furrer and Skinner, 2003; Christenson et al., 2012; Wang and Eccles, 2012; Estell and Perdue, 2013). Research on social support in the school context has identified three main sources: parents or family (e.g., Oberle et al., 2010; Wang and Eccles, 2012), teachers (e.g., Archambault et al., 2017; Gutiérrez et al., 2017), and peers, including friends and classmates (e.g., Furrer et al., 2014). Examining which sources of social support best contribute to school engagement appears to be a fundamental step in being able to promote students' school engagement and its positive consequences. Indeed, while there are many studies of the relationship between one or more of these proximal sources of social support and school engagement, they never examine all of the sources at once. Moreover, knowing which sources of social support contribute most to school engagement is particularly important for students at risk of being less engaged, as is the case with middle-school students. Indeed, researchers have identified the middle-school years as an especially risky period for school disengagement (e.g., Eccles et al., 1993; Eccles and Roeser, 2010; Wang and Holcombe, 2010; Wang and Fredricks, 2014). The risk of school disengagement is also increased by the negative stereotype of intellectual inferiority targeting some groups of students, such as students of low socioeconomic status or living in a deprived environment (e.g., Spencer and Castano, 2007; Désert et al., 2009; Loose et al., 2012; Martinot et al., 2020). Therefore, the

purpose of the present study is to examine the relationships between the main sources of social support regarding education and school engagement among middle-school students from disadvantaged and privileged backgrounds.

Sources of social support and school engagement

Research has clearly shown that the relationship that students have with their teachers can have a significant impact on their engagement in school (e.g., Garcia-Reid et al., 2005; Lam et al., 2012; Wang and Eccles, 2012; Estell and Perdue, 2013; Rimm-Kaufman et al., 2014; Archambault et al., 2017; Gutiérrez et al., 2017). Adolescents who have close and caring relationships with teachers presented higher school engagement (e.g., Wang and Holcombe, 2010). For instance, students perceiving high social support from their teachers are more cognitively engaged than those perceiving low support (Wang and Eccles, 2012). Perceived social support from their teachers also reduces students' deviant and socially undesirable behaviors (Birch and Ladd, 1997). According to Christenson et al. (2012), teacher support would mainly influence behavioral engagement and cognitive engagement through instructions, academic support, and class management. In contrast, students are more behaviorally disengaged when their teachers did not respect them (Fredricks et al., 2019) or when they perceive a lack of support from teachers (e.g., Furrer et al., 2014).

Although some studies report a decrease in parental impact as adolescence progresses (Steinberg and Silverberg, 1986; Larson and Richards, 1991), other studies show that parents remain a very important source of influence throughout adolescence (Smetana et al., 2006). Parental support in the school context is defined as the extent to which parents participate in and promote their child's education (Brewster and Bowen, 2004). Wang and Eccles (2012) identified positive association between parental support and students' engagement in school. More precisely, parental support—through goals, expectations, monitoring, learning resources in the home, and/or academic and motivational assistance—is likely to impact adolescents' school engagement (Wentzel, 1998; Chen, 2005; Christenson et al., 2012; Lam et al., 2012;

Wang and Eccles, 2012; Im et al., 2016; Smith et al., 2020). However, research on parental involvement showed that both adolescents and parents perceived mothers to be more involved in homework/schoolwork and school functions than fathers (Paulson and Sputa, 1996). When asked to think of only one person who is supportive of their academic efforts, students usually named their mother (Newman et al., 2000). Despite the support they perceive from their mother, both boys and girls tend to model their father more (Gecas et al., 1974). Because the research presents ambiguous results and rarely compares the role of the father and mother in the child's school engagement, it is relevant to examine how maternal and paternal support respectively contribute to academic engagement.

As young people enter adolescence, socialization through the family gradually fades in favor of peer socialization, which increasingly exerts influence on adolescents (Harris, 1998). The approval of the peer group becomes fundamental in the self-concept development during adolescence (e.g., Harter, 1988). Thus, adolescents' relationships with their peers become closer and more intense throughout middle school (Ryan and Patrick, 2001). Middle-school students need to maintain and establish interpersonal relationships and develop social identities (Sweeting et al., 2011). Students' school relationships would influence their engagement through shared common school values, educational expectations, attendance, aspirations for learning, and/or academic beliefs and efforts (Christenson et al., 2012; Wang and Eccles, 2012). Thus, peer support is positively related to school engagement (Chen, 2005; Juvonen et al., 2012; Wang and Eccles, 2012; Im et al., 2016; Benner et al., 2017; Wang et al., 2018). In contrast, students who have poor relationships with their peers or are actively rejected by their peers have higher levels of disengagement from school (Juvonen et al., 2012; Ladd et al., 2017). They were also more disengaged when their peers were off task (Fredricks et al., 2019). However, peer support, despite being fundamental for adolescents, might have less impact than teacher and parent support. Indeed, some studies have suggested that, compared to peer support, teacher and parent support are better predictors of student engagement and academic performance (Lam et al., 2012; Estell and Perdue, 2013). Meanwhile, there are few studies to support this argument, it is interesting to test whether peers actually contribute less than other proximal sources of social support to school engagement, especially during adolescence.

It, therefore, seems relevant to explore which source(s) of social support—teachers, parents distinguishing between father and mother, and peers—best predict school engagement, even though each of these sources is likely to predict school engagement. Moreover, researchers agree that engagement is a multidimensional construct, or a meta-construct, whose dimensions typically include behavioral, emotional, cognitive (e.g., Fredricks et al., 2004; Estell and Perdue, 2013), and more recently social engagement (Wang et al., 2019). Behavioral engagement refers to how well students behave

in class, the extent of their participation in academic, social, or extracurricular activities, and the absence of disruptive behaviors, such as skipping school or getting into trouble (i.e., behavioral disengagement) (e.g., Fredricks and McColskey, 2012; Wang and Degol, 2014). Emotional engagement is defined as students' feelings about their school, teachers, and classrooms (e.g., Estell and Perdue, 2013) and focuses on the extent of positive (and negative) reactions to teachers, classmates, academics, or the school (e.g., Fredricks and McColskey, 2012). The more negative feelings students have, the more emotionally disengaged from school. Cognitive engagement is reflected in the student's degree of investment in learning and willingness (or unwillingness) to put in the effort necessary to understand complex ideas and master difficult skills or in his or her lack of persistence and cognitive effort to complete the task (i.e., cognitive disengagement) (e.g., Fredricks et al., 2004). Finally, social engagement is defined in terms of the degree of participation, collaboration with classmates, strengthening friendships in the school context (Linnenbrink-Garcia et al., 2011), or conversely (social disengagement), lack of interest in people at school (Wang et al., 2019). The study of engagement as multidimensional and as arising from an interaction between the student and her/his sources of social support is likely to help us better understand the complexity of students' experiences in school and identify which social support to target more specifically in interventions.

Sense of school belonging as a mediating process

According to the student engagement model (Christenson et al., 2012), teacher, parental, and peer support are expected to impact school engagement through the sense of school belonging. A sense of belonging or psychological membership in the school or classroom corresponds to the extent to which students feel personally accepted, respected, included, and supported by others in their school environment (Goodenow, 1993b). Students who feel a sense of belonging in an educational environment are more engaged in classroom activities, are more motivated, are more likely to participate in extracurricular activities, report a greater sense of academic self-efficacy, and experience reduced risk behavior and depressive symptoms (Goodenow, 1993a; Walton et al., 2012; Lardier et al., 2018; Aelenei et al., 2020). Conversely, a decrease in school belonging is associated with decreased academic interest, motivation, low academic achievement, and behavioral school disengagement (Goodenow, 1993a; St-Amand et al., 2017), especially in middle-school years (Benner et al., 2017). According to Benner et al. (2017), school belonging appeared to play the most prominent buffering role in relation to school engagement, and also students' depressive symptoms or loneliness.

Sense of school belonging is achieved through the reciprocal social relationships between the student and others implied in the school context (Finn, 1989; Goodenow, 1993a). To feel a sense of belonging to their school, students must not only have confidence in their school and adopt its values but also have positive relationships with their peers and teachers (e.g., secure and satisfying social engagement; St-Amand et al., 2017). When students feel well integrated into their peer group and recognized and supported by their teachers, they will promote the values attached to the school and will be able to develop a sense of school belonging (Duru-Bellat et al., 2008), which can in turn promote student participation and, thus, plays a role in school engagement (Furrer and Skinner, 2003). On the contrary, young people who feel unsupported by school adults and classmates are at risk of developing a low or absent sense of psychological school belonging, which may reduce school engagement (Goodenow, 1993a). Thus, in the present study, we test sense of school belonging as a potential mediating process of the effect of perceived social support on school engagement in middle-school students. We hypothesize that the more social support students perceive, the higher their sense of school belonging. In turn, a higher sense of school belonging will lead to increased school engagement. We also examine whether some sources of perceived support (father, mother, teachers, and peers) are more prone to enhance students' sense of school belonging and, consequently, their school engagement.

Links between social support and school engagement according to students' social background

Youth from low socioeconomic status (SES) tends to struggle more academically, typically advancing less far in school than their more affluent peers (e.g., Kena et al., 2016; Institut national de la statistique et des études économiques [INSEE], 2020). Several studies have shown that SES, parental education level, and residential neighborhood are related to disengagement from school (e.g., Kurdek and Fine, 1993; Kurdek and Sinclair, 2000). Because students from low SES and/or with less educated parents face negative stereotypes of intellectual inferiority (e.g., Spencer and Castano, 2007; Désert et al., 2009), they are likely to perceive differential treatment or social injustice because of their group membership. Such a perception can lead them to experience a higher fear of failure and uncertainty about their capacity to succeed in school (Gecas, 1989; Spencer and Castano, 2007; Désert et al., 2009; Wiederkehr et al., 2015), thereby leading them to disengage from school (e.g., Crocker et al., 1998; Major and Schmader, 1998; Major and Schmader, 2001; Major et al., 1998; Schmader et al., 2001; Martinot et al., 2020). Thus, middle-school students from disadvantaged backgrounds are at greater risk of lower school engagement than their more privileged counterparts.

However, previous studies have demonstrated the contribution that social support networks have in the lives of disadvantaged youth (Hayes et al., 2014). Recent findings suggest that social support is positively related to the sense of school membership of students from disadvantaged backgrounds (Lardier et al., 2018). Moreover, parental support has been found to increase the likelihood of school engagement in Hispanic adolescents in the United States, while teacher support has been found to have an equally beneficial effect on reducing the likelihood of school failure for these students (e.g., Brewster and Bowen, 2004; Garcia-Reid et al., 2005; Garcia-Reid, 2007). Because supportive relationships provided by parents, peers, and teachers may serve as a safety net for students evolving in a disadvantaged environment (Garcia-Reid, 2007; Garcia-Reid et al., 2015; Lardier et al., 2019), the links between social support and school engagement might be stronger for students from disadvantaged areas than for students from the more privileged areas. Moreover, research has shown that low SES students also have a more interdependently shaped self-construal than higher SES students (Stephens et al., 2014). Therefore, one objective of the present study is to compare the direct and indirect (through sense of school belonging) effects of social support on the school engagement of French students from a priority education area with those from a more privileged area. Students enrolled in French priority education middle schools come from low or very low socioeconomic backgrounds. Such schools are located in economically depressed neighborhoods and benefit from compensatory education funds. We hypothesize that because parents, peers, and teachers may serve as more of a safety net for students in the priority education areas, social support (regardless of the source) might be more beneficial for them compared to students in more privileged areas.

Present study

The originality of this study is to examine the links among four sources of social support (father, mother, teachers, and peers), sense of school belonging, and multidimensional engagement among middle-school students from two contrasted types of school. Indeed, no study has ever examined all four sources at once to determine which source(s) students perceive as most supportive of their schooling, whether that perception is related to their social background, and whether and how (directly or indirectly) that perceived support is related to their school engagement. First, we examine which source of social support is perceived as the most supportive depending on whether students are enrolled in a priority education school—namely, students from low SES and living in a disadvantaged area—or in a school located in a more socioeconomically privileged area (i.e., students from higher SES). This question is relatively exploratory because no previous

study has examined this, even though teacher support (Garcia-Reid, 2007) and paternal support (Pujol, 1995; Bardou and Oubrayrie-Roussel, 2012) could be perceived as more important for students from disadvantaged social backgrounds than for those from more privileged social backgrounds. However, given that low-SES students have a more interdependent self-construal than higher-SES students (Stephens et al., 2014), we expect that (H1) students from disadvantaged social backgrounds will perceive more social support than those from more privileged social backgrounds. Second, we explore the specific contribution of the main sources of perceived social support to school engagement. We expect that (H2) all examined sources of perceived social support (teacher, mother, father, and peer support) predict school engagement. Third, we test whether the sense of school belonging is a mediator of the effects of perceived social support on school engagement. We expect that (H3) the more social support students perceive, the higher their sense of school belonging. In turn, a higher sense of school belonging will be associated with increased school engagement. Fourth, we expect that (H4) perceived social support is more strongly related to school engagement, directly or indirectly, among students enrolled in a priority education school compared to students enrolled in a school located in a more socioeconomically privileged area.

Materials and methods

Participants and procedure

In all, 674 students were asked to participate in the study. A preselection was made based on their family situation and 47 students belonging to a single-parent family were not retained in order to keep only participants who rated social support from the four sources. We also excluded four participants who did respond to the teacher or peer support items, which led to a final sample of 623 participants (including 310 boys, 307 girls, and six participants who did not report their gender). The sample comprised students in sixth grade ($n = 153$), seventh grade ($n = 186$), eighth grade ($n = 167$), and ninth grade ($n = 117$). Participants ranged in age from 11 to 16 years old, with a mean of 12.97 years old ($SD = 1.20$). From a large provincial city, 323 students were enrolled in a priority education middle school. As explained earlier, French priority education middle schools are located in economically depressed neighborhoods, benefit from compensatory education funds, and enroll students from low or very low socioeconomic backgrounds. From the same city, 300 students were enrolled in a school classified as socioeconomically privileged by the Board of Education. Such classification means that students enrolled in the school come from higher socioeconomic backgrounds and live in economically advantaged neighborhoods. We do not

have any data on the participants' race or ethnicity as French legislation strictly limits the collection of such information. An institutional ethics committee approved the research protocol (#IRB00011540-2019-21). School authorities and teachers were informed of the actual purpose of the study as part of the collaboration between the first author of the manuscript and the institutions involved. Parents were informed by a letter stating the purpose of the study, the same as that given to the children on the day of the study. The study was, therefore, presented to parents and children as a survey looking at the daily life of middle-school students to learn more about them. Informed consent to participate in this study was obtained first from school authorities and teachers, then from parents, and finally from students. All were assured that the data would remain anonymous and confidential.

Participants completed a paper-and-pencil questionnaire that included the measures detailed below, which were selected to tap into the theoretical concepts. To ensure proper understanding of the items, especially for younger students, the experimenter read aloud each of the questionnaire items to all the students and then let them respond individually. At the end of the questionnaire, the experimenter debriefed the students to reveal the purpose of the study and answer any questions they had.

Measures

Perceived social support

We used the Significant Other Academic Support Scale (SOASS) developed by Sands and Plunkett (2005), a 30-item scale that measures academic support from five different sources (mother, father, teachers, classmates, and close friends). Participants were asked to rate the support provided by each source on six different items using a scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Because we had no hypothesis regarding potential differences between the support provided by classmates and close friends, we considered them the same source—that is, peer support (see [Supplementary material](#) for confirmatory factor analysis). The four dimensions of support showed satisfactory reliability: mother ($\alpha = 0.86$), father ($\alpha = 0.89$), teacher ($\alpha = 0.88$), and peer support ($\alpha = 0.91$).

Sense of school belonging

We used a 5-item French version (Aelenei et al., 2020) of the Psychological Sense of School Membership (PSSM) Scale (Goodenow, 1993b). The participants rated each item (e.g., *I could really be myself in this class*) using a scale from 1 (*Strongly disagree*) to 7 (*Strongly agree*). The scale showed great reliability ($\alpha = 0.79$) once one item was dropped because of its very low communality (0.03) and its very small correlations with the rest of the items ($r_s < 0.15$), which suggested it did not share much variance with the other items.

School engagement

Finally, participants completed the 30 items of the Multidimensional School Engagement Scale (Fredricks et al., 2019; Wang et al., 2019). As we adapted this scale to the French school context, we first conducted an exploratory factor analysis on IBM SPSS AMOS (Arbuckle, 2019) using oblimin direct rotation. To find a reliable structure for our data, we successively removed cross-loading items and items that did not significantly load on a factor (<0.30). We reached a final structure comprising 24 (out of 30) items distributed along with four factors (see Table 1). The first factor, accounting for 25.36% of the variance, included 14 items (with three reverse items) corresponding to cognitive engagement—that is, the degree of student investment in learning. The second factor included five items only describing behavioral disengagement (i.e., students' engagement in maladaptive, anti-school behaviors) and accounted for 8.71% of the variance. The third factor comprised seven items (including three reverse items) referring to social engagement—namely, students' daily social interaction and collaboration with peers on educational content and the development of friendships—and explained an additional 5.82% of the variance. The fourth factor comprised four items only referring to emotional disengagement (e.g., boredom, anxiety toward their school and teachers) and explained another 5.15% of the variance. Among these four factors, only three (cognitive engagement, social engagement, and behavioral disengagement) appeared to have a satisfying internal consistency (see Table 1) and were therefore retained for path analysis. Scores for each factor were calculated by computing the average of the scores for all items comprising the factor. High scores represent greater cognitive engagement, social engagement, and behavioral disengagement in the school context.

Data analyses

Analyses were computed using the statistical software IBM SPSS 25 (IBM Corp, 2017) and IBM SPSS AMOS (Arbuckle, 2019). First, we conducted an ANOVA with the type of school as a between-participant factor and source of perceived social support as a within-participant factor to test our first hypothesis. Second, to test the other three hypotheses, we conducted path analysis using IBM SPSS AMOS 25 (Arbuckle, 2019) with the maximum likelihood estimation method. We performed bootstrapping (using 5,000 bootstrap samples) to anticipate potential normality issues and compute indirect effects (Hoyle, 2012). Multiple fit indices were computed to estimate the fit of the hypothesized model. Selected indices include the robust root mean square error of approximation (RMSEA; Steiger, 2016) and its 90% confidence interval, the Bentler (1990) comparative fit index (CFI), and the Tucker–Lewis Index (TLI; Tucker and Lewis, 1973). Values below 0.06 for the RMSEA and values above

0.95 for the CFI and TLI can be considered as a demonstration of a good fit between the predictive model and the data (Hu and Bentler, 1999).

Results

Comparison of the four sources of support

For this first objective, we conducted an ANOVA with the type of school (privileged area vs. priority education area) as a between-participant factor and social support (mother, father, teachers, and peers) as a within-participant factor to investigate which source students perceived as providing the more support and to test whether students from different socioeconomic backgrounds had different perceptions of the social support they receive. The results showed that the amount of perceived support depended on the source, $F(3, 1863) = 332.55, p < 0.001, \eta^2_p = 0.35$. The mother ($M = 6.16, SE = 0.04$) was perceived as providing more support, followed by the father ($M = 5.71, SE = 0.06$), the teachers ($M = 5.03, SE = 0.06$), and the peers ($M = 4.33, SE = 0.05$). Thus, peers were perceived as a lesser source of academic support than the others (see Table 2). This main effect was qualified by a significant interaction with the type of school, $F(3, 1863) = 3.08, p = 0.026, \eta^2_p = 0.01$. In both schools, the ranking from the most supportive (mother) to the least supportive (peers) sources was the same as the one presented below (see Table 2). The only significant difference between the two schools was in teacher support, which partially confirms our first hypothesis (H1). Indeed, students from the priority education area perceived more support from their teachers than students from the privileged area did ($p < 0.01$). However, the two subsamples did not differ concerning the other three sources.

Links between sources of social support, sense of school belonging, and school engagement

Two other main objectives of this study were to examine the links between the four sources of social support and school engagement and to investigate the mediating role of the sense of school belonging in these relationships. Thus, we conducted path analysis using the structural equation modeling software IBM SPSS AMOS (Arbuckle, 2019) to test the relationships among social support, sense of school belonging, and school engagement. It should be noted that all the effects remained significant when age and gender were included as covariates in the model.

We developed the operational model presented in Figure 1. Correlations among all measures are presented in Table 3. All

TABLE 1 Results from the factor analysis of school engagement.

	Factor loading				Explained variance	Cronbach's alpha (α)
	1	2	3	4		
Factor 1. Cognitive engagement					25.36%	0.88
Doing well in school is important to my future	0.72					
I contribute to what we are doing in class.	0.71					
I ask questions when I don't understand.	0.70					
I figure out what I did wrong when I make mistakes on my schoolwork.	0.69					
I keep trying even when I get stuck on my schoolwork.	0.66					
I look over my schoolwork and make sure it is done well.	0.65					
I am interested in what we are learning at school.	0.61					
I plan out how to finish my schoolwork.	0.61					
If I don't understand a task, I give up right away.	-0.60					
I work hard in the face of difficulties at school.	0.54					
Finishing my homework fast is more important to me than doing it well.	-0.45					
I always try my best in school.	0.44					
I get involved in school activities (e.g., school events)	0.36					
I don't pay attention in class.	-0.33					
Factor 2. Behavioral disengagement					8.71%	0.78
I find reasons to get out of class.		0.76				
I don't follow school rules.		0.74				
I find ways to be late for school.		0.73				
I goof off during work time in class.		0.69				
I don't complete my homework.		0.37				
Factor 3. Social engagement					5.82%	0.68
I enjoy spending time with peers at school			0.75			
I enjoy working with peers at school.			0.57			
I don't care about the people at my school			-0.46			
Interacting with peers isn't an important part of school for me.			-0.45			
I am open to making new friends at school.			0.43			
I enjoy working with peers at school			0.36			
I don't have friends in school.			-0.34			
Factor 4. Emotional disengagement					5.15%	0.54
I feel frustrated in school.				0.64		
I feel worried in school.				0.55		
I get in trouble at school.				0.40		
I feel overwhelmed by my schoolwork.				0.39		

TABLE 2 Means scores for perceived social support depending on its source and the type of school.

	Priority education school	Privileged school	<i>F</i>	<i>p</i>	τ^2_p
Mother	6.15 (0.06)	6.17 (0.06)	0.07	0.79	0.00
Father	5.74 (0.08)	5.69 (0.08)	0.22	0.65	0.00
Teachers	5.19 (0.08)	4.83 (0.08)	8.32	0.00	0.01
Peers	4.41 (0.07)	4.25 (0.08)	2.02	0.13	0.00

Standard errors for mean scores are presented in parentheses.

sources of social support are positively correlated with one another. Regarding the correlations between the dimensions of school engagement, the results indicated that cognitive engagement is moderately and positively related to social engagement ($r = 0.17$) but negatively related to behavioral disengagement ($r = -0.57$).

Results of the path analysis indicated that the model did not fit the data very well, $\chi^2 (3, N = 623) = 204.02, p < 0.001$; RMSEA = 0.33, 90% CI [0.29,0.37]; CFI = 0.80, TLI = 0.88. The modification indices suggested that estimating the correlations between the errors of the cognitive and behavioral disengagement dimensions would significantly improve the fit

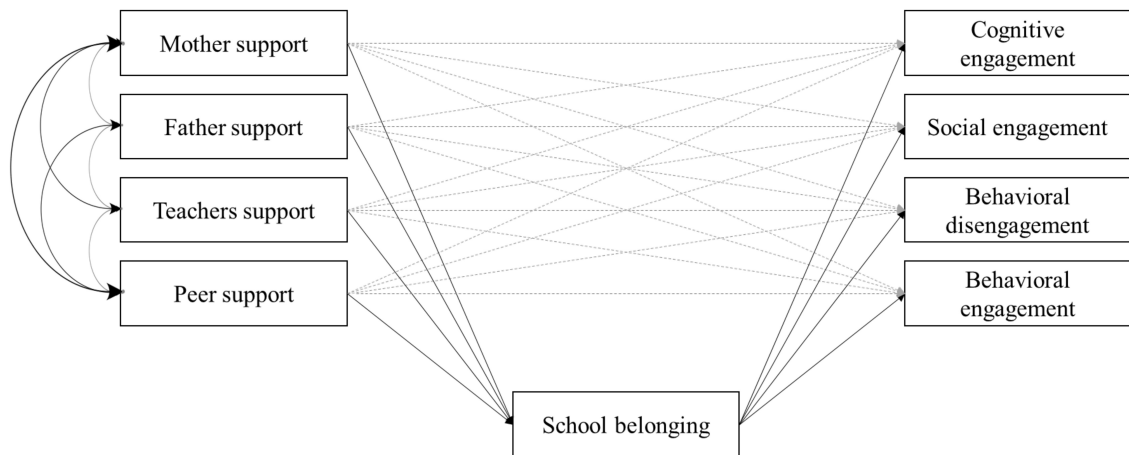


FIGURE 1
Hypothesized model regarding the relationships among social support, sense of school belonging, and school disengagement.

TABLE 3 Bivariate correlations between measures.

Variable	2	3	4	5	6	7	8	9
Mother support	0.39**	0.35**	0.24**	0.19**	0.26**	−0.13**	0.18**	0.01
Father support		0.30**	0.23**	0.18**	0.33**	−0.15**	0.150**	−0.02
Teacher support			0.42**	0.26**	0.41**	−0.26**	0.18**	−0.11**
Peer support				0.26**	0.23**	−0.03	0.37**	−0.06
School belonging					0.26**	−0.13**	0.41**	−0.14**
Cognitive engagement						−0.57**	0.17**	−0.00
Behavioral disengagement							−0.02	−0.14**
Social engagement								0.10*
School type								

* $p < 0.05$, ** $p < 0.01$. School type was coded −0.5 for the priority education school and 0.5 for the privileged school.

of the model ($MI = 172$ for the correlation between cognitive engagement and behavioral disengagement). The need to estimate this correlation implies that the predictors investigated in the present model do not account for the entirety of the correlations among the two dimensions. However, they seemed to account for their correlation with the social dimension of engagement. As we only investigate predictors related to the social aspect of schooling, such an assumption makes sense. Therefore, we decided to test a new version of our model in which we added the suggested path. The results showed that this improved model fit the data very well, $\chi^2(2, N = 623) = 2.68$, $p = 0.26$; $RMSEA = 0.02$, 90% CI [0.00,0.09]; $CFI = 0.99$, $TLI = 0.99$. Standardized regression coefficients for direct and indirect effects are presented in Table 4. The proportions of variance explained in the model were $R^2 = 0.11$ for sense of school belonging, $R^2 = 0.23$ for cognitive engagement, $R^2 = 0.09$ for behavioral disengagement, and $R^2 = 0.25$ for social engagement.

Social support appeared to have significant direct and indirect (through the sense of school belonging) effects on

school engagement (see Table 4). Starting with direct effects, results showed that, as expected in H2, each source of social support, except for maternal support, predicted school engagement on at least one of these dimensions. Teacher and peer support predicted two dimensions of school engagement. Specifically, peer support was the only source to have a significant and positive effect on social engagement. It also positively predicted behavioral disengagement. Teacher support had a negative effect on behavioral disengagement and a positive effect on cognitive engagement. Cognitive engagement was also directly predicted by paternal support.

In relation to H3, the results showed that our hypothesized mediator, sense of school belonging, was predicted by the teacher and peer support and then positively predicted cognitive and social engagement and negatively behavioral disengagement. Consequently, teacher and peer support appeared to have significant indirect effects on the three dimensions of school engagement through sense of school belonging. However, social support explains a small proportion of the variance for sense of school belonging.

TABLE 4 Standardized coefficients, standard errors, and significance for direct and indirect effects.

Variable	Direct effects					Indirect effects				
	Estimate	SE	95% bootstrap CI		p	Estimate	SE	95% bootstrap CI		p
			LL	UL				LL	UL	
School belonging										
Mother support	0.07	0.05	−0.01	0.18	0.10					
Father support	0.07	0.05	−0.02	0.17	0.13					
Teacher support	0.14	0.05	0.04	0.24	0.01					
Peer support	0.17	0.04	0.08	0.26	0.00					
Cognitive engagement										
School belonging	0.14	0.04	0.06	0.23	0.00					
Mother support	0.05	0.04	−0.03	0.13	0.22	0.01	0.01	−0.00	0.03	0.08
Father support	0.19	0.04	0.10	0.28	0.00	0.01	0.01	−0.00	0.03	0.09
Teacher support	0.29	0.04	0.21	0.37	0.00	0.02	0.01	0.01	0.04	0.00
Peer support	0.02	0.04	−0.07	0.10	0.70	0.02	0.01	0.01	0.05	0.00
Behavioral disengagement										
School belonging	−0.08	0.04	−0.16	0.01	0.07					
Mother support	−0.02	0.04	−0.11	0.06	0.65	−0.01	0.01	−0.02	0.00	0.09
Father support	−0.07	0.05	−0.17	0.02	0.11	−0.01	0.01	−0.02	0.00	0.09
Teacher support	−0.27	0.05	−0.367	−0.16	0.00	−0.01	0.01	−0.03	−0.00	0.03
Peer support	0.12	0.05	0.03	0.22	0.01	−0.01	0.01	−0.03	0.00	0.04
Social engagement										
School belonging	0.34	0.04	0.26	0.42	0.00					
Mother support	0.06	0.04	−0.02	0.15	0.13	0.02	0.02	−0.00	0.06	0.09
Father support	0.01	0.04	−0.07	0.09	0.80	0.02	0.02	−0.01	0.06	0.12
Teacher support	−0.05	0.04	−0.14	0.03	0.23	0.05	0.02	0.01	0.09	0.01
Peer support	0.28	0.04	0.20	0.36	0.00	0.06	0.02	0.03	0.09	0.00

CI, confidence interval; LL, lower limit; UL, upper limit.

The fourth aim (H4) of the present study was to test whether perceived social support is more strongly related to school engagement, directly or indirectly, among students enrolled in a priority education school compared to students located in a more advantaged area. Therefore, we conducted a multiple-group analysis to test whether the paths of our model vary depending on the type of school students attend (privileged area vs. priority education area). The analysis indicated that constraining the structural weights to equality between the two groups did not lead to significant reductions in the fit of the model. However, constraining the covariances and residuals to equality between the groups led to significant reductions in the fit of the model, suggesting that these parameters differ depending on students' background. Fit indices for the unconstrained model and model comparisons are presented in Table 5, and regression coefficients for each school type are available in Table 6.

Concerning the direct effects of social support on school engagement, the results showed that peer support significantly and positively predicted the social engagement for all students, but positively predicted the behavioral disengagement for

students from the priority education area only. Teacher support positively predicted cognitive engagement and negatively predicted behavioral disengagement of all students. Paternal support predicted the cognitive engagement of all students. It should be noted that maternal support marginally predicted sense of school belonging for students from a priority education area only, while paternal support marginally predicted sense of school belonging for students from a privileged area only. Concerning the indirect effects, it appears that the sense of school belonging was more likely to moderate the effect of social support on the academic engagement for students from a privileged area middle school than for those from a priority education area middle school. More precisely, among students from a privileged area, teacher, peer and paternal support had an indirect effect, through sense of school belonging, on cognitive engagement and behavioral disengagement. Teacher, peer, and paternal (marginally significant) support also indirectly predicted the social engagement of these students. Among students from a priority education area, peer support had a significant indirect effect, through sense of school belonging, on both social engagement and cognitive engagement (marginally

TABLE 5 Model fit for the unconstrained model and model comparison.

	CMIN	DF	P	RMSEA	CFI	TLI
Unconstrained model	8.96	4	0.06	0.04	0.99	0.93
Comparison between the unconstrained model and the model containing structural weights	20.82	19	0.35	−0.02	−0.00	0.05
Comparison between the structural weights model and the model adding constraints to covariances	19.86	10	0.03	0.01	−0.01	−0.01
Comparison between the structural covariance model and the model adding constraints to residuals	13.10	5	0.02	0.00	−0.01	−0.01

TABLE 6 Standardized coefficients for direct and indirects effects depending on the type of school.

	Direct effects		Indirect effects	
	Priority education school	Privileged school	Priority education school	Privileged school
School belonging				
Mother support	0.13 ^t	0.05		
Father support	0.02	0.12 ^t		
Teacher support	0.04	0.20**		
Peer support	0.19***	0.15*		
Cognitive engagement				
School belonging	0.10	0.22***		
Mother support	0.05	0.03	0.02	0.01
Father support	0.22***	0.14**	0.00	0.03*
Teacher support	0.31***	0.26***	0.00	0.044***
Peer support	0.02	0.02	0.012 ^t	0.034**
Social engagement				
School belonging	0.36***	0.36***		
Mother support	0.06	0.05	0.07*	0.02
Father support	−0.03	0.05	0.02	0.04 ^t
Teacher support	0.00	−0.06	0.01	0.07**
Peer support	0.28***	0.28***	0.05**	0.05**
Behavioral disengagement				
School belonging	−0.07	−0.15**		
Mother support	0.04	−0.06	−0.01	−0.01
Father support	−0.07	−0.07	−0.00	−0.02*
Teacher support	−0.33***	−0.24**	−0.00	−0.03**
Peer support	0.17**	0.06	−0.01	−0.02**

^t $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

significant). Only among these students, maternal support indirectly predicted social engagement (see Table 6).

Discussion

The purpose of this study was to examine the links among four sources of social support (father, mother, teachers, and peers), sense of school belonging, and multidimensional engagement among middle-school students from two contrasted types of school. The originality was to determine,

according to the students' social background, which source(s) the students perceived as most supportive of their schooling, whether and how (directly or indirectly) this perceived support was related to their school engagement. Therefore, (1) we compared perceived support from four sources (mother, father, teacher, and peers) as a function of two different middle-school student backgrounds, a priority education area and a privileged area; (2) and (3) we examined the contribution of these main sources of social support, either directly or indirectly (through sense of school belonging), to school engagement; and (4) we tested whether perceived social support was more strongly

related to school engagement, directly or indirectly, among students from priority education school compared to students from the advantaged area.

Regarding the first objective (i.e., explore which source was perceived as the most supportive, and to compare as a function of student background), the results showed that the mother was perceived as providing more support, followed by the father, and the teachers. Peers were perceived as a lesser source of academic support than the others. Our hypothesis H1 was partially validated because students from the priority education area perceived more social support than students from the privileged area only in teacher support. In French education priority schools, the education policy gives priority to pedagogical action—specifically, coherent, caring, and demanding pedagogical and educational practices adapted to the needs of students and designed to last. These special teaching conditions seem to allow for closer and more sustained relationships between teachers and students.

Regarding the second objective (i.e., the contribution of the four sources of social support to school engagement), the results showed that our hypothesis H2 was mostly validated. Each source of social support, except for maternal support, contributed to school engagement. Perceived teacher and peer support had the strongest impact on school engagement. More precisely, the more support students perceived from their peers, the more social engagement. More surprisingly, the more support students perceived from their peers, the more behavioral disengagement they also reported. The fact that, for all adolescents, engaging in disruptive behaviors and being a “trouble-maker” can increase their popularity and prestige with their peers and give them social recognition (Coie and Jacobs, 1993; Sweeting et al., 2011) may explain such a result. Youth place increasing importance on their relationships with peers, and this priority may be in opposition to the demands of schooling (Witherspoon and Ennett, 2011). As we will explain in relation to H4, this tendency was more pronounced among students in the priority education school. However, given that social support explains only a very small proportion of the variance for behavioral disengagement, caution should be exercised in interpreting this potentially negative peer contribution.

In addition, the more students perceived that their teachers supported them, the more cognitively engaged they were and the less likely they were to behaviorally disengage from school. Such findings corroborated qualitative findings (Fredricks et al., 2019) demonstrating the important role of teachers and peers in engagement. Finally, the more support students perceived from their father, the more cognitive engagement they reported. Consistent with Gecas et al. (1974), again in 2022, students seem to model their father more when they develop beliefs about themselves (e.g., self-efficacy, motivation), and put forth the effort necessary to master difficult skills.

Consistent with H3 (and the third objective), sense of school belonging appeared to be a mediator of the effects of perceived social support on school engagement. Indeed, teacher and peer support had significant indirect effects on the social and cognitive dimensions of school engagement, through sense of school belonging. They also had a significant and negative indirect effect on behavioral disengagement. Thus, the more social support students perceived from their teacher and peers, the higher their sense of school belonging. In turn, a higher sense of school belonging predicted less disruptive behaviors. However, social support explains only a quite small proportion of variance for sense of school belonging. Even if the role of this mediating process remains modest, it seems that sense of school belonging and school engagement are promoted primarily by the social support of those who are directly involved with students in their school environment—namely, teachers and peers. In addition, although teacher and peer support directly contributed the most to the different dimensions of school engagement, students perceived them as less supportive than their parents, especially their mother. As Beckert et al. (2007) suggested, the fact that, compared to their father, most children spend more time with and have access to their mother after school probably explains why mothers are viewed more highly in most parenting domains (see also, Richardson et al., 1984; Newman et al., 2000). However, it is worth noting that the mother was the only source to not predict any dimension of school engagement. This result underscores that being perceived as an important source of social support by students is not enough to contribute to their sense of school belonging and school engagement. Therefore, it is important that researchers and education personnel do not confuse perceived or reported social support with its real contribution to school engagement.

The fourth main objective of the present study was to compare the contribution of perceived social support to school engagement as a function of student background. Perceived social support predicted school engagement for both subsamples of students. More precisely, for both student groups, paternal and teacher support positively predicted cognitive engagement, teacher support also negatively predicted behavioral disengagement. Thus, regardless of the students' background, in predicting cognitive engagement, paternal and teacher support are positively related to students' beliefs about themselves (e.g., self-efficacy, motivation), thinking, and willingness to put in the effort necessary to understand complex ideas and master difficult skills (e.g., Fredricks et al., 2004). In addition, teacher support is likely to reduce being off task, adopting disruptive behaviors, and/or abstaining from participation, i.e., deviant and socially undesirable behaviors related to behavioral disengagement (e.g., Birch and Ladd, 1997). By positively predicting social engagement for both subsamples, peer support is likely to improve middle-school students' participation, collaboration with classmates, and strengthening

of friendships in the school context (Linnenbrink-Garcia et al., 2011). However, peer support is likely to have a double-edged effect among students in the priority education area as it was only among these students that peer support positively predicted behavioral disengagement. On one hand, the more these students perceived social support from their peers, the more they reported social engagement. Such a result tends to show that peers may serve as a safety net for students evolving in a disadvantaged environment (Garcia-Reid, 2007; Garcia-Reid et al., 2015; Lardier et al., 2019). Feeling included by their peers would put these students in a good position to ask for help from peers (Flook et al., 2005) and, thus, can promote student participation and collaboration (Furrer and Skinner, 2003). On the other hand, the more priority education school students perceived social support from their peers, the more they reported behavioral disengagement. Such a result suggests that students from a priority education area will engage in disruptive behaviors to be accepted and appreciated by their peers. This finding is in line with previous work showing that middle-school students from a priority education area tend to develop oppositional behaviors in school to protect their social self-esteem (such as discounting their academic grades) (Martinot et al., 2020). The disadvantaged neighborhood in which these adolescents live may influence their participation in deviant behaviors (Ensminger et al., 1996) because they are more likely to associate with peers who disproportionately dropout of school compared to their counterparts from more advantaged school areas. Future studies should address which behaviors can be simultaneously perceived as high in terms of peer support (or perceived popularity) and collaboration with classmates on academic tasks as this would maximize the beneficial effect of peer support on social engagement and reduce its deleterious effect on behavioral disengagement among students from a priority education area.

In addition, the effects of perceived social support on school engagement seem to be more independent of sense of school belonging among the priority education area students compared to their advantaged counterparts. Among the priority education area students, only peer and mother support contributed to sense of school belonging and in turn, this sense was related to social engagement. Peer support was also indirectly and marginally related to cognitive engagement. Comparatively, each source of support (except for mother) is related to each dimension of engagement through sense of school belonging among students in the privileged school. Recently, Jury et al. (2019) explained the poorer sense of college belonging among low SES university students compared to their high SES counterparts by the lower prestige the former feel they have in the eyes of others. If the importance of perceived prestige in the eyes of others is already at work in adolescence, we can assume that students from a priority education area (i.e., from low SES) perceive less of it from

their father and teachers than their counterparts from a privileged area. This may explain why teacher and father (more marginally) support contributed to the sense of school belonging among the latter only. However, we suggest that students from priority education backgrounds tend to feel prestige in their mother's eyes which contributed marginally to their sense of school belonging. Future studies should explore perceived prestige among middle-school students to examine whether this perception also plays an important role in younger students' sense of school belonging. It is worth noting that this greater impact of the sense of school belonging on school engagement among middle-school students from a privileged area is likely to constitute an important advantage in the medium and long term. Indeed, the sense of belonging predisposes students to continue to participate, even if the outcomes are not always evaluated positively (Finn, 1989).

The present research has some limitations that should be addressed. First, our study was correlational. Future experiments in which social support is induced could be helpful to address the causality issue. Second, comparing students in a priority education area to those in a more privileged area is a way of comparing students from lower socioeconomic backgrounds to those from more privileged socioeconomic backgrounds. However, there are additional confounding factors that are not controlled for, such as teacher availability, class size, and classroom environment, that are likely to impact the effect of perceived social support on school engagement beyond differences in background. Nevertheless, the present study highlights that the two student samples share more common points than differences in how social support predicts engagement with the key role of teachers and peers in engagement for all students. Third, future studies should examine whether the important role of peer support in school engagement is specific to middle school students, as the need for peer acceptance may be highest in early to mid-adolescence (e.g., Sweeting and Hunt, 2014). Fourth, the results showed that social support explains a small proportion of the variance in students' sense of school belonging, meaning that this psychological process is probably not the best mediator to examine. Future studies should examine more cognitive mediators, such as perceived self-efficacy, a perception that may be enhanced by social support, particularly peer support (e.g., Pierce et al., 2000). The model also explains a small proportion of variance for behavioral disengagement. Because the study took place in their regular classroom, students may have been reluctant to report behaviors that they know are frowned upon by the school institution. Fifth, as expected in the literature, with our version of the French-adapted school engagement measure (Wang et al., 2019), we identified four dimensions (cognitive, behavioral, social, and emotional) from the factor analysis. The emotional and behavioral dimensions

appeared exclusively as disengagement dimensions. Moreover, the emotional dimension did not have a satisfactory internal consistency. However, our exploratory factorial analysis on this scale was conducted on the same sample used in this study, which is a limitation. In the future, it will be useful to test whether these particularities are specific to France and/or related to an adolescent population by using a scale that will be validated and not simply adapted into French.

Conclusion and perspectives

A major strength of this study was to examine the relationship between students' four sources of proximal support and their academic engagement by considering students from contrasted backgrounds. Through this investigation, we have contributed to the literature by showing that perceived teacher and peer support is most predictive, directly or indirectly (through sense of school belonging), of school engagement for all students whether they live in a priority education area or a more privileged one. Such findings highlight that being considered the most supportive source by students is not enough to contribute to school engagement. Indeed, mothers are both the biggest and least influential source of support for students. Future studies should examine the role played by gender stereotypes in such an outcome. The gender stereotypes content (e.g., Eagly and Steffen, 1984; Eagly and Mladinic, 1994) and the motherhood myth (Ganong and Coleman, 1995; Gorman and Fritzsche, 2002) could lead people to perceive mothers as communal and caring for their children, but lacking the skills needed to guide their school engagement.

Given that adolescents spend much of their time at school, where relationships with both teachers and other students matter for development (Crosnoe and Benner, 2015), and that it is more difficult to act on the parents from the educational system, the greater contributions of teacher and peer support to school engagement are encouraging avenues for action from education professionals. This suggests that middle schools can capitalize on social support networks, including peer groups and teachers. Through these social networks, they could promote a sense of belonging and a learning environment that is safe and encouraging. In other words, all students, especially those from disadvantaged backgrounds, could improve their school engagement if their teachers and educational staff strive to create or reinforce social support that reframes students' role identities in terms of cooperation with each other and with the teacher. This active implication of school members can generate a virtuous circle in the development of students' school engagement. According to Furrer et al. (2014), instrumentally supportive interactions between classmates (e.g., interpreting teacher instructions

and sharing materials) promote feelings of competence and autonomy through understanding each other's viewpoints. Increasing the level of peer support is likely to improve the sense of school belonging, especially among students from disadvantaged areas, both factors are beneficial for middle-school students as they make the transition to high school (Benner et al., 2017).

Finally, the present results allow for a discussion of the potential harms of distance education. The COVID-19 pandemic has affected educational systems worldwide, leading to the near-total closures of schools, universities, and colleges. The distance learning programs that teachers could use to reach learners remotely and limit the disruption of education were probably largely insufficient to maintain the relationships between peers and minimalists in terms of perceived teacher support.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://osf.io/c3rgt/?view_only=1383f93211064744aea4e0ed05056160.

Ethics statement

The studies involving human participants were reviewed and approved by the Comité d'éthique de la recherche IRB-UCA: IRB00011540-2019-21. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

DM contributed to the supervision, conceptualization, methodology, writing of the first draft of the manuscript, and funding acquisition. AS contributed to the writing and performed the statistical analyses. BG contributed to the conceptualization and methodology and collected the data. SY participated to the statistical analyses. AT-S and CM contributed to the manuscript revision. All authors read and approved the submitted version.

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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.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.958286/full#supplementary-material>

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How personal values and critical dispositions support digital citizenship development in higher education students

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The virtual environment's expansion and role in young people's lives accentuate the need for developing transversal competences such as digital citizenship. The process may be supported by personal resources like personal values and critical thinking dispositions. With this study on 536 young students' students aged 18 to 26 ($M=20.85$, $SD=1.60$), we analysed the relationship between two adjacent personal values, universalism and self-direction, and students' digital citizenship. Moreover, we examined the role of critical thinking dispositions, namely learning orientation, and cognitive integrity in supporting digital citizenship development. Following structural equation modelling (SEM) analyses, the results show that universalism and learning orientation significantly positively influence digital citizenship, whereas cognitive integrity has a negative effect. Further, personal values positively associate with critical thinking dispositions.

KEYWORDS

transversal competences, students, digital citizenship, personal values, critical thinking

Introduction

For more than two decades, the development of digital competences has been approached as transversal or soft competences to be embedded in the higher education curriculum as a specific response to the pressure of employability and economic growth in contemporary and future societies. Although higher education around the world has experienced major changes in the curriculum in this respect and remarkable progress has been made towards advancing the employability-oriented profiles of the graduates, transversal competences are still hindered in favour of a theoretical, content-based university curriculum (Oria, 2012). Alongside digital competences, transversal competences also address entrepreneurship, teamwork, creativity, communicativeness, critical thinking and the ability to cope with complexity and incertitude (Larsen, 2013; Sá and Serpa, 2018; Graczyk-Kucharska et al., 2020). An important note should be made around differences between skills and competences, with implications for defining and measuring each

construct: whereas skills are acquired abilities, competences express the mobilisation of abilities and other additional resources (especially knowledge and critical understanding, values and attitudes) in specific professional or life contexts (Van der Velden, 2013). Thus, skills are to be considered and measured as elements enclosed within competences.

Recent EU higher education initiatives emphasise the critical role of universities in shaping more green and more digital economies [Council of the European Union, 2022a; Council recommendation on building bridges for effective European higher education cooperation, (Council of the European Union, 2022b)], and digital competences play a central part in this process. Thus, beyond 'hard competences' targeted as central learning outcomes of university study programmes, digital competences and other key transversal acquisitions have become a pivotal interest for teachers, learners, and researchers in higher education. Intensively studied in the last decades, digital competences among university students grow into relevant long-term assets. They are positively connected to work-related competences through self-esteem and self-regulated learning (Khampirat, 2021), to professional self-efficacy (Chonsalasin and Khampirat, 2022) and as to professional social capital (Chaker, 2020).

In a larger and diverse network of concepts (e.g., global competence and citizenship, digital competence for citizens, media literacy etc.), digital competences along with digital literacy underpin 'digital citizenship', a term that has entered the policy and academic discourse to stand for competent, confident and responsible or ethical use of technology (Ribble et al., 2004) based on respect for others and democratic values. Several empirical studies on digital citizenship in higher education have been conducted in recent years (e.g., Al-Zahrani, 2015; Kara, 2018; Takavarasha et al., 2018); however, coherent digital citizenship education in the university curriculum is most probably seen as a 'natural' outcome of efforts invested in developing students' digital competences and, thus, is rather neglected in policy papers and programme contents. Given the profound changes undertaken by universities for better preparing students for future societies, it is reasonable to assume that digital citizenship will further enrich the meaning of digital competence development and fully enter the academic debate on transversal competences in higher education. While education programmes in this area are focused more on increasing students' digital skills, public concern regarding the potential risks to youth online has prompted a quick response to provide internet safety education. The concept of digital citizenship comprises four different dimensions: media and information literacy, critical resistance, participation and engagement, and digital ethics (Choi et al., 2017). In this study, the critical perspective dimension of digital citizenship is explored, defined as the ability to approach different perspectives or to use the perspective of others in the development of new ideas (Sayer, 2009). This approach enables the decolonisation of knowledge by promoting thinking that challenges the status quo (Smith, 1999). In this context, users with advanced Critical Perspective see online

activity as valuable for continuously comparing to traditional forms of engagement with new possibilities. Users can then transform the Internet from a neutral information communication/distribution technology tool into a tool that is potentially susceptible to biases as with all other human tools (Feenberg, 1991). For the Internet to provide greater understanding, it should not be a tool of authority but rather one that allows for exploring, exchanging, comparing and augmenting ideas. The digital space represents an area of individual development and the expression of values. Hence, Gazi (2016) defines digital citizenship as "a socially constructed set of practices and the norms of behaviours that facilitate individual development and protect social values in a digital society" (p. 139). Digital citizenship spans different areas of education and is not separated from the rest of the curriculum. Therefore, in supporting the development of digital citizenship, teaching and learning strategies must be established in close relationship with values and the development of higher-order thinking such as critical thinking (Al-Abdullatif and Gameil, 2020). In addition, to develop sustainable digital citizenship, values must be clearly defined for both the digital and physical environment (Ohler, 2011). Embracing values in virtual communities is useful to create a positive culture that will promote sustainable digital citizenship (Ghosn-Chelala, 2019). Citizenship in this sense is not only about acts of expression by young people in a digital sphere, which reflect their ethics (Bennett, 2008; Bennett and Segerberg, 2012), but also manifests in other ways. Youth may be keen to share their values and impact their peers' attitudes through the digital environment. Nevertheless, educators also have an essential role in developing skills to enhance the problem-solving ability of students and competences to create persuasive media and strategically distribute it to their friends and respective communities (Gleason and Von Gillern, 2018).

In this dynamic, Schwartz's theory of universal substance and structure of basic values (Schwartz, 1992, 2012) was considered as it is widely used in modern value frameworks and recognised for its explanatory power in relation with various individual and group attitudes and behaviours (Arieli et al., 2020; Russo et al., 2022). It provides a solid theoretical foundation for establishing hypotheses based on a person's value system. According to Schwartz, values are general goals by which individuals guide their lives. In the context of guiding principles, appropriate values influence long-term behaviour in various contexts, e.g., social, personal or professional. In this way, fundamental values can help predict behaviour in various contexts. Every person has a different value hierarchy, meaning one value may be important to one person but not another. The theory delineates 10 different values, with each determined by distinct motivation aims (Schwartz, 2005, 2012; Borg et al., 2015). Values are empirically associated with a wide variety of attitudes and behaviours (see for example their effects on charity behaviour studied by Sneddon et al. (2020); or climate action explored by Bouman et al. (2020)). To sum up, values motivate people to behave accordingly (Bardi and Schwartz, 2003). In the present study, we choose to explore

the role of self-direction and universalism values in shaping students' digital citizenship. Self-direction and universalism represent adjacent values for which Schwartz (2012) defines *joint motivational emphases*. Universalism is concerned with ensuring the welfare of others, whereas self-direction coupled with universalism, on the other hand, entails the belief that one should rely on one's judgment and be comfortable with diversity and self-improvement (Beramendi and Zubieta, 2017). Generally, knowledge is considered an unproblematic phenomenon. As a result, the textbooks do not contain controversial topics or social conflicts; nor do they present clashing interpretations or viewpoints. However, described as a mix of skills to critical thinking, evaluate information, and making decisions (Puolimatka, 1995) is increasingly presented as one of the key outcomes of higher education programmes (Cruz et al., 2020; Bellaera et al., 2021). Therefore, university graduates as citizens must possess these skills to exert influence within their communities. Critical thinking becomes essential to develop digital citizenship where people become members of online communities and build collaborative and cooperative practices (Choi et al., 2017). Citizenship today requires individuals to express their views and critical thinking takes precedence over subservient accommodation. This refers to decision-making, shaping arguments, accepting other people's views and choices, discussing them, shaping a personal perspective and making it public (Ten Dam and Volman, 2004), however, it also refers to "building relationships, autonomy and acceptance, access to services and supports, shared values and social roles and civic rights and responsibilities" (MacIntyre et al., 2021, p. 699) when defined by citizens themselves. Critical thinking represents a complex and debatable construct that differs from being a politically oriented educational objective (e.g., Giroux, 1992; McLaren, 1995; Moore, 2013; Larsson, 2017), leading to a higher level of thinking (e.g., Halpern, 1998; Schulz and FitzPatrick, 2016; Liu et al., 2021). In this theory, critical thinking is a key aspect of citizenship that allows citizens to engage in a pluralistic and democratic society and empowers them to influence that society. The common goal of critical thinking development and citizenship education is to encourage active participation in the community; respect and acknowledge one's own self and others; develop social and moral values; establish values that consider divergent social viewpoints; practice listening and conflict resolution; and help maintain a safe environment. Critical thinking involves reasonable reflective thinking that aims to determine what to believe or how to act (Norris and Ennis, 1989; Ennis, 2018). A critical thinking process consists of three steps: recognising assumptions, articulating assumptions and evaluating their validity. Individuals need these skills to function effectively in a complex, democratic and modern society. In addition, higher education can help students develop their values and thinking skills through value clarification and fostering higher-order thinking abilities in personalised learning environments based on interactions with peers (Leming, 1998; Bezanilla et al., 2019; Lu et al., 2021).

The present research

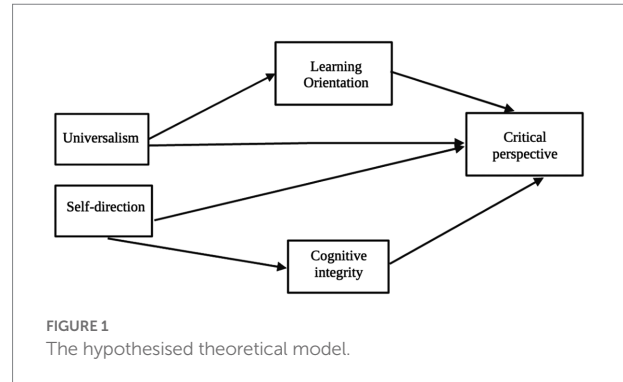
The growing interest in developing digital citizenship through education relates to the persistence of digital technologies in the social realm and the importance of information and digital literacy for personal development and social regulation (Milenkova and Lendzhova, 2021). Recently, several European institutions have designed effective training strategies for digital literacy and information (European Training Foundation, Turin, 2018; European Literacy Policy Network, 2020; European Commission, 2021). Digital citizenship becomes relevant in the context of online information processing, knowledge, online content creation and following a code of conduct for online behaviour. Many education aspects are relevant in supporting digital citizenship for students such as student learning and academic performance, student school environment and behaviour (Ribble and Bailey, 2007). Factors such as personal values and critical thinking skills may play an important part in the way people engage with novel information or behave and act in the virtual environment. For this reason, previous researchers have stressed personal values, such as collectivism, self-transcendence or self-enhancement (Sosik, 2005; Ahmad et al., 2021) and the role of critical thinking skills (Torney-Purta et al., 1999; Nguyen, 2012) in promoting digital citizenship behaviour. Previous research also underlines the predictive value of interpersonal communication competence for digital citizenship (see Xu et al., 2018) and the role of technology education in contrast with the non-significant effect of individual use of the Internet (Al-Abdullatif and Gameil, 2020).

Critical thinking is indispensable for a citizen to be truly able to exert influence in a community (Puolimatka, 1995, pp. 110–111); moreover, it is linked with communication skills and the capacity to influence others. Through digital citizenship, students have an opportunity to practice active and analytical information acquisition and to have an influence through different media. In the digital realm, students are no longer seen as passive receivers but as communicators with an active role. Living in an information society necessarily requires preparedness for critical thinking. In school, a student should be able to form questions and evaluate contradictory information as part of practicing the skills of a critical thinking citizen (Torney-Purta et al., 1999). Critical thinking skills are needed for students to reflect effectively on information and actions regarding citizenship (Halstead and Pike, 2006). Defined by Ennis (1985, p. 45) as a type of "reasonable, reflective thinking that is focused on deciding what to believe or do," critical thinking refers to the way an individual interacts with novel information in terms of interpretation, analysis and evaluation. These abilities are valuable to recognise false assumptions and conclusions, see through bias and propaganda, use evidence impartially, assess the strengths and weaknesses of an argument and to draw

justifiable conclusions that will shape the foundation of future actions. Such skills lie at the heart of responsible citizenship (Claire, 2001, pp. 112–114).

As argued above, some personal values have been explored in previous studies on digital citizenship, but to our knowledge self-direction and universalism yet to be included among them. Furthermore, although most conceptual frameworks for digital citizenship acknowledge the relevance of critical thinking, there is little empirical evidence to bridge these constructs (e.g., Herwati et al., 2020; Yildiz et al., 2020). The present research addresses these gaps and aims to show how students' personal values and dispositions can help them self-regulate their learning process and support the development of the learning process in terms of digital citizenship. The digital citizenship concept reflects individual skills and competences to actively participate in the social arena. By reflecting a certain type of awareness of emergent social issues, digital citizenship is supported by the development of critical thinking and values as it involves taking responsibility for their position from different social perspectives. In this sense, digital citizenship promotes the positive development of individuals and communities (De Coster and Sigalas, 2017). The first goal of the present study is to explore the role of self-direction and universalism, values related to the enhancement of others, self-transcendence and reliance upon one's own judgment (Beramendi and Zubieta, 2017) in shaping critical perspective towards online participation and the Internet as a measure of digital citizenship. The second goal is to determine the role of two critical thinking dispositions—learning orientation and cognitive integrity—in digital citizenship development (i.e., critical perspective towards online participation and the Internet). We suggest that learning orientation is relevant because it implies a disposition towards information-seeking as a personal strategy when solving a problem (Giancarlo et al., 2004). In addition, we propose that cognitive integrity is important because it implies a disposition towards interacting with contrasting perspective for the purpose of reaching the best decision (Giancarlo et al., 2004). The present study contributes to identifying the conditions under which the value-behaviour relationship is facilitated and informs the educational practice about personal resources that need to be advanced through learning for digital citizenship development. Considering the existing theoretical framework, we expected universalism and self-direction to predict critical perspective towards online participation and the Internet (respectively, Hypothesis 1 and Hypothesis 2). Consequently, learning orientation and cognitive integrity are expected to have a positive influence on critical perspective towards online participation and the Internet (respectively, Hypothesis 3 and Hypothesis 4). Further, universalism is expected to predict learning orientation (Hypothesis 5), while self-direction is expected to predict cognitive integrity (Hypothesis 6).

The hypothesised model is depicted in Figure 1.



Materials and methods

Participants

The invitation to participate in this research reached 900 bachelor's students enrolled in various social sciences domains such as psychology, human resources, special needs education, pedagogy and elementary education students. The computed response rate was 59.56%. The research sample size ($N = 536$) is considered appropriate for multivariate analysis (Hair et al., 2019). This cross-sectional study uses convenience sampling for its benefits in terms of costs and time, but it cannot be considered a representative sample. There were no exclusion criteria for the participants based on demographic variables. The student participants were selected from universities located in the north-eastern region of Romania. Participants completed an online survey after reading the informed consent statement on the first page. Participants received information regarding data security, the type of information being collected, data keeping and how their anonymity will be maintained. Participants were also informed that by completing the survey they were consenting to participate in the study. Further, they were instructed to save a copy of the document. Study participation was voluntary and anonymous. The research sample included 536 bachelor students aged 18 to 26 ($M = 20.85$, $SD = 1.60$). The large majority were women (92.16%) and 7.83% men. Out of the entire sample, 50.18% ($N = 269$) resided in urban areas while 49.81% ($N = 267$) resided in rural areas. One-third of the students were studying psychology. The participants' characteristics are reported in Table 1.

Procedure

The study received approval from the Research Ethics Committee of the university. The research took place during April and May 2022. The students received the information regarding the study in the classrooms. Later, the survey link was distributed to various university social media groups. The announcements related to this research included a link to the online survey form. In the first sections, participants were asked to read the informed

TABLE 1 Participants characteristics.

Sample characteristics	<i>n</i>	%	<i>M</i>	<i>SD</i>
Age			20.85	1.60
Gender				
Female	494	92.16%		
Male	42	7.83%		
Residing area				
Rural	269	50.18%		
Urban	267	49.81%		
Bachelor enrollment year				
1st year	190	35.44%		
2nd year	115	21.45%		
3rd year	231	43.09%		
Field of study				
Psychology	175	32.64%		
Pedagogy	63	11.75%		
Elementary education	125	23.32%		
Special needs education	70	13.05%		
Human resources	103	19.21%		

consent form and provide demographic information. Before starting the study, the respondents were informed that participation was voluntary and they could withdraw from the study at any point. They also received information regarding data gathering, security and maintenance. The online survey was designed with a closed-answers interface for all variables, including demographic information. Because all responses were closed answers, there were no errors or missing data. All the answers had to be selected from a list and the form could not be submitted in the presence of a missing value. The questionnaire took around 30 min to complete. This study was carried out following the recommendations of the Code of Ethics of the university. The protocol was approved by the Ethics Committee for Research of the Faculty of Psychology and Educational Sciences. Following the Declaration of Helsinki, all participants gave written, informed consent for their participation in the study.

Measures

The questionnaires were translated from English into Romanian using the forward-backward translation procedure (Hambleton et al., 1999). Afterwards, the translations were adjusted based on the back-translation process. The measures' construct validity was explored through confirmatory factor analysis and the internal consistency was examined by McDonald's omega (ω) reliability index.

Universalism and self-direction personal values

To assess universalism and self-direction personal values, specific scales of the Portrait Values Questionnaire (PVQ) were used (Schwartz et al., 2001). The instrument is based on Schwartz's

(1992) theory of human values and represents a novel and more concrete measurement method. The universalism scale includes six items and the self-direction scale contains four items. The respondents must rate their answers on a Likert-type scale from 1 (*not at all like me*) to 6 (*very much like me*). The universalism scale includes statements such as '*He/She thinks it is important that every person in the world be treated equally*'; '*He/She believes everyone should have equal opportunities in life*'. The self-direction scale includes items such as '*Thinking up new ideas and being creative is important to her*'; '*He/She likes to do things in her own original way*'.

Critical thinking dispositions: Learning orientation and cognitive integrity

To measure critical thinking dispositions, we used the learning orientation and cognitive integrity sub-scales from the California Measure of Mental Motivation (CM3) (Giancarlo et al., 2004). The learning orientation section comprises six items and the cognitive integrity section includes five reversed items rated on a four-point Likert-type scale from 1 (*strongly disagree*) to 4 (*strongly agree*). One item example for learning orientation is, '*I always look forward to learning challenging things*'; and for cognitive integrity, '*It is just not that important to keep trying to solve difficult problems*'.

Digital citizenship was measured using the critical perspective towards online participation and the Internet sub-scale, part of the Digital Scale (Choi et al., 2017). It consists of seven items rated on a seven-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Example items in this dimension include: '*I think online participation is an effective way to make a change to something I believe to be unfair or unjust*' or '*I think online participation promotes offline engagement*'.

Data analysis

The data analysis procedure was supported by SPSS 26 software used for data recording and descriptive statistics analyses (i.e., means, standard deviations, skewness and kurtosis). Preliminary analyses were conducted to assess data normality. Investigation of the normal distribution of data is examined in terms of skewness ($SK \leq 3$) and kurtosis ($Ku \leq 10$) (Kline, 2011). Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy ($KMO \geq 0.50$) was used to investigate data and sample size adequacy for performing factor analysis (Kaiser, 1974). Bartlett's test of sphericity was used to examine whether the correlation matrix is an identity matrix. A significant result ($p < 0.050$) indicates that the data is suitable for factor analysis (Snedecor and Cochran, 1989). The internal consistency or reliability between items was evaluated by McDonald's omega reliability coefficient, which should have values above 0.65 (Creswell and Creswell, 2017).

In the first step, confirmatory factor analysis (CFA) was conducted to evaluate the construct validity of the measurement model (Brown, 2015). In the second step, the hypothesised structural

equation model (SEM) was verified. SEM is a tool used in multicausal analysis at a given time in a theoretical structure, including observed and latent variables (Chonsalasin and Khampirat, 2022). The tested model included two latent exogenous variables (personal values: universalism and self-direction) and three endogenous variables (critical thinking dispositions: learning orientation and cognitive integrity and critical perspective towards online participation and the Internet). CFA and SEM were performed using IBM SPSS Amos 22 software. The goodness of fit of the model was assessed using the following indices: root means square error of approximation (RMSEA < 0.08), values between 0.08 and 1 are considered marginal (Fabrigar et al., 1999), standardised root means square residual (SRMR < 0.08), comparative fit index (CFI \geq 0.90) and Tucker–Lewis's index (TLI \geq 0.90) (Bentler, 1990). The exogenous variables were allowed to correlate.

Results

Descriptive statistics and preliminary analyses

Descriptive statistics of the means, standard deviations, skewness, and kurtosis are presented in Table 2. The absolute values of skewness range from 1.900 to 0.079 ($SK < 3$) and the absolute values of kurtosis range from 0.03 to 3.29 ($KU < 10$), indicating that the data are normally distributed (Table 2). Further, the resulted values of KMO ($KMO = 0.875$) and Bartlett's test of sphericity ($\chi^2 = 4854.56$, $df = 378$, $p < 0.001$) support the use of factor analysis.

McDonald's ω of each subscale and construct is presented in Table 3. For universalism, McDonald's $\omega = 0.769$, for self-direction McDonald's $\omega = 0.699$, for learning orientation McDonald's $\omega = 0.824$, for cognitive integrity scale McDonald's $\omega = 0.660$ and for critical perspective and towards online participation and the Internet McDonald's $\omega = 0.811$ (Table 3). The values exceeded 0.65 threshold recommended by Creswell and Creswell (2017) and indicates that the measures have satisfactory internal consistency. This was confirmed by composite reliability (CR), where all construct values are between 0.777 and 0.881 (Table 3), whereas the general standard of CR should exceed 0.60 (Hair et al., 2019). Further, the average variance extracted (AVE) should be higher than 0.50 (Hair et al., 2019); here, the AVE values varied between 0.381 and 0.555 (Table 3). However, if AVE values are below the 0.50 threshold but the CR is greater than 0.60, then the construct's convergent validity is satisfactory (Fornell and Larcker, 1981; Khampirat, 2021). Table 3 also shows the goodness of fit indices for all measurement models. The results of confirmatory factor analysis (CFA) showing an acceptable fit.

Measurement model results

The CFA examined the 5 latent and 28 observed variables. All latent variables were allowed to correlate with each other

(Anderson and Gerbing, 1988). The measurement model was examined using the maximum-likelihood method, which indicated a satisfactory fit to the data as follows: $\chi^2 = 766.518$, $df = 339$, $p < 0.001$, CFI = 0.906, TLI = 0.899, RMSEA = 0.040 (90% [CI]: 0.04 to 0.05), SRMR = 0.050. Likewise, as Table 2 shows, the values of standardised loading of the 28 indicators vary between 0.237 and 0.791 and have statistical significance ($p < 0.001$), which confirms convergent validity. Further, the measurement model was used to test the hypothetical structural model.

Structural equation model results

The SEM results of higher education students' digital citizenship suggested that the third item of the self-direction scale should be deleted due to second-order factor cross-loading. Also, two items of the digital citizenship subscale were allowed to correlate among them. Consequently, the goodness of fit indices for the SEM model are as follows: $\chi^2 = 744.792$, $df = 316$, $p < 0.001$, RMSEA = 0.050, CFI = 0.900, TLI = 0.889 and SRMR = 0.061. These values indicate that the model has an acceptable fit (see Figure 2). The significance level of the hypotheses was examined by computing standard beta (β) values for each relationship (Figure 2; Table 4).

High and significant beta (β) values highlight the substantial effects of endogenous latent variables. Further, to investigate the significance of the beta values, the critical ratios (t-values) method was used. The results show that universalism has a positive significant effect on critical perspective towards the Internet and online participation (Hypothesis 1: $\beta = 0.458$, C.R. = 3.648, $p = 0.000$), showing a positive association between the two variables. In contrast, self-direction showed no significant effect the digital citizenship measure (Hypothesis 2: $\beta = -0.769$, C.R. = -1.096 , $p = 0.273$). Therefore, the second hypothesis is not supported. The third hypothesis documented a significant positive relationship between learning orientation and critical perspective towards the Internet and online participation, and the results supported this hypothesis (Hypothesis 3: $\beta = 0.116$, C.R. = 1.991, $p = 0.046$). A positive effect of cognitive integrity on the digital citizenship measure was expected. In turn, the results show a negative effect of cognitive integrity (Hypothesis 4: $\beta = -0.280$, C.R. = -4.821 , $p < 0.001$). Finally, personal values, universalism and self-direction predicted the hypothesised direction for the critical thinking dispositions learning orientation (Hypothesis 5: $\beta = 0.487$, C.R. = 8.663, $p < 0.001$) and cognitive integrity ($\beta = 0.289$, C.R. = 4.784, $p < 0.001$).

Discussion and conclusion

The present study aimed to explore the role of personal resources in supporting learning effectiveness related to the

TABLE 2 Descriptive statistics and results of CFA measurement model ($N = 536$).

Constructs	Items	<i>M</i>	<i>SD</i>	<i>SK</i>	<i>K</i>	Standardized loading	C.R. (<i>t</i> -value)	<i>R</i> ²
Universalism	val1	5.52	0.843	−1.900	3.290	0.472	9.773***	0.223
	val2	5.05	1.025	−0.865	0.143	0.514	10.590***	0.264
	val3	5.23	0.945	−1.028	0.185	0.729	14.511***	0.531
	val4	5.27	0.985	−1.262	1.007	0.709	–	0.503
	val5	5.24	0.963	−1.144	0.520	0.639	12.967***	0.408
	val6	4.90	1.165	−0.847	−0.036	0.575	11.771***	0.331
Self-direction	val7	4.73	1.113	−0.537	−0.484	0.556	10.406***	0.320
	val8	5.20	0.960	−1.117	0.718	0.548	10.147***	0.300
	val9	5.13	0.978	−0.979	0.504	0.709	12.173***	0.503
	val10	5.24	0.985	−1.220	0.747	0.612	–	0.374
Learning Orientation	L1	3.71	0.503	−1.422	1.041	0.737	16.199	0.544
	L2	3.44	0.653	−0.761	−0.486	0.791	17.335	0.626
	L3	3.34	0.715	−0.656	−0.574	0.744	–	0.553
	L4	2.98	0.880	−0.382	−0.777	0.530	11.579	0.281
	L5	3.47	0.669	−0.968	0.075	0.709	15.584	0.503
	L6	3.36	0.742	−0.901	0.129	0.579	12.671	0.336
Cognitive integrity	cog1	2.68	0.920	−0.117	−0.852	0.237	4.716***	0.056
	cog2	2.64	0.966	−0.088	−0.982	0.442	8.520***	0.196
	cog3	3.35	0.807	−1.029	0.196	0.719	12.039***	0.517
	cog4	3.00	0.863	−0.474	−0.551	0.723	–	0.523
	cog5	3.02	1.016	−0.595	−0.900	0.568	10.553***	0.322
Critical perspective	cp1	4.94	1.687	−0.483	−0.473	0.691	14.589***	0.477
towards online use and	cp2	4.77	1.581	−0.368	−0.378	0.569	12.085***	0.324
the Internet	cp3	4.03	1.857	−0.079	−0.880	0.773	–	0.597
	cp4	4.50	1.769	−0.330	−0.679	0.567	11.921***	0.321
	cp5	4.47	1.658	−0.249	−0.515	0.613	12.940***	0.376
	cp6	3.54	2.005	0.186	−1.157	0.581	12.325***	0.337
	cp7	2.97	2.025	0.619	−0.978	0.529	11.213***	0.279

M = Mean, *SD* = standard deviation and *** significant at $p < 0.001$.

TABLE 3 Psychometric properties of the measures.

Constructs	Composite reliability (CR)	Average variance extracted (AVE)	McDonald's omega	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR
Universalism	0.817	0.433	0.769	56.642	9	0.944	0.906	0.094	0.046
Self-direction	0.779	0.541	0.699	13.958	3	0.970	0.941	0.084	0.032
Learning orientation	0.881	0.555	0.824	44.209	9	0.969	0.948	0.086	0.036
Cognitive integrity	0.777	0.425	0.660	12.345	5	0.982	0.964	0.052	0.028
Critical perspective	0.796	0.381	0.811	68.757	13	0.950	0.920	0.090	0.044

development of digital citizenship as a transversal competence in higher education by examining the role of two adjacent values, self-direction and universalism. Furthermore, we examined the mediating role of students' critical thinking disposition, such as learning orientation and cognitive integrity. Modern society has encouraged citizenship to also expand into the digital environment. Yet, for digital

citizenship to develop, personal values must be clearly defined and critical thinking dispositions must be put into action concerning digital knowledge. Sustainable digital citizenship can be created by including personal values in virtual communities (Ghosn-Chelala, 2019). Values are empirically associated with a wide variety of attitudes (Bardi and Schwartz, 2003) and behaviours that relate also to critical

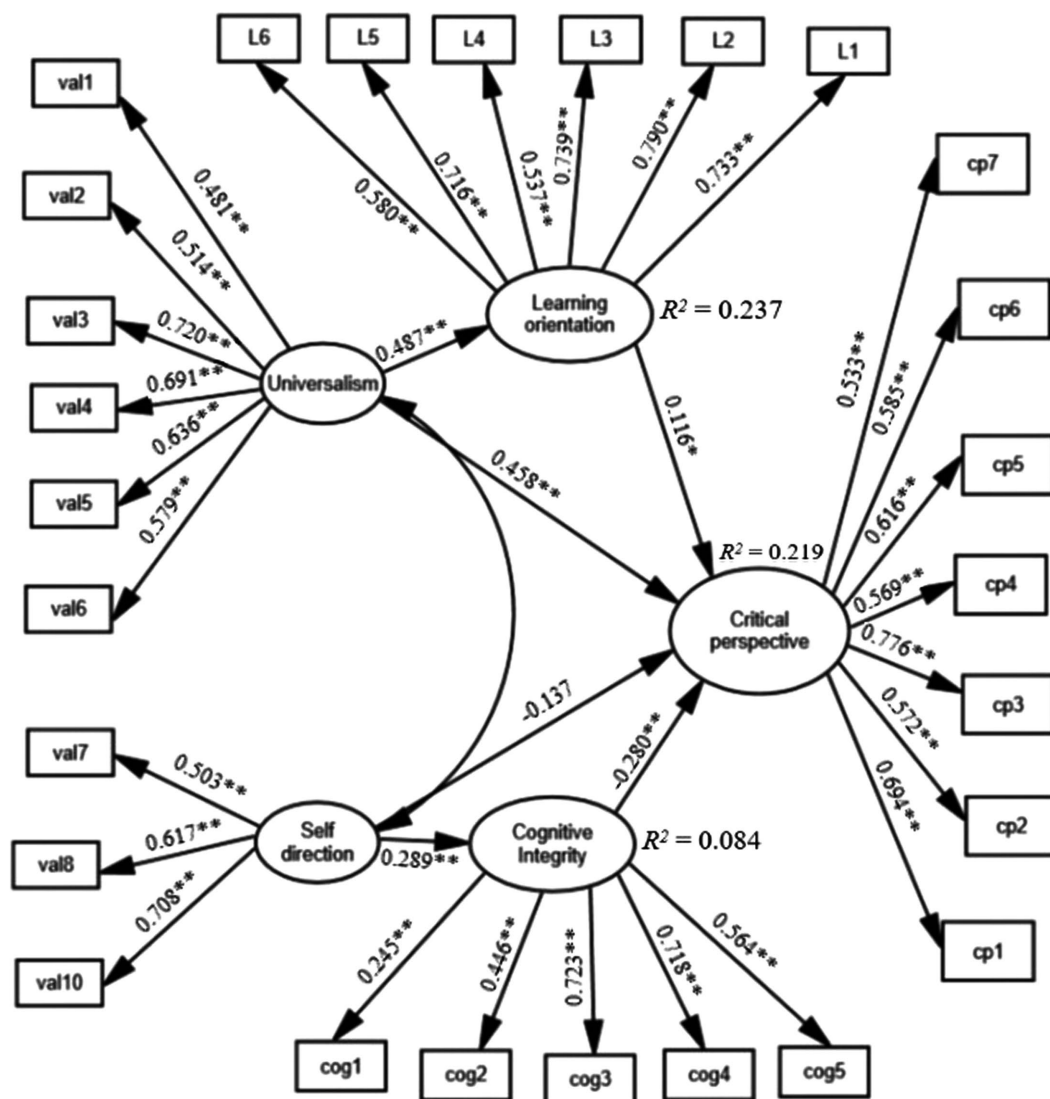


FIGURE 2

The structural equation model. All coefficients are standardized. * $p < 0.05$, ** $p < 0.001$.

thinking dispositions and are highly valued in the digital space. The present findings could contribute to a better understanding of the personal resources that can support the digital citizenship development process. The first hypothesis presumed that values linked to individual action and the enhancement of others, namely self-direction and universalism, would be positively related to the critical perspective towards online participation and the Internet as a measure of digital citizenship. The results show that higher universalism relates to sustainable digital citizenship. These findings are in line with previous research that universalism relates to actions and behaviours that promote the welfare of others (Bardi and Schwartz, 2003; Stankevičiūtė and Wereda, 2020). This shows that the universalism value is an important resource for developing citizenship in the spirit of fostering a critical perspective towards online participation and the

Internet. The second hypothesis which focused on the positive effect of self-direction was not supported by the results. The third and fourth hypotheses focused on the role of critical dispositions, learning orientation and cognitive integrity in supporting digital citizenship development. Higher learning orientation motivates individuals towards intellectual activities that involve reasoning, particularly wanting to expand one's knowledge and using information-seeking strategies when attempting to solve a problem (Giancarlo et al., 2004). Therefore, individual orientation towards information-seeking endorses digital citizenship and a critical perspective towards online participation and the Internet. Surprisingly, cognitive integrity had a negative effect on digital citizenship as a critical perspective towards online participation and the Internet. Because critical integrity is defined within this study as the "disposition toward

TABLE 4 The results of the structural model.

Hypothesis path	Standardized estimate	C.R. (t-value)	Value of <i>p</i>
H1: Universalism → Digital citizenship	0.458	3.648	0.000
H2: Self-direction → Digital citizenship	−0.137	−1.096	0.273
H3: Learning orientation → Digital citizenship	0.116	1.991	0.046
H4: Cognitive integrity → Digital citizenship	−0.280	−4.821	0.000
H5: Universalism → Learning orientation	0.487	8.663	0.000
H6: Self-direction → Cognitive integrity	0.289	4.784	0.000

→ regression on.

interacting with differing viewpoints for the sake of learning the truth or reaching the best decision” and “valuing the fair-minded consideration of alternative perspectives” (Giancarlo et al., 2004, p. 353), its high level may foster the consideration of offline or traditional means of participation and thereby lower engagement with digital citizenship. In other words, in relation with digital citizenship it may function as a blocker at high levels and as an enhancer at low levels; however this needs to be further explored in future studies. The last two hypotheses show the effect of personal values on critical thinking dispositions. Hence, individuals with higher universalism reported higher learning orientation. Focusing on the welfare of others motivates individuals towards intellectual activities that involve reasoning, particularly wanting to expand one’s knowledge and using information-seeking strategies when attempting to solve a problem (Giancarlo et al., 2004). Similar results were reported by Coskun and Altinkurt (2016), showing that values like universalism support critical thinking dispositions in students. However, for critical thinking not to descend on the reasoning that holds logically valid arguments founded on unreasonable or unethical premises, an explicit underpinning in values is needed (Higgins, 2014). These findings have relevance for both theory and practice. From a theoretical perspective, this is one of the few studies examining the implications of values and critical thinking dispositions in the context of digital citizenship. Thus, it expands the conceptual model of value-related behaviour across the virtual domain. From an educational practice perspective, the results show that by supporting the development of certain personal values and critical thinking dispositions may support the development of digital citizenship. Higher education

educational practices should stimulate the development of specific values in students. At the same time, students should acquire skills and dispositions that enable them to think critically and to analyse various opinions on their value orientation. Therefore, teaching strategies should combine strategies for advancing the development of specific values by teaching students to think critically. Teachers stimulate these values *via* subject matter, chosen examples and reactions to their students (Veugelaers, 2010). Teachers can express values implicitly in the hidden curriculum (Giroux and Purpel, 1983) or by means of reflection; they can also be explicit about the values they express and the way they express them (Liston and Zeichner, 1991). In interpreting these findings, some limitations should be noted. First, our research is limited to only one factor of digital citizenship, the critical perspective towards online participation and the Internet, and does not investigate the larger spectrum of behaviours in the digital space. Second, using a cross-sectional design prevents us from drawing any inferences regarding the causality of the relationships between self-direction and universalism values, critical thinking dispositions and digital citizenship. In addition, generalisability is limited by the sample characteristics of mostly young and well-educated females. Although the sample size was adequate due to convenience sampling, the results cannot be generalised beyond young adult females. Hence, future research should endeavour sampling a balanced ratio of men and women. Furthermore, to minimise measurement errors, more extensive measures of digital citizenship should be applied. Despite these limitations, this study expands the role of values and highlights its importance related to critical thinking dispositions. Using a cross-sectional design, the results show that universalism value, learning orientation and cognitive integrity predict critical perspective towards online participation and the Internet. We believe that these findings have important educational implications and may substantiate a mechanism that can advance digital citizenship in youth.

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 Ethics Committee for Research of the Faculty of Psychology and Educational Sciences. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GA, NP, and MM: conceptualisation, methodology, validation, formal analysis, data curation, and writing—original draft preparation. GA: visualisation and funding acquisition. All authors contributed to the article and approved the submitted version.

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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.

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Teachers' assessment literacy improves teaching efficacy: A view from conservation of resources theory

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Recent revisions to the Conservation of Resources theory have not only reclassified categories of resources, but have also acknowledged the conceptual importance of "gain spirals" and "resource caravans" in enriching the theoretical understanding of resources. Given that teachers' assessment literacy is a prominent yet underexplored personal constructive resource in teaching, this paper examines its role in teaching efficacy. In addition, personal energy resources (e.g., psychological capital and professional identity) are studied as antecedents to teaching efficacy. To this end, a survey based on the Chinese versions of the Teacher Assessment Literacy Scale, the Teaching Efficacy Scale, the Psychological Capital Scale, and the Teacher Professional Identity Scale was administered to secondary school teachers in Henan Province, China, and 351 completed, valid surveys were returned. The findings indicated that the teachers' assessment literacy and teaching efficacy were positively correlated, verifying that assessment literacy can influence teaching efficacy through the separate and chain mediation effects of psychological capital and professional identity. The identification of such mediating pathways has confirmed that resources owned by teachers can lead to gain spirals and full resource caravans, thus expanding the Conservation of Resources theory by positing that resources can be nested within one another. This study has theoretical implications for teaching efficacy research and the Conservation of Resources theory as well as practical implications regarding how to boost teachers' constructive and energy resources and professional development.

KEYWORDS

teachers' assessment literacy, teaching efficacy, psychological capital, professional identity, conservation of resources theory, gain spirals, resource caravans

Introduction

Occupational stress among teachers has long aroused widespread concern (Kyriacou and Sutcliffe, 1977; Johnson et al., 2005; Newberry and Allsop, 2017; Fynes-Clinton et al., 2022), and the considerable job pressure experienced by teachers is closely related to low teaching efficacy (Betoret, 2006; Klassen and Chiu, 2010). The concept of teaching efficacy refers to teachers' personal beliefs about their capability that they could influence students' performance (Xie et al., 2022). Researchers have found that teaching efficacy affects teachers' job satisfaction (Collie et al., 2012), classroom management (Tsouloupas et al., 2010), teaching-learning conceptions (Erbaş, 2021), and task-centered anxiety levels (Erbaş and Ünlü, 2020); additionally, scholars have showcased its important role in helping students to realize their development potential (Pendergast et al., 2011). At present, questions pertaining to which factors can influence teachers' teaching efficacy have become the focus of global attention. Numerous studies have found that objective antecedents, such as peer support, teaching resources, university types (Chang et al., 2010), and teaching subjects (Riggs and Enochs, 2010) influence teaching efficacy. However, it seems insufficient to consider only the impact of the external factors on teaching efficacy. Enochs and Riggs (1990) have noted that even with given external variables, teachers who lack internal strengths may not believe that they have the capability to teach. Accordingly, studies that explore the effect of the teachers' personal resources on their teaching efficacy can contribute to theoretical and practical understandings of teaching efficacy.

The Conservation of Resources (COR) theory proposed by Hobfoll (1989) emphasizes resources as the central mechanism to explain the generation and coping of professional stress. The original COR theory defines "resources" as something that are valuable to an individual's survival and development. Notably, the COR theory roughly classifies resources into four categories: object resources (e.g., shelter), conditional resources (e.g., work), personal characteristic resources (e.g., self-esteem), and energy resources (e.g., time) (Hobfoll, 1989). Hobfoll (1989) argues that humans have always been driven by evolution to acquire, protect, and build on these resources, and to perceive the loss of resources as threats. When pressure creeps in, if individuals are unable to effectively stop the loss of resources and have no opportunity to be compensated in a timely manner, the loss of resources will proceed at an accelerated rate, creating "loss spirals" (Hobfoll, 1989). By contrast, individuals who are able to successfully access beneficial resources when stress signals arise may not only effectively offset resource depletion but may also generate "gain spirals" (Hobfoll, 2001). In Hobfoll (2011) follow-up research, he argued that the COR theory was incomplete because it ignored associations between the resources; in response, he proposed the concept of "resource caravans," which refer to the accumulation of and linkages between various resources. That is, rather than exist in isolation,

individual resources are interrelated and form an array of symbiotic relationships.

Although the COR theory has become an important theory for understanding the driving mechanisms of employee attitudes and behaviors (Westman et al., 2004), it has been challenged by scholars because of its lack of clarity in classifying resources. Brummelhuis and Bakker (2012) reclassified the resources into macro resources (e.g., culture), object resources (e.g., marriage and work), social support (e.g., advice and respect), key resources (e.g., self-efficacy), constructive resources (e.g., knowledge and skills), and energy resources (e.g., emotional and cognitive ability) based on their source and stability. This reclassification has heavily influenced work on the value of resources. Within these resource categories, key resources are placed at a higher level because they are the most stable personality traits (Brummelhuis and Bakker, 2012). However, most of the research on teaching efficacy as a key resource has been conducted without integrating other proposed predictors; accordingly, the mechanisms of the interaction between teachers' personal resources and teaching efficacy remains elusive. For example, research on the relationship between energy resources and teaching efficacy has been conducted in isolation of other constructive resources (Poulou, 2007), which ignores the interconnectedness of the resources. Moreover, a large number of studies have focused on the loss spirals between resources (Demerouti et al., 2004; McTernan et al., 2016; Deng et al., 2018; Zhou et al., 2019), while ignoring the impact of gain spirals. With the rise of positive psychology, researchers are gradually showing more interest in the advantages of positive resources. For instance, Duyar et al. (2013) found that principals' leadership and teachers' collaboration could facilitate teachers' gain spirals. However, few studies have directly examined how teachers' personal resources generate such gain spirals from the perspective of teacher assessment literacy professionalism. In response to the gaps in the research identified above, the main aim of our study was to examine the internal mechanisms among teachers' assessment literacy, psychological capital, professional identity, and teaching efficacy. In doing so, this current study contributes a solid foundation and a new perspective for developing better strategies to improve teachers' teaching efficacy. It also presents a more comprehensive understanding of the COR theory by demonstrating the positive gaining spirals that exist among teachers' personal resources and the fact that these resources are not appropriated piecemeal, but rather combined.

Teachers' assessment literacy and teaching efficacy

Assessment literacy has become an important component of teacher professionalism and educational practice. Specifically, assessment literacy represents a teacher's view of education

and the utilization of his or her relevant skills and knowledge of assessment to measure students' achievements in various fields to inform instruction (Stiggins, 1991; Abell and Siegel, 2011; Xu and Brown, 2016; Lam, 2019). More recently, Pastore and Andrade (2019) expanded the concept of teachers' assessment literacy and revealed that teachers' assessment literacy should include assessment knowledge, assessment behaviors, and social-emotional competence to implement assessment. According to the COR theory, teachers' assessment literacy, as a personal resource at the level of knowledge and skills, can help them make accurate inferences about student learning and provide guidance for instruction (Abell and Siegel, 2011), which in turn can increase their teaching efficacy. Conversely, when teachers lack adequate assessment literacy, the reliability and validity of their teaching may be reduced (Carter, 1984; King, 2010), thereby leading them to make incorrect and unwise educational decisions (Xu and Brown, 2017), which has a debilitating effect on their teaching efficacy. Robust and consistent associations have been found between teachers' assessment literacy and teaching efficacy (Zhang and Burry-Stock, 2003; Eufemia, 2012; Looney et al., 2017). For instance, Zhang and Burry-Stock (2003) in-depth examination suggested that teachers with assessment training tend to have a higher level of efficacy for assessment skills. Using data from 79 teachers in a public school district, Eufemia (2012) found that teacher's engagement in the formative assessment of their own mathematics teaching was positively related to their self-efficacy in assessment. Looney et al. (2017) similarly indicated that teachers' confidence in their teaching ability is an important aspect that affects their practices of assessing students in the classroom. On the basis of the above theoretical perspectives and literature findings, the following is hypothesized:

H1: Secondary school teachers' level of assessment literacy can positively predict their teaching efficacy.

Teachers' assessment literacy, psychological capital, and teaching efficacy

Psychological capital refers to a state of an individual's positive development that is representative of their motivational tendencies, which are accumulated through positive psychological constructs, including the following four factors: self-efficacy, hope, optimism, and resilience (Luthans et al., 2007, 2008). Considering the cultural differences between China and the West, Wu et al. (2012) revised the psychological capital measurement scale for localization. In the Chinese

cultural context, psychological capital emphasizes the mutual coordination among individuals and the need for people to behave in accordance with social expectations, including two dimensions: transactional psychological capital and interpersonal psychological capital. Transactional psychological capital focuses on individual affairs (e.g., hope and optimism), while interpersonal psychological capital pays attention to the influence of traditional culture and the demands of social life (e.g., gratitude and altruism). According to the COR theory (Brummelhuis and Bakker, 2012), assessment literacy belongs to one of the valuable constructive resources for teachers. Therefore, teachers with better assessment literacy could experience enhanced confidence and satisfaction when they accomplish their teaching tasks and a higher probability of obtaining the psychological resources that they need. Popham (2011) and Luthans et al. (2004) argued that teachers with sufficient assessment literacy are often better able to adapt their instructional plans and reap the rewards of education, and their positive emotions (e.g., confidence) are more likely to be elicited. Accordingly, a higher level of assessment literacy means that a teacher could motivate students to engage in assessment activities and build friendly teacher-student relationships (Xu and Brown, 2017), which contributes to the accumulation of both transactional and interpersonal psychological capital.

Furthermore, the broaden-and-build theory of positive emotions (Fredrickson, 2001) suggests that the accumulation and compounding of teachers' psychological capital is an important way to construct personal resources. Specifically, teachers with higher levels of psychological capital tend to experience more positive emotions and are able to effectively cope with trials and tribulations at work, thereby expanding their intrinsic motivation and confidence to teach (Isgett and Fredrickson, 2015). Although positive emotions are temporary for teachers, such emotions are also unique in that they can increase resources for teaching efficacy by generating instructional performance (Fredrickson, 2013). Clarence et al. (2021) revealed that teachers with positive emotions effectively engage in creative teaching. Through this process, their contentment and efficacy are more likely to be stimulated. In addition, Heng et al. (2020) found that psychological capital has a greater impact on self-evaluation than certain social resources and is directly related to an individual's behavioral expectations and self-confidence. On the basis of the abovementioned theoretical perspectives and research findings, the following is hypothesized:

H2: Secondary school teachers' level of assessment literacy can indirectly predict their teaching efficacy through the intermediary role of psychological capital.

Teachers' assessment literacy, professional identity, and teaching efficacy

Numerous studies have proposed that professional identity can play a mediating role in many relationships (Andrianto et al., 2018; Chen et al., 2020; Hao et al., 2020). Richter et al. (2021) defined teachers' professional identity as a multidimensional concept that includes perceptions of teaching tasks, feelings of personal competencies, job satisfaction, and personal belief systems about teaching. Beijjaard et al. (2004) highlighted the important role that teachers' construction of teaching-related practical knowledge plays during the formation of their professional identities. Teachers' assessment literacy, as practical knowledge essential to the educational process (Fulcher, 2012), is distinctively valuable to their professional identity formation. Pastore and Andrade (2019) found out that the ability to integrate assessment knowledge and practices into pedagogy can help teachers scrutinize their professional identity. In terms of the COR theory, teachers with heightened levels of assessment literacy tend to experience gain spirals through the continued acquisition of resources, which prevents a loss of confidence in their teaching practice and enhances their professional identities.

In addition, Rozati (2017) found that when teachers failed to consider their professional identities in a foreign language setting, it led to their inability to improve their teaching efficacy. Similarly, a study conducted by Esmaili and Dastgoshadeh (2016) with English lecturers at an Iranian university indicated that educators' knowledge and awareness of their professional identity is critical in enhancing their teaching efficacy. Chen et al. (2020) found that when teachers were loyal to their profession, they were able to ignore unpleasant work situations and become more confident and engaged, thereby increasing their academic self-efficacy. A study on the relationship between teachers' perceptions of teaching tasks and teaching practices similarly showed that teachers who identified more highly with their profession tended to exhibit higher levels of efficacy (Richter et al., 2021). Combining the aforementioned theories and research results, the following is hypothesized:

H3: Secondary school teachers' level of assessment literacy can indirectly predict their teaching efficacy through the intermediary role of professional identity.

Psychological capital and professional identity

Previous studies have pointed out that psychological capital can positively impact professional identity. For instance, utilizing 1,009 Chinese nurses, Ren et al. (2021) examined the correlation between psychological capital and professional identity and found that those with high levels of psychological

capital have high-level professional identities. Furthermore, Luthans et al. (2008) concluded that psychological capital could positively influence employees' performance, satisfaction, and commitment. Qiu et al. (2019) found that Chinese doctors' professional identities could be improved by enhancing the positive resource of psychological capital. Meanwhile, Clarence et al. (2021) found that groups of teachers with positive emotions are able to free themselves from barriers and actively engage in school activities. In such cases, the teachers' tendency to leave their positions is comparatively weak (Schaufeli and Bakker, 2004), and their professional identity is high. In accordance with these studies, the following is hypothesized:

H4: Secondary school teachers' level of assessment literacy can indirectly predict their teaching efficacy through the chain mediating effects of psychological capital and professional identity.

A conceptual model was constructed based on the above four hypotheses to explore the effects of the teachers' personal resources excluding external object and conditional resources on their teaching efficacy (see Figure 1). This model illustrates the hypothesized mechanism of the link between the teachers' assessment literacy and their teaching efficacy. The framework includes four variables, which are categorized as constructive resources, energy resources, and key resources according to the resource classification introduced by Brummelhuis and Bakker (2012). Assessment literacy constitutes a constructive resource for teachers. Energy resources include both psychological capital and professional identity, and teaching efficacy is embodied in key resources.

Materials and methods

Participants

A combination of cluster and convenience sampling was used to collect the data from teachers in three prefecture-level cities in Henan Province, China using online or paper questionnaires. Between January and March 2022, 433 questionnaires were distributed; after invalid questionnaires were discarded, 351 valid questionnaires were collected (81.6% completion rate). The study was reviewed and approved by the Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior. A consent form was signed by all the participants before they completed the survey. The participants comprised 79 male teachers (22.5%) and 272 female teachers (77.5%); 137 were 20 to 30 years old (39.1%), 145 were 31 to 40 years old (41.3%), 51 were 41 to 50 years old (14.5%), and 18 were over 50 years old (5.1%); 77 had been teaching for less than four years (21.9%), 129 had been teaching for four to 10 years (36.8%), 99 had been teaching for 11 to 20 years (28.2%), 46 had been teaching for more than 20 years (13.1%).

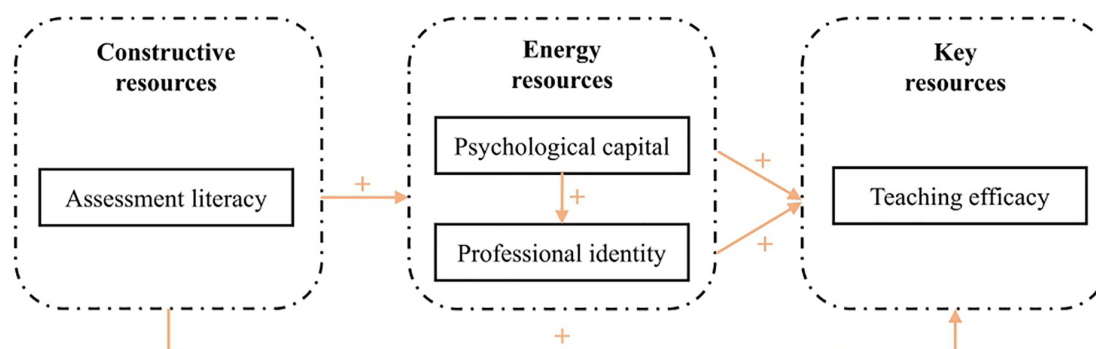


FIGURE 1

A conservation of resources (COR) conceptual model of the “gain spiral” and “resource caravan” generated by the teacher’s personal resources.

Materials

Teacher assessment literacy scale

We adapted the scale developed by Hudson (2017) to measure the teachers’ levels of assessment literacy. The adapted scale included 33 items along two subscales: teachers’ assessment practices and teachers’ understanding of the assessment. Each subscale comprised five dimensions: assessment design, assessment criteria, use of student participation, setting clear goals, and use of assessment results. An example is as follows: “I design different assessment methods depending on the purpose of the assessment.” The measure was assessed on a 5-point scale (1 = *never*, 5 = *always*) on the assessment practices subscale and a 5-point scale (1 = *completely disagree*, 5 = *completely agree*) on the understanding of the assessment subscale. The confirmatory factor analysis indicated that the fit indices for RMSEA = 0.064, NFI = 0.827, CFI = 0.889, IFI = 0.89. The internal consistency coefficient for this scale was 0.944, and the internal consistency coefficients of the dimensions ranged from 0.738 to 0.844.

Teaching efficacy scale

We adopted the Teachers’ Teaching Efficacy Scale originated by Yu et al. (1995) and then revised by Yang (2010) to measure participants’ teaching efficacy. This scale comprises 15 items such as teaching strategies, classroom management, and motivating students. An example is as follows: “I am able to keep the students disciplined in class.” A 5-point scale (1 = *completely inconsistent*, 5 = *completely consistent*) was used. The internal consistency coefficient for this scale was 0.923, and the internal consistency coefficients of the dimensions ranged from 0.801 to 0.839.

Psychological capital scale

The Psychological Capital Scale designed by Luthans et al. (2007) and then designed and verified by Wu et al. (2012) was applied. This scale contained 32 items along two dimensions: transactional psychological capital and interpersonal

psychological capital. Transactional psychological capital included three factors: hope, optimism, and perseverance. Interpersonal psychological capital included five factors: modesty, gratitude, altruism, emotional intelligence, and self-confidence. An example is as follows: “At the moment, I consider myself quite successful in my career.” Participants rated all items on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). The internal consistency coefficient for the scale was 0.923, and the internal consistency coefficients of the dimensions ranged from 0.886 to 0.942.

Teacher professional identity scale

The 18-item Teacher Professional Identity Scale conducted by Wei (2008) was adopted, including four dimensions: role values, professional values, professional affiliation, and professional behavior tendencies. An example is as follows: “I am proud to be a teacher.” A 5-point scale (1 = *completely inconsistent*, 5 = *completely consistent*) was used. The internal consistency coefficient for this scale was 0.956, and the internal consistency coefficients of the dimensions ranged from 0.729 to 0.854.

Data analysis

IBM SPSS25.0 was used to perform the preliminary data processing, generate descriptive statistics, and conduct reliability, correlation, and regression analyses. The chain mediating role of the teachers’ psychological capital and professional identity in the relationship between assessment literacy and teaching efficacy was checked using Model 6 of the PROCESS macro.¹ The bias-corrected percentile bootstrap method was used to test the significance of the mediating role. A 95% confidence interval was considered statistically significant if it did not contain a value of

¹ <http://www.afhayes.com>

zero (Erceg-Hurn and Miroseovich, 2008). Furthermore, prior to analyzing the data, we applied Harman's one-factor test to verify the common method variance of the variables (Podsakoff et al., 2003).

Results

Common method bias test

This study used Harman's one-factor method to put the teachers' assessment literacy, psychological capital, professional identity, and teaching efficacy items into the exploratory factor analysis. The maximum factor can only explain a variance of 30.84%, which was less than the 40% threshold, thereby indicating that no significant common method variance existed and that the relationship between the variables is credible.

Descriptive analyses

The means, SD, and correlation coefficients for the participating teachers' assessment literacy, teaching efficacy, psychological capital, and professional identity are shown in **Table 1**. Teachers' assessment literacy is positively correlated with teaching efficacy ($r = 0.581, p < 0.01$), psychological capital ($r = 0.603, p < 0.01$), and professional identity ($r = 0.591, p < 0.01$). Teaching efficacy is positively correlated with psychological capital ($r = 0.652, p < 0.01$) and professional identity ($r = 0.675, p < 0.01$). There is a significant positive correlation between psychological capital and professional identity ($r = 0.682, p < 0.01$). The results indicate that all variables are significantly positively correlated.

Chain mediation model analysis

Teachers' assessment literacy, psychological capital, professional identity, and teaching efficacy are significantly correlated, which meets the statistical requirements for further analysis of the mediating effect of the teachers' assessment literacy and teaching efficacy (Wen and Ye, 2014). We used Model 6 in the SPSS macro program (Hayes, 2012) to analyze the mediating effects of psychological capital and professional identity between the teachers' assessment literacy and teaching efficacy, while controlling for variables of gender, age, and teaching experience.

The regression analysis results are shown in **Table 2**. The results indicate that the teachers' assessment literacy has a significant positive predictive effect on the teaching efficacy ($\beta = 0.590, p < 0.001$). When psychological capital and professional identity are introduced into the regression analysis, the teachers' assessment literacy is a significant positive

predictor of psychological capital ($\beta = 0.609, p < 0.001$) and professional identity ($\beta = 0.280, p < 0.001$). Moreover, psychological capital significantly predicts professional identity ($\beta = 0.515, p < 0.001$) and teaching efficacy ($\beta = 0.284, p < 0.001$). Professional identity significantly predicts teaching efficacy ($\beta = 0.365, p < 0.001$). Meanwhile, the direct effect of the teachers' assessment literacy on teaching efficacy is decreased ($\beta = 0.201, p < 0.001$). These results suggest that the independent intermediary effects of psychological capital and professional identity, together with the chain intermediary effect of psychological capital \rightarrow professional identity, are significant in the influence of the teachers' assessment literacy on teaching efficacy. Thus, Hypotheses 1–4 are all confirmed.

Table 3 shows the mediating effect values of psychological capital and professional identity on the relationship between teachers' assessment literacy and teaching efficacy; the chain mediating model is shown in **Figure 2**. The results indicate that the total indirect effect accounts for 67.01%, and the 95% confidence interval does not contain zero (0.303, 0.489). Teacher Assessment Literacy \rightarrow Psychological Capital \rightarrow Teaching Efficacy mediating effect is significant ($\beta = 0.173$), accounting for 29.73%. Teacher Assessment Literacy \rightarrow Professional Identity \rightarrow Teaching Efficacy mediating effect is significant ($\beta = 0.103$), accounting for 17.70%. The chain multiple mediation effect of Teacher Assessment Literacy \rightarrow Psychological Capital \rightarrow Professional Identity \rightarrow Teaching Efficacy is significant ($\beta = 0.113$), accounting for 19.42%. Hypotheses 2–4 are thus confirmed once again.

Discussion

This study constructed a complete theoretical framework around the classification and gain spiral of resources and explores the influence of teachers' constructive and energy resources on teaching efficacy. The findings offer novel evidence that teachers' assessment literacy, as a constructive resource, affects their teaching efficacy directly and indirectly through the intermediary of their psychological capital and professional identity. The current study extends the existing research in three important ways.

First, we found that teachers' assessment literacy significantly and positively predicted their teaching efficacy, which validated Hypothesis 1. This result is consistent with a study by Zhang and Burry-Stock (2003), which reported that teachers with higher levels of assessment literacy have a greater sense of efficacy in their teaching. This finding also supports the research of Eufemia (2012) and Looney et al. (2017), which states that professional competence strengthens teachers' perceptions of the value of their work, thus increasing their motivation and sense of efficacy in accomplishing teaching tasks. It can also be demonstrated that a teacher's level of professional development is an important motivating factor in enhancing

TABLE 1 Descriptive statistics and correlation matrix variables.

Variables	<i>M</i>	<i>SD</i>	1	2	3	4
1. Teachers' assessment literacy	3.917	0.475	1			
2. Teaching efficacy	4.102	0.475	0.581**	1		
3. Psychological capital	4.103	0.469	0.603**	0.652**	1	
4. Professional identity	4.228	0.473	0.591**	0.675**	0.682**	1

**Significant correlation at the 0.01 level (two-tailed test), $p < 0.01$.

TABLE 2 Regression analysis of the relationship between teacher assessment literacy and teaching efficacy.

Regression equation result variable	Predictor variable	Index of fit			Significance	
		<i>R</i>	<i>R</i> ²	<i>F</i>	β	<i>t</i>
Teaching efficacy		0.588	0.339	45.807***		
	Gender				−0.095	−2.098*
	Age				−0.008	−0.103
	Teaching experience				−0.007	−0.098
	Teacher assessment literacy				0.590	13.377***
Psychological capital		0.612	0.368	51.914***		
	Gender				−0.070	−1.581
	Age				0.116	1.575
	Teaching experience				−0.073	−0.991
	Teacher assessment literacy				0.609	14.101***
Professional identity		0.719	0.510	73.837***		
	Gender				−0.003	−0.086
	Age				−0.030	−0.461
	Teaching experience				0.003	0.046
	Psychological capital				0.515	10.877***
	Teacher assessment literacy				0.280	5.864***
Teaching efficacy		0.741	0.542	70.001***		
	Gender				−0.061	−1.606
	Age				−0.052	−0.819
	Teaching experience				0.026	0.414
	Professional identity				0.365	7.006***
	Psychological capital				0.284	5.362***
	Teacher assessment literacy				0.201	4.162***

TABLE 3 Multiple mediated analysis between the teacher variables.

	Effect	Boot SE	Bootstrap 95% CI		Effect ratio
			Low	High	
Total effect	0.582	0.044	0.496	0.667	100%
Direct effect	0.192	0.048	0.098	0.286	32.99%
Total indirect effect	0.390	0.048	0.303	0.489	67.01%
Path 1: Teacher assessment literacy → Psychological capital → Teaching efficacy	0.173	0.043	0.095	0.265	29.73%
Path 2: Teacher assessment literacy → Professional identity → Teaching efficacy	0.103	0.032	0.048	0.174	17.70%
Path 3: Teacher assessment literacy → Psychological capital → Professional identity → Teaching efficacy	0.113	0.023	0.071	0.162	19.42%

their teaching confidence in the Chinese context. Furthermore, exploring the gain spirals that result from the impact of teacher assessment literacy on teaching efficacy is particularly

important, as it highlights the idea that teachers with solid resource reserves have a greater probability of experiencing the effects of resource enrichment (Hobfoll, 2002). That is, the

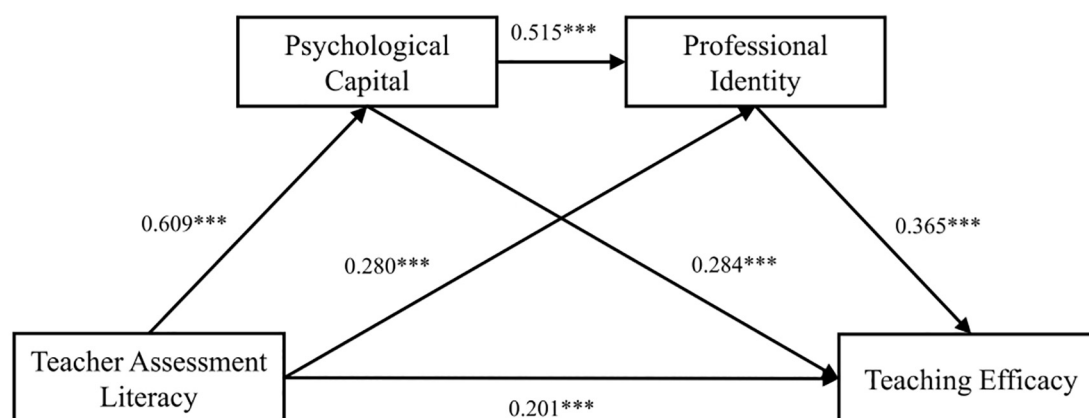


FIGURE 2
Chain mediation model. *** $p < 0.001$.

acquisition and accumulation of assessment literacy resources can be considered a pivotal driver that initiates and maintains teachers' teaching efficacy (Carter, 1984; King, 2010; Abell and Siegel, 2011). This finding enriches the current research on gain spirals. In this regard, teachers with higher assessment literacy are more likely to positively influence students' learning than teachers who lack assessment knowledge and skills training. Because of the additional confidence they have in their teaching capabilities and the competence to infer the validity and reliability of their students' learning (Deluca et al., 2013; Xu and Brown, 2017), which in turn may promote the development of teaching efficacy resources. Since resource conservation is a primary concern, the internal process that triggers the spiral of resource gain within teachers is an important part of building and maintaining the "resource caravans." Teachers create the primary motivation that necessarily supports this caravan when they strive to acquire, retrain, and protect personal resources for themselves (Hobfoll, 2014). Through a review of previous research on the COR theory (Hobfoll and Lilly, 1993), we devised a more coherent picture of how teachers' assessment knowledge and skills resources produce teaching efficacy gain spirals. This study complements the theoretical gap in the field of teacher professional development regarding the resource caravans generated by teachers' constructive resources.

Second, the present study showed that psychological capital and professional identity individually and continuously mediated the relationship between teachers' assessment literacy and teaching efficacy by testing for mediating effects. This verified Hypotheses 2–4. Notably, this finding is supported by similar studies (Beijaard et al., 2004; Fulcher, 2012; Qiu et al., 2019; Chen et al., 2020; Clarence et al., 2021). The total indirect effect accounted for 67.01% of the total effect, which was greater than the direct effect in the total effect (32.99%). This indicates that teachers with a positive psychological state or a higher level of identification with their profession are able to adopt

constructive coping strategies, leading to increased optimism, self-affirmation and professional belonging, which ultimately enhance their teaching efficacy (Esmaili and Dastgoshadeh, 2016; Rozati, 2017; Heng et al., 2020). More importantly, the examination of the chain mediation effects of teachers' psychological capital and professional identity yielded solid evidence that is consistent with the notion that an individual's resources do not exist in isolation but are clustered together (Hobfoll, 2002). The self-perpetuating, complex, and dynamic motivational processes that take place among resources in the teachers' resource caravans have also been validated (Salanova et al., 2010). This finding further verifies and explains the broaden-and-build theory of positive emotions (Fredrickson, 2001; Isgett and Fredrickson, 2015). The most influential explanation for the mechanism behind these relationships posits that teachers' assessment literacy boosts teaching efficacy by increasing the energy resources critical to teaching success. More specifically, once teachers' assessment literacy is well-developed, they will feel more confident in their assessment abilities and respond to the challenges in their teaching practice with positive emotions (Luthans et al., 2004; Popham, 2011). Simultaneously, teachers who have positive psychological capital will be more satisfied with their work, and show more emotional commitment, continuity and normativeness (Larson and Luthans, 2006), which will allow them to maximize their key resource (i.e., teaching efficacy). Overall, this study provides empirical support for the potential mechanisms of resource caravans and contributes new insights into the dynamic interactions between resources highlighted by the COR theory in the professional field of teaching.

Finally, the present study's results have several important practical implications. On the one hand, given the role of teachers' assessment literacy in predicting teaching efficacy, teachers may invest more time and energy in training on assessment knowledge and skills to help them stay up-to-date

with the knowledge on educational assessment. At the same time, it is beneficial to guide teachers to link the assessment principles and strategies with the relevant assessment practices to increase their assessment experiences in teaching (Abell and Siegel, 2011), thereby enhancing their assessment literacy and teaching confidence, which increase their personal resource storage. It is important to note that assessment trainers could examine teachers' current assessment experiences, actively seek out a variety of available resources for assessment training, and provide guidance to teachers in all phases of assessment development and use during teacher assessment training (Yan et al., 2018). On the other hand, from the perspective of the role of teachers' psychological capital and professional identity, educational administrators could enhance their support and care for teachers to strengthen the protection of positive resources, such as optimism, resilience, and a sense of belonging. Teachers could increase their energy resources by maintaining positive psychological states and professional identities, thereby preventing negative effects on their teaching efficacy when faced with job challenges. It is worth noting that, compared with unstable external social supports, a combination of factors such as assessment literacy, psychological capital, and professional identity have helped teachers survive. For instance, Bellibas and Liu (2017) found that teachers felt a higher sense of efficacy when they received additional professional development through a training program combined with the principal's instructional leadership. In light of this, to enhance teaching efficacy, it is important to consider not only external factors, such as help from others and performance feedback, but also, and more importantly, factors such as teachers' cultivation and development of their constructive resources and energy resources. All in all, schools should provide teachers with a shared marketplace of resources and facilitate the flow of positive resources through management mechanisms, thereby creating opportunities for teachers to acquire and grow resources (Chen et al., 2015; Hobfoll et al., 2018). In this way, teachers can increase their ability to resist stress through gain spirals among resources, ultimately facilitating the accumulation of key resources.

Conclusion

To conclude, based on the COR theory, this study explored the influence mechanism of teachers' assessment literacy on teaching efficacy and tested the mediation roles of psychological capital and professional identity. Identification of the chain-based multi-mediating role reveals new pathways to consider the impact of the teachers' assessment literacy on teaching efficacy. The findings suggest that teachers' assessment literacy is an important antecedent for predicting psychological capital, professional identity, and teaching efficacy. Teachers' assessment literacy can influence their teaching efficacy directly

or indirectly through psychological capital and professional identity. The present study simultaneously underscores that rich individual constructive resources and energy resources facilitate positive gaining spirals in key resources; these findings validate and enrich existing research on the COR theory. In addition, the relationships among the multiple personal resources teachers possess are not isolated, separated, and fragmented from one another, but rather interconnected and interactive, ultimately forming a web-like array of resources; notably, this finding extends the COR theory on resource caravans. Taken together, the findings of this study provide information on how to improve teachers' assessment literacy to enhance psychological capital and professional identity, thereby snowballing their sense of teaching efficacy.

Limitations and future directions

This study shows some shortcomings. (1) Due to the pandemic conditions, the sample of this study is relatively small and focused on the Henan Province, which cannot reflect the overall situation of Chinese teachers. Follow-up research should be conducted in a wider area of China to increase the representativeness and diversity of the sample. (2) This study features only cross-sectional data; thus, solid conclusions cannot be drawn. To improve the reliability and validity of the present results, follow-up longitudinal study could be considered. (3) The influence of the external resources on teaching efficacy and the uncertainty of whether external resources can affect teaching efficacy through their internal resources need to be resolved. (4) Given that teaching efficacy is a key resource for teachers' professional development, it is unclear what role it plays in promoting teachers' assessment literacy, psychological capital, and professional identity. The contribution of teaching efficacy to teachers' constructive resources and energy resources could be considered in future research. In short, our results advance the evidence illustrating the core role of the teachers' assessment literacy, psychological capital, and professional identity in teaching efficacy; however, follow-up studies are required to resolve the abovementioned issues.

Data availability statement

The original contributions presented in this study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior. The

patients/participants provided their written informed consent to participate in this study.

Author contributions

PZ and HW designed the study and reviewed and revised the manuscript. WS drafted the manuscript and coordinated the data collection. YZ and TL analyzed the data and revised the manuscript. All authors contributed to the article and approved the submitted version.

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Supplementary material

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How teacher and classmate support relate to students' stress and academic achievement

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According to the conservation of resources theory, social support provides resources to help overcome challenges. Although some empirical findings have emphasized the pivotal role of teacher support and/or peer support for students' stress and academic achievement, multilevel analyses that consider contextual class and individual student effects are scarce. The current study addresses this gap and further includes gender, socio-economic status, and neuroticism as covariates. Multilevel analyses in Mplus were conducted. All measures were taken at the student level and then aggregated to the classroom level to estimate class-level relationships. Results revealed that on the individual level, teacher support was related to higher ability to cope and lower levels of helplessness, while on the class level, peer support by classmates was related to higher ability to cope and academic achievement. The context effects also show that in classes with higher peer support, students are more likely to benefit in terms of coping ability and achievement, whereas in classes with higher teacher support, students tend to show less coping ability.

KEYWORDS

teacher support, peer support, helplessness, ability to cope, academic achievement, multilevel analysis

Introduction

Social relationships with peers and teachers play a pivotal role for students' stress and learning outcomes as they act as resources that support learning and mitigate feelings of stress (Cohen et al., 1983; Hobfoll et al., 1990; Wentzel et al., 2017). The conservation of resources theory (COR) states that "human beings' primary motivation is to build, protect, and foster their resource pools in order to protect the self-bond and the social bond that support the self" (Buchwald and Schwarzer, 2010, p. 500). Unlike previous stress theories that focus on individual appraisals of stressors, COR assumes that stress has "central environmental, social, and cultural bases in terms of the demands on people to acquire and protect the circumstances that ensure their well-being and distance themselves from threats to well-being" (Hobfoll and Ford, 2007, p. 565). Hence, the perception of stress is determined to a great extent by the social environment which is linked to the protection, gain, or loss of individual resources when faced with challenges (Hobfoll and Ford, 2007). COR can be applied to complex learning situations, e.g., the

school context in which peers and teachers shape students' social environment. Hence, if these relationships are perceived as supportive, students are less likely to experience stress and can invest their actual resources in the learning process which most likely increases their academic success. In contrast, if students feel a lack of support by peers and teachers, they consequently must invest more resources to handle and overcome stressful situations and be academically successful (see [Hobfoll et al., 1990](#)). In the current study, we define perceived stress along two dimensions, including helplessness and the ability to cope ([Klein et al., 2016](#)). Thereby, perceived helplessness reflects an individuals' reaction to stress, whereas ability to cope emphasizes the self-assessed capability to cope with stressors ([Roberti et al., 2006](#)). Hence, if students feel helpless in stressful situations and exhibit low abilities to cope with stressors, chances of increased stress are high. As stress has become prevalent, particularly among the student cohort of young adolescents ([Inchley et al., 2016](#)) and presents a risk for students' personal and academic development, it is important to investigate and detect factors that are part of students' immediate environment and promise to mitigate feelings of stress.

A promising factor in reducing stress and boosting students' academic achievement involves students' relationships with teachers and peers at school. Teachers' support can be quite complex and has been viewed as a multidimensional construct consisting of emotional, instrumental, informational, and feedback-related components ([Tardy, 1985](#)). Recent empirical studies show teacher-student relationships include emotional support, classroom organization, and instructional support ([Downer et al., 2015](#); [Hoferichter et al., 2020](#)). Emotional support is characterized by emotional closeness, recognition, and interest for students' concerns ([Hamre and Pianta, 2006](#)), whereas classroom organization includes, e.g., managing the teaching environment, student activities, and providing an orderly and functional classroom setting for students to achieve their educational goals ([Creemers, 1994](#); [Savage and Savage, 2009](#)). Instructional support includes, e.g., helping students solve assignments, motivating students, and providing feedback on students' learning progress ([Kilpatrick Demaray et al., 2010](#)).

Peer support describes the process of giving and receiving help from a similar person (with whom one shares similar demographics or social aspects), expressing empathy, encouragement, and support within a reciprocal relationship ([Mead et al., 2001](#); [Shalaby and Agyapong, 2020](#)). As adolescents mature, social relationships change as they increasingly look to peers for support ([Tarrant, 2002](#); [Branje, 2018](#)).

In sum, to capture social support, we speak of supportive relationships when they are characterized by close ties, care, esteem, and provide help if necessary ([Sarason and Sarason, 2009](#)). In this study, teacher support is conceptualized as the average of emotional and instructional support, thereby peer support relates to the positive relationship students have with their classmates. Students' academic achievement is conceptualized by students' grades in the subjects German, Math, and English.

So far, there have been some empirical studies investigating the single paths on how peer support and/or teacher support relate to students' stress, while others have focused on how social support relates to students' achievement (e.g., [Tennant et al., 2015](#); [Hoferichter and Raufelder, 2021](#); [Hoferichter et al., 2021a](#)). Although COR provides a framework for how social support may be related to student stress and academic achievement, it has not been empirically quantified how peer support as well as teacher support relate to students' stress and academic achievement on an individual (student) and contextual (classroom) level. Educational systems such as schools are multilevel systems ([Kozlowski and Klein, 2000](#)) in which students are grouped into classes and share similar experiences. At the class level, perceived peer and teacher support constitute the class climate, which, when analyzed, must be treated as a class-level construct ([Lüdtke et al., 2009](#); [Bardach et al., 2020](#)). The classroom climate is a common characteristic that all students in a class are exposed to. In empirical studies, such as this study, students are asked to indicate their perceptions of classroom climate, which consists of interpersonal communication and interactions between students and teachers. The use of multilevel analyses has the potential to identify the effects of a supportive classroom-level climate beyond the level of individual students.

Teacher support, students' stress, and academic achievement

Previous multilevel studies suggest that teacher support has a positive impact on student learning and behavioral outcomes. For example, [Ma et al. \(2021\)](#) found that perceived teacher support promoted the academic self-concept and enjoyment of learning, while [Yildirim \(2012\)](#) found a positive relationship between teacher support and students' use of learning strategies in mathematics. Another multilevel study highlighted the important role of teacher support in student motivation and engagement ([Wentzel et al., 2017](#)). These multilevel studies take a promising approach by viewing classrooms as complex learning environments, taking into account individual (student) perspectives and contextual (classroom) aspects. However, when it comes to teacher support, student stress, and achievement, multilevel analyses are scarce, and empirical findings are limited to correlational or longitudinal studies that do not account for student clustering in classrooms.

Investigating into the relationship of teacher support and students' stress, [Hoferichter and Raufelder \(2021\)](#) found that teacher support buffered the development of students' academic exhaustion—a symptom of stress and burnout—over 1 school year. In a sample of elementary school students, it has been found that a positive teacher-student relationship serves children in their stress regulation measured by the stress hormone cortisol ([Hughes, 2012](#)). Students who rated their relationships with teachers as supportive exhibited the most optimal cortisol profiles and as such appropriately

down-regulated stress compared to students with a lack of support from teachers.

Next, to the impact on students' stress, supportive teacher-student relationships present an educational asset throughout students' school career as they directly relate to students' academic achievement and moreover to students' behavioral variables that are linked to academic achievement. Empirical research indicates that students who perceive their teachers as supportive show better school adjustment (Sabol and Pianta, 2012), invest more in learning (Vansteenkiste et al., 2005), are more curious to learn new things (Hoferichter et al., 2020), and exhibit higher great point average (Tennant et al., 2015).

A wide range of empirical research that investigated the impact of teacher support on children's academic achievement focused on elementary school students, while studies with secondary school students are underrepresented. This situation is particularly problematic, as studies have indicated that stress is a major problem for students during adolescence (Inchley et al., 2016). In their 3-year longitudinal study with elementary students at risk, Hughes et al. (2008) found that supportive relationships with teachers predicted students' effortful engagement which further impacted their math and reading performance positively.

Peer support, students' stress, and academic achievement

During adolescence, peers become increasingly important as peer relationships contribute to social, emotional, and cognitive development (see Tarrant, 2002; Reitz et al., 2014). Although there are only a few studies that have investigated the direct link between peer support and students' stress, various studies emphasize the beneficial role of supportive peer relationships for students' mental and physical health (Rageliené, 2016), including better psychological well-being (Holt et al., 2018; Moore et al., 2018; Hoferichter et al., 2021a), adaptive behavior (La Greca and Harrison, 2005; Yeung and Leadbeater, 2010), and low levels of stress (Lyons and Jiang, 2021). Research suggests that peer support acts as a protective factor against depression, social anxiety (La Greca and Harrison, 2005), and test anxiety (Hoferichter and Raufelder, 2015). Examining classroom climate in a meta-analysis, Wang et al. (2020) found that classroom climate was negatively associated with students' socioemotional distress. On a neurobiological level, Telzer et al. (2015) detected that peer support helped students regulate their response to stressors. Meanwhile, social exclusion by peers is related to disturbed neurodevelopment (Raufelder et al., 2021). In their review, Suresh et al. (2021) list the few studies that have investigated peer support as resource and summarize that in general, peer support has shown to improve the mental and physical health of students, including students' stress and burnout, although literature, and particularly multilevel approaches, is limited.

Investigating peer support and students' academic achievement, most studies disregard the multilevel structure

of the educational context. Only a few multilevel studies have been conducted and indicate that peer support positively relates to students' academic achievement (Burke and Sass, 2013; Wentzel et al., 2017). Burke and Sass (2013) found significant effects of peer support on students' academic achievement only at the class but not individual level, indicating that the experience of peer support within the shared classroom context contributes to students' achievement. In their study, Wentzel et al. (2017) examined peer support and learning effort at the individual student level and found positive associations, suggesting that emotional support facilitates learning. In their meta-analysis, Wang et al. (2020) find that overall classroom climate is associated with academic achievement. Single-level studies on the topic support the notation that peer support relates to increased academic involvement (Vargas-Madriz and Konishi, 2021) and academic achievement in Chemistry (Uzezi and Deya, 2017) and helps students to pursue their academic goals (Patrick et al., 2004; Wentzel, 2005).

The current study and hypotheses

Previous studies that investigated teacher and/or peer support emphasize the beneficial effect for students' stress and/or academic achievement. From a theoretical perspective, supportive relationships act as resources that help to manage and overcome challenges that require more resources to consequently ensure the well-being of the individual (COR, Hobfoll and Ford, 2007).

However, to the best of our knowledge, no studies have investigated both teacher support and peer support simultaneously in relation to stress and academic achievement in one model, although both teachers and peers are part of students' social environment at school, shaping the class climate. Furthermore, to evaluate the role of teacher and peer support for students' stress (helplessness, ability to cope) and academic achievement (final grades in German, math, English) and consider students' classroom context, it is necessary to (a) include both support variables as predictors for students' stress and academic achievement in one statistical model as well as (b) apply a multilevel model to identify individual and contextual effects – which are the aims of the current study.

Students in class are usually interdependent with their peers which means that they influence each other and share a similar context, e.g., same teachers, same classroom settings, and rules, which distinguishes them from students that attend different classrooms. Therefore, it may be beneficial to examine the individual's experience of support by teachers and peers related to stress and academic achievement considering the classroom context by means of multilevel analyses (Kozlowski and Klein, 2000; Bardach et al., 2020).

Based on the outlined research and COR, we hypothesize the following:

H1: Individual students who experience teacher support and/or peer support are more likely to cope with stressors and are less likely to report helplessness. In addition, those students also exhibit higher academic achievement.

H2: The average teacher and peer support in class relates to student stress perception and academic achievement. As previous analysis on the topic in light of contextual and individual effects are scarce, we follow an exploratory approach.

As students' gender, socio-economic status as well as the personality trait neuroticism have been linked to students' stress and academic achievement, they were included as covariates into the model. In detail, girls tend to report higher stress levels (Salmela-Aro et al., 2009; Hoferichter et al., 2021b) and exhibit higher academic achievement (Voyer and Voyer, 2014) compared to boys. Furthermore, students with lower socio-economic status tend to experience more stress (Roubinov et al., 2018; Tarullo et al., 2020) and exhibit lower academic achievement (Sirin, 2005). Neuroticism was included in the analysis, as it is related to higher threat appraisals (Schneider, 2004) and an intensified stress reactivity (Suls, 2001) which may compromise academic achievement (Hakimi et al., 2011).

Materials and methods

Participants

The dataset used in this study is built on a large, quantitative questionnaire survey of German adolescent students in Mecklenburg-Western Pomerania. The data were collected from 11 randomly selected secondary schools during the winter term 2018/2019 of the German school year. Schools that were located less than 2 h away from the research facility were contacted and invited to participate in the study. The 11 participating schools represent about 73% of all schools contacted of which all were located in urban areas. A total of 733 7th and 8th grade students ($M_{age} = 13.97$, $SD = 0.41$, 52% girls) participated in the questionnaire. They belonged to 60 classes. For the variables used in the study, the average cluster size varied between 11.60 and 12.23 ($6.04 \leq SD \leq 6.34$). As the state of Mecklenburg-Western Pomerania has only a small proportion of ethnic minority residents (4.3%; Statistisches Amt Mecklenburg-Vorpommern, 2018), data on ethnic background were not collected as the anonymity of the participants could become compromised.

Procedure

To comply with ethical standards (American Psychological Association, 2002), a strict procedure was followed prior to all data collection. First, permissions were obtained from the respective educational authorities (Ministry for Education,

Science and Culture Mecklenburg-Western Pomerania). Second, informed consent and permissions were consecutively obtained from schools, parents, and students. The students were informed in written and orally about the nature of the study and its goals, the voluntary nature of participation as well as the assurance of anonymity of data collection. At least two trained research assistants were present throughout the data collection. They explained the instruments to the students and particularly, how to use the Likert scales. Furthermore, the research assistants answered any comprehension questions.

Measures

Teacher and peer support in class

Teacher and peer support in class were assessed with two subscales by Torsheim et al. (2000). Both subscales consist of five items each with answers ranging from 1 ("not true at all") to 5 ("completely true"). They evaluate students' satisfaction regarding the support from teachers and peers in the classroom, as well as the availability of support and helpfulness (e.g., "Our teachers treat us fairly," "The students in my class enjoy being together"). The teacher support scale exhibited good internal reliability ($\alpha = 0.71$) as did the peer support in class scale ($\alpha = 0.78$).

Perceived stress

Perceived stress was evaluated with the help of the German version of the *Perceived Stress Scale* (Klein et al., 2016) which was originally developed by Cohen et al. (1983). The scale consists of a two-dimensional structure with two related subscales. Both subscales consist of five items each and were measured on a five-point Likert scale from 1 ("never") to 5 ("very often"). The subscale perceived helplessness refers to a general measurement of stress as it emphasizes individual reactions to stress (e.g., "In the last month, how often have you been upset, because of something that happened unexpectedly?"). The scale exhibited a very good internal consistency of 0.81. The subscale perceived ability to cope relates to an individual's assessment of the ability to cope with stressors (e.g., "In the last month, have you felt that you were unable to control the important things in your life?"). This subscale achieved a good internal reliability as well ($\alpha = 0.71$).

Achievement

To measure achievement, the grade point average (GPA) was assessed by students' self-reporting on their last report card in the three main subjects Math, German, and English. In Germany, the grade scale usually ranges from "1" (best outcome possible) to "6" (worst outcome possible).

Covariates

To rule out potential confounders for perceived stress and academic achievement, we included several covariates in our analyses. For the socio-economic status, we used the "book question" (Nachtigall and Kröhne, 2004) and asked the students

about the number of books that are available in their households (e.g., “How many books do you have at home?”). Answers were measured on a 5-point Likert scale ranging from 1 (“any to few books”) to 5 (“over 200 books”). Moreover, neuroticism was assessed with the help of a subscale from the *Big Five Kids Inventory* (Bleidorn and Ostendorf, 2009), which is based on the scales developed by Mervielde and De Fruyt (1999). The two items (e.g., “I doubt myself”) were measured on a 5-point Likert scale ranging from 1 (“hardly”) to 5 (“very”). The scale exhibited a good internal consistency of $\alpha=0.77$. Gender was also included as covariate with 0 = boys and 1 = girls.

Statistical analyses

The statistical analyses were conducted using Mplus 8.1 (Muthén and Muthén, 1998–2017). All analyses were performed using robust maximum likelihood estimation and missing data were compensated for using the full information maximum likelihood approach.

As our data are hierarchically structured (i.e., students clustered in classes), we performed multilevel structural equation modeling (MLSEM) (Hox et al., 2018). This approach allows to differentiate effects on the student level from those on the class level. Multilevel analyses can be further extended to subsequent hierarchical structures (e.g., schools). However, the class level was chosen as it represents the immediate context of students’ learning environment (van Ewijk and Sleegers, 2010). Lüdtke et al. (2009) highlight in their study that using a multilevel approach is usually warranted when examining the impact of learning environment characteristics (i.e., teacher and classmate support). Ignoring the different levels (e.g., student vs. classroom level) leads to aggregated and biased parameter estimates (see also Marsh et al., 2009).

After careful consideration, we made use of parcels instead of single-item data for the scales’ indicators. Parceling is a technique widely used in psychology and social sciences to produce more stable results due to more parsimonious models (Little et al., 2002; Nasser and Wisenbaker, 2003). Accordingly, random parcels were built meaning that the scales’ items were randomly assigned to built one parcel. In case of perceived helplessness, three random items were assigned to two parcels. For all other variables, two random items were assigned, so that each latent variable would be measured by two parcel indicators. Parceling has several advantages over item-level data. The advantages relate to psychometric characteristics, such higher reliability and a higher ratio of common-to-unique factor variance. In terms of model estimation, parceling has a lower likelihood of distributional violations and it leads to a more parsimonious model with fewer parameter estimates, a lower likelihood of correlated residuals and cross-loadings, and reduced sources of sampling error (Little et al., 2002, 2013). Achievement, neuroticism, gender, and SES were entered as manifest variables.

To test our hypotheses whether teacher as well as peer support would be related to lower stress levels and higher academic achievement among secondary school students, a MLSEM was built. This MLSEM builds upon the work of Lüdtke et al. (2011) who presented the latent-measurement/manifest-aggregation approach. This approach is referred to as a partial correction approach, as it corrects bias in the estimates due to item sampling (latent measurement), but it does not correct the estimates for bias in the sampling of individuals (manifest aggregation). The latter indicates that classroom-level constructs are based on group average of individual-level constructs. However, this approach is preferably over the doubly latent approach (Marsh et al., 2009), if there is only limited information at the cluster level (e.g., few clusters or few individuals within certain clusters) (Lüdtke et al., 2011). Contrarily to our dataset, doubly latent models require at least 50 clusters (preferably 100) with 10–15 individuals within each cluster. As group differences were of utmost interest in this study, we used group-mean centering for the predictors at the student level. Thereby, only in-group variance is included in the prediction meaning that the regressions at L1 represent the expected change of an outcome variable based on the increase of one within-cluster unit in the predictor (Enders and Tofighi, 2007; Enders, 2013).

Accordingly, a null model was estimated first to confirm the factor structure of the latent constructs and to investigate their variances at the different levels (student level and class level). This separation of variance is necessary to compute the intra-class correlations (ICC). The ICC(1) provides information about potential individual variance at the two levels, whereas the ICC(2) provides an estimate of reliability of aggregated classroom mean ratings (Snijders and Bosker, 2012). Particularly, ICC(1) is necessary to investigate the amount variance at L2 that can be analyzed by adding predictors at the respective levels. This examination was necessary to determine whether a multilevel approach is actually warranted for our data. To be precise, only if there were substantial differences in the dependent variables (achievement, ability to cope, and perceived helplessness), a multilevel approach should be favored over a single-level model. Subsequently, this model was extended with L1 predictors (model 1) and finally with L1 and L2 predictors (model 2; teacher support, classmate support, SES, gender, and neuroticism).

Additionally, we added parameters to the analyses that computed the context-effects. A context effect is present, if an aggregated variable at class level is still associated with the dependent variable after controlling for the same effect on the individual level. Consequently, there are context effects if the slopes of the within-group regressions are different from the between-group regressions (Raudenbush and Bryk, 2002). This difference between both regressions was therefore added as an additional parameter in the *model constraint* option of Mplus and was further standardized to facilitate interpretation. The standardization is based on multiplying the unstandardized effect with two standard deviations of the predictor variable at L2 divided by the total variance of the L1 dependent variable. The

standardized effect size can then be interpreted as the difference in the dependent variable between two L2 clusters that differ by two standard deviations on the predictor variable (Marsh et al., 2009).

Evaluations of the model fit are based on the recommendations of Hu and Bentler (1999): Consequently, we report and evaluate χ^2 test of model fit, Comparative-Fit-Index (CFI), Tucker-Lewis Index (TLI), standardized root mean square Residual (SRMR), and root mean square error of approximation (RMSEA) with its 90% confidence intervals.

Results

Table 1 shows the manifest zero-order correlations of the study's variables and Table 2 their descriptive statistics.

Multilevel structural equation modeling

Initially, we conducted a null model in which only the dependent variables were modeled. Similarly to the ICC(1) values, this model served as a reference model to examine whether there is significant variance of the dependent variables at both levels. The null model showed a good fit [$\chi^2(10) = 18.89$, $p(\chi^2) < 0.05$; CFI = 0.99, TLI = 0.98, SRMR_{within} = 0.02, SRMR_{between} = 0.07, RMSEA = 0.07]. At the student level, all three dependent variables exhibited significant variances: perceived helplessness ($\sigma^2 = 0.38$, $p < 0.001$), ability to cope ($\sigma^2 = 0.24$, $p < 0.001$), and achievement ($\sigma^2 = 0.35$, $p < 0.001$). Similarly, all variances at the between level were significant, thus warranting a multilevel approach: perceived helplessness ($\sigma^2 = 0.06$, $p < 0.01$), ability to cope ($\sigma^2 = 0.08$, $p < 0.001$), and achievement ($\sigma^2 = 0.18$, $p < 0.001$).

Subsequently, we added predictors based on theory and prior empirical research to L1 (model 1). This model achieved an adequate fit: $\chi^2(39) = 103.942$, $p(\chi^2) < 0.001$; CFI = 0.97, TLI = 0.94, SRMR_{within} = 0.03, SRMR_{between} = 0.30, RMSEA = 0.05 (see Table 3).

Further, we added predictors to L2 which resulted in our final model (model 2; Figure 1; Table 3). This final model achieved a good fit: $\chi^2(54) = 94.90$, $p(\chi^2) < 0.001$; CFI = 0.98, TLI = 0.96,

SRMR_{within} = 0.03, SRMR_{between} = 0.11, RMSEA = 0.03. In this model, the significant paths of model 1 remained robust in light of the addition of the added predictors at L2. However, as indicated by the R^2 values, significant proportions of variance were explained by classroom differences of the predictors at L2 (see Table 4).

Standardized factor loadings of the latent constructs ranged between 0.64 and 0.81 on the within level and between 0.75 and 1.00 on the between level. The model included significant correlations of the predictor variables: gender was significantly associated with peer support ($r = -0.12$, $p < 0.05$) and neuroticism ($r = -0.35$, $p < 0.001$). Moreover, teacher support was significantly associated with neuroticism ($r = -0.14$, $p < 0.01$) and peer support ($r = 0.46$, $p < 0.001$). Lastly, ability to cope was associated with perceived helplessness ($r = -0.41$, $p < 0.001$). On the between level, average peer support was significantly associated with teacher support ($r = 0.70$, $p < 0.001$).

At the student level, teacher support predicted perceived helplessness ($B = -0.23$, $\beta = -0.19$, $SE = 0.06$, $p < 0.001$) and ability to cope ($B = 0.17$, $\beta = 0.18$, $SE = 0.07$, $p < 0.05$). Thus, if the students in our study perceived their teachers to be supportive, students indicated less perceived helplessness and more ability to cope. Moreover, gender proved to be a significant covariate, indicating that boys have a higher ability to cope ($B = 0.15$, $\beta = 0.14$, $SE = 0.06$, $p < 0.01$) and exhibited lower achievement than girls ($B = -0.20$, $\beta = -0.14$, $SE = 0.07$, $p < 0.01$). Moreover, neuroticism negatively predicted ability to cope ($B = -0.20$, $\beta = 0.44$, $SE = 0.02$, $p < 0.001$), positively predicted perceived helplessness ($B = 0.34$, $\beta = 0.59$, $SE = 0.03$, $p < 0.001$), as well as academic achievement ($B = -0.08$, $\beta = -0.12$, $SE = 0.03$, $p < 0.01$). Moreover, SES was significantly related to all three dependent variables: the higher students' SES, the more likely they exhibited higher ability to cope ($B = 0.06$, $\beta = 0.14$, $SE = 0.02$, $p < 0.01$), lower perceived helplessness ($B = -0.05$, $\beta = -0.10$, $SE = 0.02$, $p < 0.05$), and higher achievement ($B = 0.19$, $\beta = 0.33$, $SE = 0.03$, $p < 0.001$).

On the classroom level, average peer support by classmates significantly predicted class average ability to cope ($B = 0.54$, $\beta = 1.15$, $SE = 0.15$, $p < 0.001$). Additionally, average classmate support significantly predicted average achievement ($B = 0.66$, $\beta = 0.49$, $SE = 0.25$, $p < 0.01$).

TABLE 1 Zero-order correlation coefficients among all study variables at student and classroom level.

	1	2	3	4	5	6	7	8
1. Helplessness		-0.73***	-0.30	-0.36*	-0.07	-0.48**	0.90***	0.54***
2. Ability to cope	-0.48***		0.52**	0.70***	-0.01	0.82***	-0.78***	-0.92***
3. Teacher support	-0.23***	0.18***		0.77***	-0.05	0.40*	-0.26	-0.56***
4. Peer support	-0.18***	0.15***	0.34***		-0.24	0.56***	-0.18	-0.74***
5. Gender	-0.18***	0.21***	-0.06	-0.08*		-0.36	-0.02	0.28
6. SES	-0.01	0.04	-0.01	-0.01	-0.06		-0.47	-0.97***
7. Neuroticism	0.54***	-0.42***	-0.11**	-0.07	-0.36***	0.01		0.52*
8. GPA	-0.21***	0.21***	0.07	0.03	-0.17***	0.14***	0.02	

Lower triangle = L1; upper triangle = L2; gender: (0 = girls, 1 = boys). Estimates are significant at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE 2 Descriptive statistics.

	Range	<i>M</i>	<i>Var_{within}</i>	<i>Var_{between}</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>ICC(1)</i>	<i>ICC(2)</i>
1. Helplessness	1–5	2.80	0.47	0.07	0.07	−0.42	0.13	0.64
2. Ability to cope	1–5	3.22	0.39	0.09	−0.25	−0.04	0.18	0.73
3. Teacher support	1–5	3.59	0.39	0.05	−0.67	1.10	0.11	0.61
4. Peer support	1–5	3.92	0.41	0.12	−1.07	1.69	0.23	0.78
5. Gender	0–1	0.47	0.24	0.01	0.09	−2.00	0.05	0.41
6. SES	1–5	3.39	1.30	0.40	−0.35	−0.98	0.24	0.78
7. Neuroticism	1–5	2.86	1.24	0.06	0.12	−85	0.05	0.37
8. GPA*	1–6	2.57	0.32	0.21	0.35	−0.11	0.40	0.89

TABLE 3 Results of multilevel structural equation modeling.

Coefficient	Ability to cope				Helplessness				Achievement			
	<i>B</i>	<i>SE</i>	<i>p</i>	β	<i>B</i>	<i>SE</i>	<i>p</i>	β	<i>B</i>	<i>SE</i>	<i>p</i>	β
Level 1 - Student												
teacher support	0.18	0.07	= 0.02	0.17	−0.23	0.07	< 0.01	−0.18	0.08	0.07	= 0.23	0.06
peer support	0.10	0.07	= 0.14	0.10	−0.14	0.09	= 0.11	−0.11	−0.01	0.06	= 0.92	−0.00
neuroticism	−0.34	0.03	< 0.001	−0.45	0.34	0.03	< 0.001	0.59	−0.08	0.03	< 0.01	−0.12
Gender	0.13	0.06	= 0.04	0.12	−0.03	0.06	= 0.60	−0.02	−0.20	0.07	< 0.01	−0.14
SES	0.08	0.02	< 0.001	0.19	−0.05	0.02	= 0.02	−0.10	0.19	0.03	< 0.001	0.33
<i>R²_{within}</i>				0.37				0.48				0.15

Bold values indicate significance.

Three contextual effects were found to be significant: (1) the association between peer support in class and ability to cope ($B = 0.43$, $\beta = 3.97$, $SE = 0.17$, $p = 0.01$) meaning that if two students who indicate equal values on peer support, the one being in a classroom with a higher average of peer support would perceive significantly more ability to cope. (2) the association between teacher support and ability to cope ($B = -0.45$, $\beta = -3.39$, $SE = 0.19$, $p < 0.05$) meaning that if two students who indicate equal values on teacher support, the one being in a classroom with a higher average of teacher support would perceive significantly less ability to cope. Lastly, (3) the association between peer support and academic achievement ($B = 0.67$, $\beta = 1.18$, $SE = 0.26$, $p < 0.05$) meaning that if two students who indicated equal values on peer support in class, the one being in a classroom with a higher average peer support would exhibit higher academic achievement.

The model explained 48% ($R^2 = 0.48$, $p < 0.001$) of variation of perceived helplessness, 37% of variation of ability to cope ($R^2 = 0.37$, $p < 0.001$), and 15% of variation of students' academic achievement ($R^2 = 0.15$, $p < 0.001$) on the student level. On the classroom level, the model explained 79% ($R^2 = 0.79$, $p < 0.001$) of variation of class average ability to cope, 8% ($R^2 = 0.08$, $p = 0.51$) of variation of class average perceived helplessness, and 31% ($R^2 = 0.31$, $p < 0.001$) of variation of classes' average academic achievement.

Discussion

The current study investigated how perceived teacher and peer support in class relate to secondary school students' stress,

captured by ability to cope and helplessness, as well as students' academic achievement on both the individual and the class level. Because teacher and peer support shape the class climate, which is a class-level variable, multilevel analyses were applied to detect individual student and contextual classroom effects, including gender, SES, and neuroticism as control variables.

The theoretical underpinnings of the study include COR (Hobfoll et al., 1990; Hobfoll and Ford, 2007), which assumes that social support acts as a resource during challenges. Specifically, the investment of resources is required to successfully face and overcome challenges. Applying COR to the school context and the current study, we expected that peer and teacher support would provide resources to help students manage their stress and improve their academic performance.

The multilevel analyses partly confirmed H1 by revealing that on an individual student level, teacher support was related to higher ability to cope and lower levels of helplessness. Hence, if a student perceives teachers as supportive, this student experiences less stress, as he/she applies coping strategies to deal with stressors and reports lower helplessness. These findings are in line with previous correlational and longitudinal studies that investigated the direct paths of the predictor variables teacher support (Hughes, 2012; Hoferichter and Raufelder, 2021) for students' stress level. Contrary to H1, however, no significant relationship was found between teacher support and grades. This contradicts previous studies, possibly because they are all based on data from elementary school students (Ladd and Burgess, 2001; Hughes et al., 2008; Mason et al., 2019). In general, teacher-student relationships are

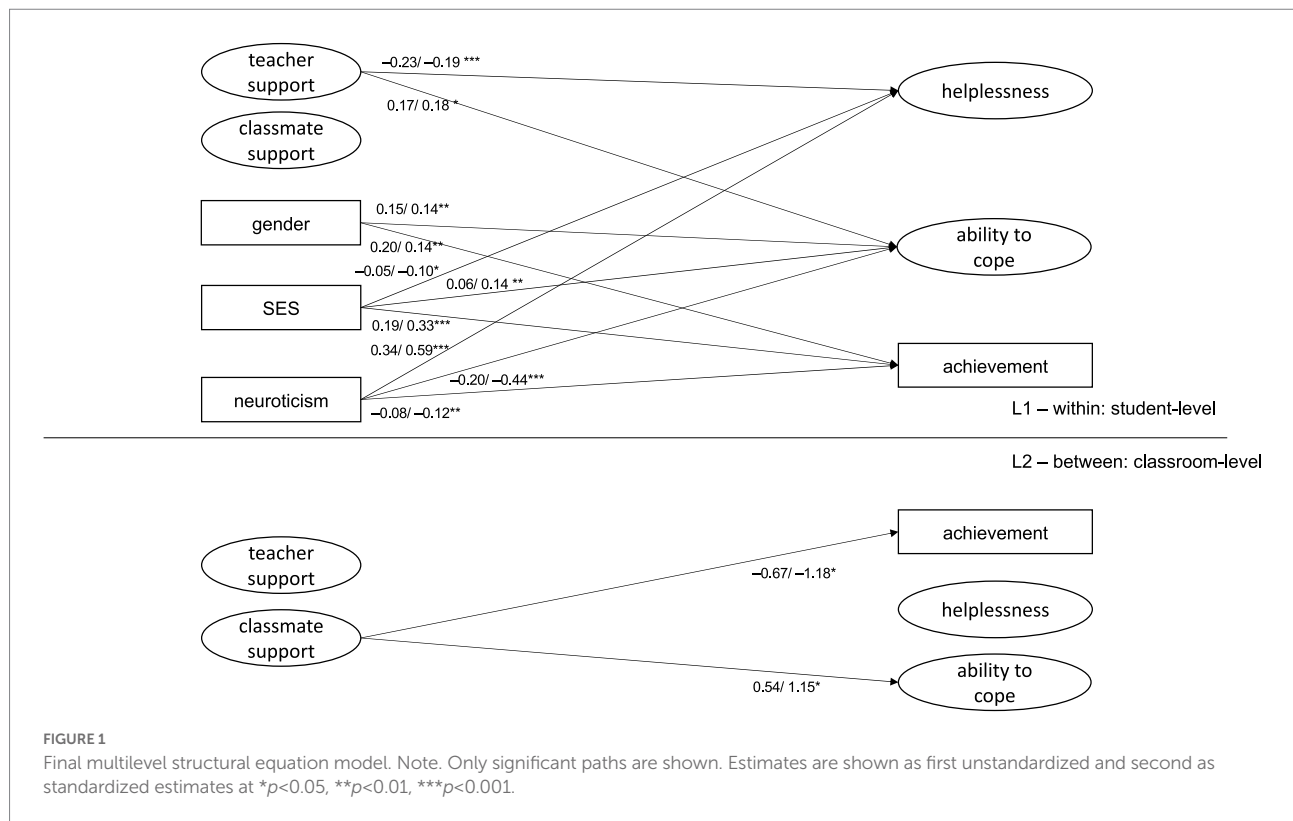


TABLE 4 Results of multilevel structural equation modeling.

Coefficient	Ability to cope				Helplessness				Achievement			
	<i>B</i>	<i>SE</i>	<i>p</i>	β	<i>B</i>	<i>SE</i>	<i>p</i>	β	<i>B</i>	<i>SE</i>	<i>p</i>	β
Level 1 - Student												
teacher support	0.17	0.07	= 0.01	0.18	-0.23	0.07	< 0.001	-0.19	0.07	0.06	= 0.23	0.05
peer support	0.11	0.07	= 0.10	0.11	-0.14	0.08	= 0.08	-0.11	0.00	0.06	= 0.95	0.00
neuroticism	-0.20	0.02	< 0.001	-0.44	0.34	0.03	< 0.001	0.59	-0.08	0.03	< 0.01	-0.12
Gender	0.15	0.06	< 0.01	0.14	-0.03	0.06	= 0.61	-0.02	-0.20	0.07	< 0.01	-0.14
SES	0.06	0.02	< 0.01	0.14	-0.05	0.02	= 0.03	-0.10	0.19	0.03	< 0.001	0.33
R^2_{within}				0.37				0.48				0.15
Level 2 - Class												
teacher support	-0.27	0.16	= 0.10	-0.48	0.01	0.19	= 0.96	0.02	0.14	0.36	= 0.69	0.09
peer support	0.54	0.15	< 0.001	1.15	-0.12	0.17	= 0.48	-0.29	0.66	0.25	< 0.01	0.49
$R^2_{between}$				0.79				0.08				0.31
Additional parameters												
context-effect	-0.45	0.19	= 0.02	-3.39	0.24	0.20	= 0.22	1.00	0.07	0.38	= 0.86	0.10
teacher support												
context-effect peer support	0.43	0.17	= 0.01	3.97	0.02	0.18	= 0.91	1.00	0.67	0.26	= 0.01	1.18

Significant effects are displayed in bold at the 0.05 level. Gender: (0 = girls, 1 = boys).

perceived as more supportive and caring in elementary schools, and the type of teaching (e.g., subject teachers; teacher-centered learning) also differs greatly in the two types of schools (Wigfield et al., 1991; Anderman and Maehr, 1994; Midgley et al., 1995; Anderman and Midgley, 1997). In addition, the

results of previous studies may differ due to different operationalization procedures.

H1 could also not be confirmed in the sense that no significant associations between perceived peer support and stress experience or grades were found at the individual level, which contradicts

previous studies (Burke and Sass, 2013; Uzezi and Deya, 2017; Vargas-Madriz and Konishi, 2021). Interestingly, and in line with H2, peer support within the classroom had a significant association with ability to cope and academic achievement, when analyzed on the class level. Hence, when peer support was aggregated on a class level and as such class context taken into consideration, students reported higher ability to cope in stressful situations and better GPA, when they perceived peer support by their classmates. In line with these results, Burke and Sass (2013) did also find that peer support was related to higher students' academic achievement only on the class level. The results reveal that classmates together present a powerful context providing support to their peers which in turn is related to better coping strategies in stressful situations and better academic performance. Meanwhile, teachers who support their students may be able to help them cope with stressors and feel less helpless.

The current study also partly confirmed H2 as it was found that students' perceived class context was related to the degree students were able to cope with stress and be academically successful. Context effects can be interpreted as a comparison between two identical students in different classes (contexts). In detail, if two students who indicate equal values regarding peer support, the one being in a classroom with a higher average of peer support would perceive significantly more ability to cope and higher academic achievement. Furthermore, the current study also revealed that students who are part of a context in which teachers are perceived as supportive tend to exhibit less ability to cope. This finding may be counterintuitive, as COR and previous studies suggest that teacher support is related to lower stress in students (Hughes, 2012; Hoferichter and Raufelder, 2021). Therefore, this finding could lead to the conclusion that high levels of teacher support affect students' coping skills, as excessive support can undermine self-development. Perhaps, students in classes with very high teacher support do not feel the need to expand their coping skills because the high teacher support cancels out their stressful experience. When teachers provide too much support, they can interfere with students' autonomy and competence, which are important prerequisites for developing self-determined behaviors and skills (Catalano et al., 2004; Wehmeyer, 2005). Self-determined behavior refers to "volitional actions that enable one to act as the primary causal agent in one's life and to maintain or improve one's quality of life" (Hui and Tsang, 2012, p. 117). In other words, students who have the opportunity to experience autonomy and competence are more likely to develop self-determined behaviors, which, in turn, can strengthen their coping skills. Future studies, however, should examine the varying degrees of teacher support from the perspective of students in order to differentiate how much support teachers should provide to help students cope with stressors.

Considering the covariates that were included in the model on the student level to rule out potential confounders, it was found that neurotic students reported less ability to cope and more helplessness as well as worse GPA compared to non-neurotic

students. As neurotic individuals tend to experience higher threat appraisals and are more vulnerable to stress which compromises their academic achievement, the current studies' findings are in line with previous research (Suls, 2001; Schneider, 2004; Hakimi et al., 2011).

Furthermore, students from high socio-economic backgrounds reported higher ability to cope and less helplessness as well as better academic achievement compared to students from lower socio-economic backgrounds. This finding is in line with previous studies, indicating higher stress levels among low SES students (Roubinov et al., 2018; Tarullo et al., 2020) as well as medium to strong SES-achievement relations (Sirin, 2005). As expected, girls reported lower ability to cope with stressors and better GPA compared to boys, which was also found by Hoferichter et al. (2021b) and Salmela-Aro et al. (2009) as well as Voyer and Voyer (2014), respectively.

In sum, the current study emphasizes the essential role of teachers and peers for students' stress management and academic achievement. The multilevel approach allowed us to identify different effects at the individual and class levels: While on the individual level particularly teacher support was found to be positively related to students' stress management and academic achievement, on the class level and considering context effects, peer support related to students' ability to cope with stressors and to high academic achievement. In other words, general class climate characterized by mutual support is needed above all to reduce the experience of stress and have a positive effect on academic performance. Thereby, the role of teachers differs from peer support, as individual students who perceive their teachers as supportive exhibit better stress management in general, i.e., high ability to cope and low helplessness. On the other hand, if all teachers in a class are perceived as highly supportive, there may be a reversal effect insofar as students then tend to report fewer coping skills. By considering the hierarchical structure of students nested in classrooms, this study could give even more detailed information on how teacher and peer support relate to students' stress and academic ability. This study reveals empirical findings that contribute to research on social resources in the frame of the conservation of resource theory (Hobfoll et al., 1990), revealing that students' stress and academic achievement to a large part are related to the quality of teacher and peer support differently on the individual and class level. Thus, while COR provides a general approach to the function of social resources as protective factors in difficult situations, our empirical study provides additional information on how classroom climate variables differentially affect student stress and academic achievement, illustrating the complex nature of social relationships and their impact on student outcomes.

Transferring the findings to the school context, school staff should be advised that their 1:1 relationship with students enhances students' ability to deal with challenging situations and enables them to take action rather than feeling helpless. Thus, a teacher who responds to the student individually, attends to the student's concerns and interests, and expresses

a great deal of appreciation to the student plays an important role in helping the student cope with stress. Because peer support as a classroom variable plays an important role in students' coping strategies and academic achievement, teachers can consider peers as significant protective factors that promote their classmates' academic achievement. Collaborative classroom activities, shared learning scenarios, and peer feedback should be integrated into daily classroom routines (see [Simonsmeier et al., 2020](#)). In addition, school staff should understand their role in the classroom as mentors who guide learning processes while keeping a low profile rather than overemphasizing their support for students, as too much teacher support can hinder students' personal and academic development.

Strengths, limitations, and future research

This study examined how both teacher and peer support relate to students' stress and academic achievement by considering covariates such as gender, SES, and neuroticism. Thereby, this study investigates social resources from the immediate environment of students that can further benefit interventional programs that aim at reducing stress and increasing academic success among students. A strength of this study is the multilevel analysis that considers individual and context effects in the interplay of the variables of interest. However, as in all empirical studies, there are limitations that have to be taken into consideration when interpreting the results, such as the cross-sectional nature of data investigated. Hence, no causal relationships between the variables may be derived from the analyses. Future research should therefore investigate the longitudinal relationship between teacher and peer support on students' stress and academic achievement over the school years, to consider long-term effects of social resources and further develop COR by adding the time factor and by covering developmental processes of students. As the school context shapes students' stress, school engagement, and motivation ([Hoferichter and Raufelder, 2022](#)), future studies are advised to investigate potential differences across students from various school types (e.g., lower- and higher track schools) and consider different age groups (e.g., elementary school students), as peer relationships and teacher-student relationships change during students' school career as well as students' needs for social support from different agencies ([Tarrant, 2002](#); [Branje, 2018](#); [Hoferichter et al., 2021a](#)). In addition to self-report data, future studies may include teacher and parental ratings when it comes to students' ability to cope and helplessness as well as include competencies of students in various subjects that complement GPA.

As the current study indicates individual and group-level specifics with respect to the association of teacher and peer

support for students' stress and academic achievement, further person-oriented approaches promise to bring to light detailed information on the topic by addressing the following research questions: What would students' profiles look like given varying degrees of teacher support, students' coping skills, helplessness, and achievement? Would these profiles be stable across school years? How might different learning environments (e.g., teacher-centered instruction, self-directed learning) contribute to students' coping skills and academic achievement? How do boys and girls differ in their need for peer and teacher support to develop their coping skills and succeed academically? How does differentiated teacher support, such as emotional and instructional support and classroom management, contribute to students' stress development and academic achievement?

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 Ethikkommission der Universitätsmedizin Greifswald. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin as well as by students themselves.

Author contributions

FH and SK designed the study. FH wrote the theoretical part and discussion, while SK did the statistical analyses and wrote the methods and results sections. DR acted as consultant and edited the MS. All authors contributed to the article and approved the submitted version.

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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.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.992497/full#supplementary-material>

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Need strength, perceived need support, stress symptomatology, and performance in the context of oral exams: A typological approach

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Introduction: Based on self-determination theory, we investigated whether examinees are classifiable into profiles based on basic need strength and perceived need support that differ in stress parameters and achievement in the context of a standardized oral exam.

Methods: 92 students reported their basic need strength before and perceived need support provided by the examiner once after the exam. Students indicated their emotions and stress perception at four measurement points and we measured their saliva cortisol concurrently, analyzing stress-related changes over time.

Results: Latent class analyses revealed two higher-quality (low/high, high/high) and two lower-quality (low/low, high/low) need strength/need support classes. Physio-affective stress development was typical of exam situations. Higher-quality classes that met or exceeded the needs displayed more beneficial stress and emotion response patterns than lower-quality classes. Gain-related emotions mediated achievement in the higher-quality classes.

Discussion: Need-supportive examiners can promote student well-being and achievement when they succeed in providing high need satisfaction.

KEYWORDS

basic needs, oral exams, cortisol, stress perception, achievement emotions

Introduction

Three basic psychological needs energize human behavior: the needs for autonomy, competence, and relatedness. The basic psychological needs are fundamental to human nature and must be satisfied for an optimal sustainment of psychological interest, development, and wellness (Ryan and Deci, 2017). The basic needs play a crucial role in student learning and performance in academic settings. When an environment supports the basic needs, for instance, when a teacher creates a learning atmosphere that the students perceive as need-supportive, the students' resulting need satisfaction can positively affect their motivation, academic performance, and

well-being (Ryan and Deci, 2017). Vice versa, a lack of teacher need support may result in unsatisfied needs, entailing negative consequences like stress and lower achievement (Reeve and Tseng, 2011; Ryan and Deci, 2020). Importantly, teachers' need support behavior affects their students' motivation indirectly, as it is the students' *perception* of need support and the resulting need satisfaction that inform their motivational quality (Ryan and Deci, 2017).

The functionality of the basic psychological needs is universal and, therefore, applies to all individuals. However, the value, desire, or salience of the basic psychological needs for the individual may vary, which represents need strength (Ryan and Deci, 2017; Vansteenkiste et al., 2020). Differences in need strength might play a role in the configurations of the effects of need strength and experienced need satisfaction (Ryan et al., 2019; Vansteenkiste et al., 2020). Therefore, it can be fruitful to consider intensity patterns of both the strength and the satisfaction of the three basic psychological needs in a parallel manner, for which person-centered approaches such as latent class analyses are suitable.

Despite solid evidence for the beneficial effects of need-supportive teacher behaviors (Gilbert et al., 2021), formal education is often not designed in a need-supportive way (Ryan and Deci, 2017). Oral exams constitute one of the strongest social-evaluative stressors (Zeidner, 1998) in education that may have a high impact (e.g., thesis defense) but often lack adequate examiner support (Buchwald and Schwarzer, 2003). Oral exams comprise time pressure, little feedback or feedback only as a final grade, and they are associated with uncertainty, lack of control, the necessity for quick reactions to exam questions and tasks, and high complexity, stemming from the direct interaction between examinee and examiner (Roick and Ringeisen, 2017; Ringeisen et al., 2019). This lack of "built-in" basic need support can result in a negative perception of the situation, thus in lower need satisfaction, higher stress, and lower achievement (Reeve and Tseng, 2011; Oberauer et al., 2016; Yu et al., 2018).

However, despite the general set-up, the interactive nature of oral exams offers the opportunity for examiners to support their examinees' basic needs during the exam through their behavior. For example, an examiner could let the students choose the starting topic of a presentation, supporting their *need for autonomy*, i.e., students' feeling of willingness, interest, or value in their actions. When examiners give informational feedback, they support students' *need for competence*, i.e., the universal need to feel effective. When examiners behave in a caring, friendly, empathetic, and respectful way (Buchwald, 2002; Buchwald and Schwarzer, 2003), they support their students' *need for relatedness*, i.e., the need to belong to, be involved with and cared for by others (Ryan and Deci, 2017, 2020). This basic need support could reduce stress responses, eventually improving student performance and achievement (Reeve and Tseng, 2011). Accordingly, investigating the impact of need support on well-being and achievement by means of an examiner's behavior during oral exams offers an opportunity to improve formal education in a need-supportive, motivating, and healthy way (Ryan and Deci, 2017).

It is conceivable that not only perceived basic need support but also the individual's basic need strength is essential for stress and achievement in oral exams (e.g., Vansteenkiste et al., 2020). For example, a student with a strong need for relatedness might try more than a student with a weak need for relatedness to engage in an emotionally responsive interaction with the examiner and, therefore, perceive more relatedness support. In oral exams, interindividual basic need differences might result in different basic need configurations in combination with need-supportive examiner behavior.

More detailed knowledge about occurring basic need strength and satisfaction configurations could help support a heterogeneous student body, consisting of different subgroups, to live up to their potential in the stressful event of an oral exam. This typological perspective has recently gained interest (Ryan and Deci, 2020) and is particularly useful in the investigation of the basic psychological needs in the context of oral exams. Person-centered approaches allow for an inclusion of the possibility that a sample includes "multiple subpopulations characterized by different sets of parameters" (Morin et al., 2016, p. 8), enabling an investigation of how many different classes can be found within data and how these classes differ from each other, also regarding different outcome variables and their development (Laursen and Hoff, 2006).

In the present case, the person-centered approach enabled an identification of subgroups with distinct configurations of basic psychological need intensity and support intensity that may be congruent or incongruent. In the congruent case, for example, a person has a high level of need strength as well as a high level of perceived need satisfaction. In the incongruent case, a person has, for example, a low level of need strength but at the same time a high level of perceived need satisfaction, which would mean over-satisfaction of the needs for that person. This differentiation is important because the three basic psychological needs are usually correlated and occur together naturally, and because each need is characterized by a specific intensity that may vary interpersonally (Ryan and Deci, 2017). Moreover, person-centered approaches are well-suited to address differences in group-specific patterns of the development of stress-related outcome variables (Laursen and Hoff, 2006) such as emotions, cortisol, or subjective stress perception, or performance outcomes such as grades, in association with the basic psychological needs (Vansteenkiste and Ryan, 2013). In this matter, prior research has found the configuration of the basic needs to have distinct associations with affect and well-being (e.g., Tóth-Király et al., 2020; Santana-Monagas and Núñez, 2022).

Accordingly, the current study investigated whether there are naturally occurring profiles based on the examinee's basic need strength and perceived need support in oral exams, which has not been covered by empirical studies yet. In a second step, we analyzed whether the displayed profiles differed in stress responses and achievement to understand which intensity constellations of need strength and need support are associated with which stress- and performance-related outcomes. If there

were specifically vulnerable or beneficial configurations, examiners might modulate their support behaviors according to the need strength of the subgroups or examinees might be screened for their need strength so that groups of varying need strength could be assigned to the most suitable examiner under consideration of their response to these need constellations. As such, examiners could help examinees live up to their possibilities by reducing stress through basic need support. It could enable new options to prepare students for and organize oral exams.

Students' basic psychological needs and need-supportive teacher behavior

Self-determination theory (SDT; Ryan and Deci, 2017) differentiates qualitatively distinct types of motivation. The most autonomous quality is intrinsic motivation. Intrinsically motivated behavior is performed for the sake of itself, e.g., out of curiosity or interest. Extrinsically motivated behavior is conducted for a purpose that is separable from the behavior. It can be integrated, identified, introjected, or externally regulated, i.e., more or less accepted and integrated into the self. The types of motivation stand on a continuum of relative autonomy, from controlled lower-quality to autonomous higher-quality motivation (Ryan and Deci, 2000). An individual's environment, e.g., their teacher, can facilitate the emergence of high-quality motivation through basic need support: When students *perceive* that their teacher supports their needs, it can result in basic need satisfaction, subsequently promoting more autonomous motivation types like intrinsic motivation. For example, perceived need support is positively related to emotional well-being at the level of traits and daily fluctuations (Reis et al., 2000). A lack of perceived basic need support or even need frustration, on the other hand, promotes stress (Vansteenkiste and Ryan, 2013).

In education, students who perceive need support from their teachers are more prone to develop high-quality motivation, greater engagement, and better achievement (Ryan and Deci, 2020). For instance, perceived autonomy support predicted experienced interest in the classroom and could even attenuate a general decrease in students' school motivation (Gillet et al., 2012). Moreover, the three basic needs are interrelated (Ryan and Deci, 2017). For example, autonomy support is positively linked to relatedness support. A teacher supporting autonomy by considering the student's perspective might also be more responsive to relational concerns (Ryan and Deci, 2020). A greater sense of relatedness is further connected to a better relationship between student and teacher, fostering integration and, therefore, autonomous types of motivation, commitment, effort, satisfaction, engagement, achievement, and intellectual development (see overview by Hagenauer and Volet, 2014).

Investigating the role of perceived need support in oral exams, it seems necessary to also consider students' basic need strengths, i.e., the relative salience or importance of the basic needs for the individual (Chen et al., 2015; Ryan and Deci, 2017). For example,

it is conceivable that individuals with a strong need for autonomy might feel more stressed because of the exam-inherent time pressure and restrictions than those with a weak need for autonomy. These examples highlight the claim for "universality without uniformity" (Vansteenkiste et al., 2020, p. 17) in basic need research. While basic need satisfaction is of universal importance, basic need strength is acknowledged as a contributing factor with more subtle effects. Empirically, there are inconclusive findings regarding perceived need support, need strength, and their associations to (impaired) well-being. Research reported a minor albeit significant impact of need strength on the relation between need satisfaction and well-or ill-being that might be context- or situation-specific (Van Assche et al., 2018; Vansteenkiste et al., 2020). Accordingly, need strength might be associated with the relation between perceived need support and well-being in oral exams (Ryan and Deci, 2017). Therefore, research should consider both perceived basic need support in conjunction with basic need strength when investigating exam-related stress responses and achievement.

Basic need support, stress, and oral exams

Stress is an organismic reaction to stressors like exams. Responses can be cognitive, e.g., lowered concentration, affective, e.g., increased subjective stress levels, and physiological, e.g., the reactivity of the hypothalamic-pituitary-adrenal (HPA) axis (Reeve and Tseng, 2011), as indexed by changes in acute cortisol concentrations. Higher perceived stress is generally associated with acutely higher cortisol levels, particularly in social contexts (Adam, 2012). In exams, characteristic changes in stress-related responses are expected across its stages, reflecting that uncertainty about the contents and the performance gradually decreases over time (Folkman and Lazarus, 1985; Carver and Scheier, 1994): Uncertainty and stress-related responses should be greatest during the *anticipatory stage* shortly before the exam, drop throughout the exam until the *waiting stage* commences once the exam is completed yet the grades are still unannounced. Afterward, stress responses should further decrease during the *outcome stage* once students have received feedback on their performance. These patterns are primarily confirmed for threat-related emotions such as anxiety, loss-related emotions such as anger or disappointment, and endocrinological responses such as saliva cortisol concentrations (Folkman and Lazarus, 1985; Carver and Scheier, 1994; Ringeisen and Buchwald, 2010; Bermeitinger et al., 2018; Ringeisen et al., 2019; Graham et al., 2022). However, some studies also found still elevated cortisol levels after the completion of oral exams (e.g., Preuß et al., 2010). Inverse patterns with gradual increases in intensity could be observed for challenge-related emotions such as hope and gain-related emotions such as relief (Folkman and Lazarus, 1985; Carver and Scheier, 1994; Ringeisen and Buchwald, 2010; Bermeitinger et al., 2018). Consequentially, reducing stress should be an important objective for examiners:

Stress may be counterproductive during exams, and a steeper decline of stress-related symptoms may be associated with better performance (Ringeisen et al., 2019).

From a basic need perspective, stress responses might result from an overall lack of perceived need support during exams (Ryan and Deci, 2017; Campbell et al., 2018). The link of perceived need support to health and well-being and of need thwarting to ill-being (Vansteenkiste and Ryan, 2013) can be explained by stress: Need satisfaction in response to a positive event (e.g., perceived need support) is associated with anterior insula-based subjective feelings and their integration with reward processing in the striatum (Reeve and Lee, 2019), the brain's reward center (Delgado, 2007; Haber, 2011). Striatum activity is linked to the adaptive regulation of the HPA axis, which is responsible for cortisol output (Heller et al., 2013). In short, basic need satisfaction by means of perceived need support and need frustration by thwarting are associated with activity in the body's reward system, which influences subjective-affective stress responses accompanied by changes in acute cortisol secretion.

The influence of perceived need support on stress through need satisfaction has been corroborated in academic achievement contexts. Overall, teachers' global basic need support negatively predicted stress levels in college students (Gilbert et al., 2021). Regarding interpersonal events like oral exams, autonomy-supportive teaching attenuated cortisol reactivity in students (Reeve and Tseng, 2011), while a lack of basic need satisfaction functioned as a stressor and resulted in worse daily functioning and poorer sleep quality and quantity during an exam period (Campbell et al., 2018). Basic need satisfaction, therefore, may influence learners' stress responses. These findings provide important implications for oral exams: An examiner could influence the students' subjective and endocrinological stress responses during exams indirectly through basic need support to help them live up to their full performance potential and minimize stress-related deterioration in achievement, for example, due to impaired retrieval of learned information (Reeve and Tseng, 2011; Oberauer et al., 2016; Yu et al., 2018; Ringeisen et al., 2019).

Typological analysis of basic needs

In oral exams, differences between need strength and the degree to which the desired need is met or missed can be perceived by students as various levels of need support, which should have corresponding effects on stress-related reactions during oral exams. Therefore, investigating the three basic needs of students concurrently and in conjunction with the corresponding need-supportive behaviors of examiners is helpful. However, basic need profiles in oral exams have not been explored yet. Such investigations may be realized using a typological, *person-centered* perspective, which groups individuals into profiles, allowing conclusions regarding individuals' motivational profiles as a whole (Wang et al., 2017). In our case, configurations of *both* need strength *and* perceived need support for all three basic needs should be considered to create a holistic picture of need-related profiles in the oral exam context. Typological approaches include

both cluster and latent class analysis. The latter illustrates combinations of motivational characteristics as they occur naturally. While the categorization of individuals using cluster analysis produces different results depending on the cluster method, latent class analysis groups people into relatively homogenous subgroups using a model-based method yielding more reliable results (Geiser, 2011; Fan et al., 2019). Therefore, latent class analysis was the chosen method in the current research.

Motivational research, including SDT research, has recently increased the usage of the typological, *person-centered* approach (Vansteenkiste et al., 2009; Ryan and Deci, 2020), underpinning and extending prior research (Vansteenkiste et al., 2009; Hayenga and Corpus, 2010), complementing the variable-centered perspective that is usually taken (Wormington and Linnenbrink-Garcia, 2017). New groupings of students according to motivational profiles (Martinent and Decret, 2015) or different distributions within profiles (Kusurkar et al., 2013) could implicate that different groups of students need different types of support provided by the teacher. So far, the person-centered perspective has focused mainly on configurations of intrinsic and extrinsic types of motivation in academic settings, not on the underlying basic needs. For example, Wang et al. (2017); Kusurkar et al. (2013); Hayenga and Corpus (2010); Baars and Wijnia (2018) investigated profiles of secondary and university students' intrinsic and extrinsic motivation. Haerens et al. (2018) considered teaching styles and examined autonomy support and control. They all reported four profiles that basically differentiated between better and worse motivational quality, where intrinsic motivation was always associated with higher-quality profiles.

Therefore, identifying need-related classes of students may help researchers and lecturers to understand and foster the nature of their students' motivation in oral exams (Ratelle et al., 2007). Specifically, latent class analysis enables the examination of class-specific changes in stress-related outcome variables (Laursen and Hoff, 2006; Tóth-Király et al., 2020; Santana-Monagas and Núñez, 2022) such as emotions, cortisol, or subjective stress perception, or performance outcomes such as grades, in association with the basic psychological needs (Vansteenkiste and Ryan, 2013). Considering that rising physio-affective stress may predict worse performance, for example, due to impaired memory retrieval under intensifying arousal, it seems likely that students' membership to distinct groups based on configurations of need strength and need support could have indirect effects on exam performance through different associations with physio-affective stress-related variables (Reeve and Tseng, 2011; Oberauer et al., 2016; Yu et al., 2018; Ringeisen et al., 2019).

Current study

The present study investigated students' basic needs and responsive support behaviors of examiners in oral exams. Using latent class analyses, we examined whether there were groups of students that varied in their naturally occurring profiles across the

strength and the perceived support of the three basic needs. Moreover, we investigated whether the expected examinee profiles differed in their stress response, indicated by subjective-affective and endocrinological changes, and their exam achievement, indicated by their achieved grade. To control for unwanted variability in variables that should not be affected by the exam procedures, we checked whether the profiles differed regarding other exam- and person-related control variables. We considered three hypotheses that guided our empirical investigation:

- *H1*: Aligned with the findings of prior research (e.g., Hayenga and Corpus, 2010; Kusurkar et al., 2013; Wang et al., 2017; Baars and Wijnia, 2018; Tóth-Király et al., 2020; Santana-Monagas and Núñez, 2022), we expected to find different profiles regarding basic psychological need strength and perceived need support. Because the basic psychological needs are correlated (Ryan and Deci, 2017) and both need satisfaction and need strength can be distinguished as contrastive pairs with low versus high levels (Vansteenkiste et al., 2009; Hayenga and Corpus, 2010), we expected to find four classes reflecting low need strength and low perceived support, low need strength and high perceived support, high need strength and high perceived support, and high need strength and low perceived support.
- *H2*: The support of the basic psychological needs is generally related to lower stress responses (Vansteenkiste and Ryan, 2013; Ryan and Deci, 2017, 2020; Campbell et al., 2018; Reeve and Lee, 2019). Thus, we expected higher-quality profiles (high perceived need support and high need strength levels, or higher perceived need support than need strength levels) to be associated with lower levels of loss-related emotions, lower perceived stress, lower cortisol, and higher levels of gain-related emotions compared to lower-quality profiles (low perceived need support and low need strength levels, or lower perceived need support than need strength levels).
- *H3*: As the support of the basic psychological needs is generally related to better performance (Ryan and Deci, 2017), we expected higher-quality profiles with more perceived need support to achieve better grades in the oral exam than lower-quality profiles with less perceived need support. As intensifying stress responses may impair performance (e.g., Oberauer et al., 2016; Ringeisen et al., 2019), we further examined whether class membership could have indirect effects on exam performance through different associations with physio-affective stress-related variables.

Materials and methods

Sample and procedure

Participants were $N=92$ university students ($M=24.53$ years old, $SD=3.07$, $n=46$ women) who attended a regular course on

personality and social psychology at a German university, including a weekly lecture and accompanying tutorials. The response rate was 100%, i.e., all students of the course took the exam and participated in the study. Referencing the European Language Framework (Council of Europe, 2001), all participants were at least at C2-level in German (71.77% native German speakers), the highest global level ensuring full command of German for oral and written examinations. The non-native German participants reported Russian, Chinese, or Vietnamese as their mother tongue. All participants had lived in Germany for at least two years, with 74.6% of the participants raised in Germany. The study was designed according to the Declaration of Helsinki and approved by the University's Ethics Commission. Participants gave written informed consent before data collection, knowing that participation was voluntary and their data would be treated with confidentiality.

The reported study was part of a larger research project on stress and coping in the context of oral exams (see Roick and Ringeisen, 2017; Bermeitinger et al., 2018). To complete the module mentioned above, students had to pass an oral exam, one of the strongest social evaluation stressors (Zeidner, 1998), that lasted about 30 min. The same examiner conducted all exams over the course of 14 days and was at that time blind to the hypotheses. The protocol of the oral exam was standardized, including the topics, question pool, wording of primary and follow-up questions, and feedback for all students. Standardization was important to ensure that class differences based on need strength and perceived need support represent interindividual response variability (cf. Herold et al., 2021). Specifically, the examiner supported the examinees' basic needs moderately yet consistently (e.g., autonomy support: students could choose the topic they started the exam with; competence support: examiner provided verbal feedback during and after exam; relatedness support: friendly introduction and conduct of the exam). The co-examiner monitored need support consistently. In order to back up the sample for conducting analysis on interindividual response variability concerning need strength and perceived need support, we performed a power calculation for between factors ANOVA using G* Power 3.1 (Faul et al., 2007). Specifying the power test for a sample size of 92, four expected classes, and a power ($1-\beta$ error probability) of 0.95, we got a critical F value of 2.708 and a required effect size of $f=0.442$ (large effect) for class comparisons. As Table 1 shows, the classes differed in need strength and perceived need support with consistently large effects.

The study comprised four measurement points: A control day one week before the exam (T1) and three points of measurement on the exam day itself (cf. Schoofs et al., 2008; Preuß et al., 2010), namely 30 min before the exam (T2), directly after the exam but before the announcement of the grade (T3), and about 30 min after the exam, after the announcement of the grade (T4) (Figure 1). Thereby, our design covered the temporal stages of an exam (Folkman and Lazarus, 1985), namely the *anticipatory stage*, the *waiting stage*, and the *outcome stage*. Initially, it was planned to have an additional measurement point right before the start of

TABLE 1 Class comparisons of participant characteristics.

Variables	Class 1 Under- supported needs (need strength > need support)		Class 2 Over-supported needs (need strength < need support)		Class 3 Need strength and need support at low level		Class 4 Need strength and need support at high level		<i>p</i> ^a	partial η^2	post-hoc ^b
	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>			
Basic needs											
Need strength autonomy (T1)	30	3.27 ± 0.32	25	3.11 ± 0.39	18	2.61 ± 0.25	19	3.43 ± 0.34	<0.001	0.423	2 < 4; 3 < 1,2,4
Need strength competence (T1)	30	3.21 ± 0.28	25	2.84 ± 0.29	18	2.64 ± 0.37	19	3.37 ± 0.33	<0.001	0.445	2 < 1,4; 3 < 1,4
Need strength relatedness (T1)	30	3.25 ± 0.36	25	2.77 ± 0.47	18	2.63 ± 0.38	19	3.46 ± 0.32	<0.001	0.417	2 < 1,4; 3 < 1,4
Need support autonomy (T3)	30	2.88 ± 0.27	25	3.33 ± 0.27	18	2.63 ± 0.29	19	3.78 ± 0.21	<0.001	0.717	3 < 1 < 2 < 4
Need support competence (T3)	30	2.81 ± 0.26	25	3.19 ± 0.22	18	2.56 ± 0.31	19	3.64 ± 0.28	<0.001	0.678	3 < 1 < 2 < 4
Need support relatedness (T3)	30	2.89 ± 0.25	25	3.53 ± 0.26	18	2.51 ± 0.46	19	3.87 ± 0.16	<0.001	0.753	3 < 1 < 2 < 4
Controls											
Age, years	30	24.70 ± 2.87	25	25.20 ± 3.69	18	23.50 ± 2.6	19	24.79 ± 3.38	0.373	0.035	
Sex (% female)	30	43.3	25	60.0	18	44.4	19	52.6	0.613		
Average awakening time	28	8.08 ± 1.28	24	8.18 ± 1.86	18	8.33 ± 1.03	19	8.11 ± 1.13	0.941	0.005	
Body mass index, kg/m²	30	22.68 ± 3.15	24	23.22 ± 4.16	18	23.72 ± 3.37	19	25.47 ± 4.84	0.103	0.068	
Importance of performance (T1) ^c	30	3.97 ± 0.93	25	3.68 ± 1.03	18	3.67 ± 0.77	19	4.05 ± 0.97	0.418	0.031	
Intensity of preparation (T1) ^c	30	3.10 ± 0.80	25	2.92 ± 0.95	18	3.11 ± 0.83	19	3.00 ± 1.05	0.870	0.008	
Expected performance (T1) ^d	30	2.47 ± 0.58	25	2.70 ± 0.75	18	2.60 ± 0.70	19	2.30 ± 0.69	0.242	0.046	
Performance											
Achieved grade (T4) ^e	30	2.59 ± 0.89	25	2.60 ± 0.80	18	3.13 ± 1.01	19	2.47 ± 0.91	0.113	0.065	

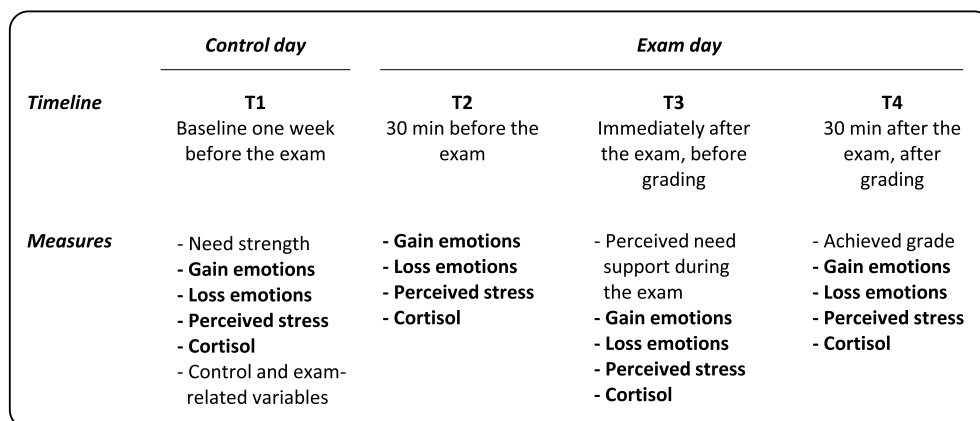
^aAll statistical comparisons performed via ANOVAs, except sex via χ^2 -tests;^bBonferroni correction;^c1 = “not a bit” ... 5 = “extremely”;^d1 = “very good” (A) ... 4 = “sufficient” (D);^eGerman grading system: lower values indicate better performance: 1 = “very good” (A) ... 5 = “failed” (E).

FIGURE 1

Assessment design and measures. Measures which were assessed longitudinally are printed in bold font.

the exam to ensure intervals of 30 min between assessments on the exam day, which the Ethics Commission denied. Using paper-pencil-questionnaires, participants reported their basic need strength at T1, their perceived basic need support during the exam retrospectively at T3, and perceived stress and gain- and loss-related outcome emotions at all four measurement points. We followed the recommendations by Chan (2009) to use

self-report data; hence, we operationalized all constructs strictly according to theory, used only scales validated for the respective language group, and randomized the order of measures.

Complementarily to subjective stress and emotions, cortisol levels were measured with salivary samples from T1 to T4. Cortisol levels do not only vary in response to the onset of a stressor (acute cortisol response) but also throughout the day (diurnal cortisol

pattern) (Dickerson and Kemeny, 2004; Foley and Kirschbaum, 2010), with a peak cortisol concentration about 30 min after waking up and a subsequent continuous decrease (Hellhammer et al., 2009). All oral exams started at different times between 9 am and 4 pm for practical reasons. Therefore, we implemented an intraindividual control design to control for participants' baseline cortisol concentrations and individual diurnal cortisol patterns. We asked for the participants' awakening time and parallelized the timing of the cortisol assessment times at T1 and T2, also ensuring that the time lag between waking up and cortisol assessment at T1 and T2 was equal. Besides, we considered the unwanted effects of demographic variables, medical conditions, or long-term medication that may also influence cortisol concentrations. For example, being over- or underweight (body mass index BMI > 30 kg/m² or < 17.0 kg/m²) can have confounding effects on cortisol concentrations (Foley and Kirschbaum, 2010).

In terms of control variables, we assessed person-related information such as age, sex, height and weight (to calculate the BMI), medical condition, the use of hormonally active long-term medication, and the average awakening time at T1. In addition, we assessed selected exam-related variables (the expected grade, the intensity of exam preparation, and the importance of performing well at T1; the achieved grade at T4).

Instruments and measures

Need strength and perceived need support

Due to the specific German oral exam setting, we used validated scales in German that mirror the wording and subscale structure of the widely used instrument by Chen et al. (2015). Aligned with considerations on trait assessment in academic performance settings (Zeidner, 1998; Tibubos et al., 2019), we operationalized need strength as a situation-specific trait with reference to exam-related tasks or examiner behaviors. Specifically, we investigated autonomy and competence strength employing the two respective scales from Rakoczy et al. (2005), enriched by items by Katz and Cohen (2014). We measured social relatedness strength by adapting a questionnaire designed by Seidel (2012). Items were introduced with "It is important to me that ..." and followed by, for example, "the examiner gives me hints so I can solve tasks by myself" (competence strength, nine items), "I have the opportunity to work through the topics autonomously with the guidance of the examiner" (autonomy strength, six items), and "the examiner gives me a sense of belonging" (relatedness strength, six items). Students indicated "rarely," "sometimes," "often," or "very often" on a 4-point Likert scale.

To assess the extent to which students perceived the examiner to satisfy their needs during the exam, participants evaluated the examiner's behavior at T3 in retrospect with the same set of items. However, we adapted the wording to past tense and the introductory phrase to "During the oral exam ...". Students indicated how often they perceived the respective aspect on a 4-point scale from "not at all" to "to a great deal." For example, "It

is important to me that I feel the examiner meets my needs and understands me" (social relatedness strength) became "During the oral exam, I felt that the examiner met my needs and understood me" (perceived social relatedness support), "It is important to me that I have the opportunity to deal with tasks or topics that interest me in more detail" (autonomy strength) became "During the oral exam, I could deal with tasks or topics that interested me in more detail" (perceived autonomy support), and "It is important to me that I get help when I cannot solve a task by myself" (competence strength) became "During the oral exam, the examiner helped me when I could not answer a task/question" (perceived competence support). Except for autonomy strength ($\alpha = 0.64$), reliability of the need strength and perceived need support scales was acceptable, ranging from $\alpha = 0.77$ to $\alpha = 0.88$.

Gain- and loss-related outcome emotions

With three adjectives each, we assessed the level at which participants perceived themselves as satisfied, happy, and relieved, mirroring gain-related emotions, and as angry, disappointed, and guilty, mirroring loss-related emotions, at each measurement point (Carver and Scheier, 1994; Ringeisen and Buchwald, 2010). Cronbach's alphas ($\alpha = 0.77, 0.60, 0.61$, and 0.78 for gain-related emotions and $\alpha = 0.54, 0.79, 0.75$, and 0.85 for loss-related emotions from T1 to T4, respectively) were similar to or even slightly above those in the cited studies. Participants were asked, "Please specify to which extent the following descriptions apply to you when you think about the oral exam now," followed by a list of the above-named adjectives. They indicated their answer on a five-point scale from "not at all" (1) to "extremely" (5).

Subjective stress experience

We assessed the participants' subjective stress experience using the Visual Analog Scale (VAS; Luria, 1975), yielding high to very high correlations with longer scales measuring stress-related affect (Gallagher et al., 2002). Students marked on a continuous line of exactly 10 cm from "no stress" on the left-hand side to "maximum stress" on the right-hand side how stressed they perceived themselves regarding the oral exam.

Cortisol assessment

Cortisol levels were measured in saliva. Saliva was collected with a shortened straw into polypropylene microtubes (SafeSeal, Sarstedt). Samples were then frozen at -20°C , thawed, vortexed, and centrifuged for 15 min at $2500 \times g$ (Function Line 400R, Heraeus) twice. Before analysis, the supernatant was transferred in duplicate into a pre-coated microwell plate. Cortisol concentration was quantified by an immunoassay kit (IBL, Hamburg, Germany). Two samples had to be excluded due to blood contamination caused by gum bleeding or injuries in the participant's mouth, affecting subsequent measurements (Westermann et al., 2004). A 96-well ELISA reader (Thermo Fisher) was used for saliva analyses and intra-assay coefficients of variance below 5% and inter-assay coefficients below 11% were reported by a professional laboratory.

Exam-related variables

We measured the expected and achieved exam grade with one single open-response item, as recommended by the German Association to Foster Educational Research (Rakoczy et al., 2005; adapted from Carver and Scheier, 1994) because research has shown that single-item measures may be used effectively in similar education settings (e.g., Leung and Xu, 2013). Students answered the questions “What grade do you think you will achieve in the oral exam?” (expected grade; T1) and “Which grade did you achieve in the exam?” (achieved grade; T4). Participants expected to pass the exam with good to satisfactory grades ($M=2.52$, $SD=0.68$) and achieved well satisfactory grades, on average ($M=2.67$, $SD=0.91$). Please note that lower numbers signify better grades because the German university grading system ranges from 1 (“A”) as the best grade to 5 (“E”) as the worst grade. Participants also indicated the importance of their performance at T1 (Rakoczy et al., 2005). Participants answered the question “How important is it for you to do well in the oral exam” on a scale from “not at all” (1) to “extremely” (5). It was important to them to perform well ($M=3.85$, $SD=0.94$). To assess the intensity of preparation, we asked participants the question “How well-prepared do you feel regarding the upcoming exam?” (Ringeisen, 2008), which they answered on a 5-point scale from “not at all” (1) to “extremely” (5) ($M=3.03$, $SD=0.91$).

Person-related control variables

Participants indicated their age and sex as well as height and weight. The BMI could be calculated from the latter two variables. Besides, participants reported any medical condition “Do you suffer from any illness/health impairment (e.g., a cold, diabetes)? If yes, which?” and the intake of medication “Do you currently take any medication (e.g., aspirin, hormonal contraceptives)? If yes, which?” To control for awakening times, participants reported the awakening time on the control day at T1 and their average awakening time during the week between the control day and the exam day by answering the question “At what time do you usually get up (*ca.* average time across the last 7 days).”

Statistical analysis

For (repeated measures) ANOVAs, correlations, and regressions, we used IBM® SPSS® Statistics Version 27, and Mplus Version 8.5 (Muthén and Muthén, 1998/2017) for latent class analyses. Before analysis, the data set was cleaned. Because of possible confounding effects on cortisol concentrations, the saliva of students with a severe medical condition and of those using any hormonally active long-term medication or reporting being over-/underweight ($BMI > 30 \text{ kg/m}^2$ or $< 17.0 \text{ kg/m}^2$) was not analyzed (Foley and Kirschbaum, 2010). Consequently, the final data set contained saliva samples from 80 students and questionnaire data from all 92 students.

To assess interindividual differences in needs and perceived need support, we used a person-centered approach and analyzed data *via* latent class analysis (LCA; Geiser, 2011; Dziak et al., 2014).

In general, LCA identifies homogenous subgroups in a sample using continuous variables (Marsh et al., 2009; Geiser, 2011). The classification into groups or different classes was made based on the mean scales for each of the need variables. To determine the most adequate number of need classes, different solutions were tested and compared based on the following indices: Loglikelihood (LL), Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), sample-size adjusted BIC (ssaBIC), Mendell–Rubin-Likelihood-Ratio-Tests (VLMRT, aLMRT), Bootstrap LRT, and the mean class membership probabilities. For AIC, BIC, and ssaBIC, lower values generally indicate a better model fit when comparing models with different numbers of classes (Geiser, 2011; Dziak et al., 2014). However, Nylund-Gibson and Choi (2018) stated that it is not uncommon that the BIC, such as other information criteria, continue to decrease for each additional class added. In this case, according to the authors, the point of diminishing returns should be examined, the so-called “elbow.” LMRT and Bootstrap LRT provide values directly comparing the calculated model with a defined number of classes with a model that contains one class less (Nylund et al., 2007; Geiser, 2011). Concerning mean class membership probabilities, Weller et al. (2020) state that values between 0.8 and 0.9 are acceptable. All measures are therefore indicators of relative model fit. Another criterion is the so-called entropy, where a value of > 0.8 indicates an acceptable classification. Weller et al. (2020) stated that the entropy values of the class solutions should be reported and investigated but should not be used to determine the final class solution. Last but not least, Marsh et al. (2009) recommended that a profile should not be made of less than 5% of the sample size.

Subsequently, we compared the identified latent classes on the stress-related state variables (emotions, subjective stress perception, cortisol concentrations), person-related control variables, and exam-related control variables. First, we calculated Pearson–Correlations for measures of need variables and mean changes in gain-related emotions, loss emotions, perceived stress, and cortisol values. Second, to compare change patterns in stress-related state variables between classes, we conducted repeated-measures ANOVAs for gain-related emotions, loss emotions, perceived stress, and cortisol concentration, with TIME of measurement as the repeated within-subjects factor and CLASS as the between-subjects factor. Mean differences between groups for each point of measurement were tested *via* ANOVAs. Third, we compared the classes regarding baseline-corrected, relative changes in stress-related state variables. Considering interindividual variability in baseline values, we subtracted the values at T1 from the following values at T2, T3, and T4, as recommended by Roberts et al. (2004) and Kärner et al. (2018) and tested for corrected relative mean changes (averaged sums of baseline-corrected data) *via* ANOVAs.

To examine the direct effects of class membership and indirect effects of physio-affective stress-related variables on performance, we conducted a mediation analysis with a multi-categorical independent variable following the general description of Hayes and Preacher (2014) (the statistical computations were carried out using Mplus version 8.5; Muthén and Muthén, 1998/2017). For

this purpose, the mean changes over time of the variables gain-related emotions, loss-related, perceived stress and cortisol levels were used as mediators and separate models were calculated for each mediator variable.

Results

Associations between the study variables

Screening the Pearson correlations yielded several significant associations (see Table 2). We found medium to strong positive associations between the three facets of need strength ($0.446 \leq r \leq 0.737$) and strong associations between the three facets of need support ($0.760 \leq r \leq 0.795$). Facets of need strength reflected significant weak to medium positive associations with facets of need support ($0.162 \leq r \leq 0.415$). Mean increases in gain-related emotions were associated with greater need strength autonomy ($r = 0.305$), and greater perceived need support regarding autonomy ($r = 0.359$), relatedness ($r = 0.381$), and competence ($r = 0.222$). Mean increases in cortisol values were related to lower values in need strength autonomy ($r = -0.357$), need strength competence ($r = -0.264$), perceived need support autonomy ($r = -0.278$), and need support relatedness ($r = -0.267$). The relative changes in the two stress-related measures (perceived stress and cortisol measures) correlate negatively ($r = -0.154$) but not significantly with each other.¹ Concerning performance, higher need strength competence ($r = -0.241$) and more gain-related emotions experienced during the test ($r = -0.379$) are significantly associated with better test results.

Identification and characterization of classes

Table 3 contains the model fit information for latent class models with 1 to 6 classes. Weighing statistical criteria for cluster

identification, we selected the four-classes solution for subsequent analysis, which appeared to fit the data best, although the fit indices provided a somewhat mixed indication of the best-fitting number of classes.² The information criteria (AIC, BIC, ssaBIC) favored the four-classes solution reflecting a diminishing decrement in information criteria values for each added class (the so-called “elbow”). For the four-classes solution, the entropy value was 0.860, indicating an acceptable classification (cf. Weller et al., 2020), and all cell frequencies were above the recommended 5% of the total sample (cf. Marsh et al., 2009). In order to back up the four-classes solution, we conducted a split-half cross-validation (cf. Fu and Perry, 2020). We divided the sample randomly into two subsamples (A and B) and calculated the four-classes solution for each of the two subsamples. The solution obtained with the two subsamples and the solution obtained with the full sample matched each other accurately (Pearson $\chi^2 = 184.60$, $p < 0.001$; Cramer's $V = 0.818$, $p < 0.001$; Contingency Coefficient = 0.817, $p < 0.001$). The mean differences in the variables need strength and perceived need support between the classes-solution generated on the total sample and the classes-solution generated on the subsamples were consistently not significant. On this basis, we performed cross-validation. Each participant from subsample B was assigned to the class from subsample A whose variable values were closest to the centers of the classes from subsample A. Comparing the class assignment on the basis of class centers and the classes determined via class analysis for subsample B indicated accuracy (Pearson $\chi^2 = 44.68$, $p < 0.001$; Cramer's $V = 0.569$, $p < 0.001$; Contingency Coefficient = 0.702, $p < 0.001$). Even given the relatively small sample size, the results indicate adequate stability of the four-classes solution.

In addition to the model fit criteria and the split-half cross-validation, the mean class membership probabilities also indicate an acceptable four-classes solution because all group-related average probabilities exceed the threshold of 0.9 (Table 4).

To characterize the class configurations, we compared the four classes with regard to need strength and need support. Autonomy strength ($p < 0.0001$; $\eta_p^2 = 0.423$), competence strength ($p < 0.0001$; $\eta_p^2 = 0.445$), and relatedness strength ($p < 0.0001$; $\eta_p^2 = 0.417$) as well as autonomy satisfaction ($p < 0.0001$; $\eta_p^2 = 0.717$), competence satisfaction ($p < 0.0001$; $\eta_p^2 = 0.678$), and relatedness satisfaction ($p < 0.0001$; $\eta_p^2 = 0.753$) differed significantly between the four classes. Post-hoc Bonferroni tests revealed that autonomy strength

¹ Approximately 75% of existing studies do not report a link between subjective stress and cortisol levels, an effect that strengthens when single measures are aggregated and mean changes are correlated (Campbell and Ehler, 2012). To additionally examine the validity of the two stress-related measures, the time-related raw values were correlated with each other. Reporting only the significant correlations, results show that perceived stress (T1) is significantly positively correlated with cortisol values at T2 ($r = 0.234$, $p = 0.048$) and T4 ($r = 0.240$, $p = 0.041$) and that perceived stress at T2 is significantly positively correlated with cortisol values at T4 ($r = 0.266$, $p = 0.021$). These correlations show time-lagged associations between perceived stress and subsequent cortisol responses during the examination period, corroborating time-lagged associations around $r = 0.20$ (Campbell and Ehler, 2012).

² We also discussed a two-class solution, consisting of a Class 1 with significantly lower need for autonomy strength at T1 compared to a Class 2 (medium effect), but no significant group differences for need for competence and need for relatedness. Compared to Class 1, participants of Class 2 displayed significantly higher levels of perceived autonomy, competence, and relatedness support at T3 (large effects). Class 1 of the two-class solution corresponded to Classes 1 and 3 of the four-classes solution, and Class 2 corresponded to Classes 2 and 4, respectively. Therefore, the two-class solution signifies a less fine-grained variant of the described four-classes solution.

TABLE 2 Pearson correlations between the study variables.

Variables	1	2	3	4	5	6	7	8	9	10
1. Need strength autonomy	–									
2. Need strength competence	0.661***	–								
3. Need strength relatedness	0.446***	0.737***	–							
4. Need support autonomy	0.415***	0.303**	0.223*	–						
5. Need support relatedness	0.358***	0.324**	0.284**	0.795***	–					
6. Need support competence	0.331***	0.247*	0.162	0.760***	0.769***	–				
7. Gain emotions ^a	0.305**	0.094	0.095	0.359***	0.381***	0.222	–			
8. Loss emotions ^a	−0.008	0.028	0.062	0.039	0.085	0.041	−0.053	–		
9. Perceived stress ^a	0.097	0.097	−0.030	−0.082	−0.047	−0.060	−0.150	−0.066	–	
10. Cortisol values ^a	−0.357**	−0.264*	−0.143	−0.278*	−0.267*	−0.185	−0.157	−0.093	−0.154	–
11. Achieved grade ^b	−0.202	−0.241*	−0.176	−0.155	−0.190	−0.124	−0.379	0.172	−0.066	0.082

73 ≤ *n* ≤ 92; ****p* ≤ 0.001; ***p* ≤ 0.01, **p* ≤ 0.05;

^aMean changes over time;

^bGerman grading system: lower values indicate better performance: 1 = “very good” (A) ... 5 = “failed” (E).

TABLE 3 Model fit information for latent class models with 1–6 classes.

		No. of classes					
		1	2	3	4	5	6
Cell frequencies per class	1	92	51	33	30	9	5
	2		41	9	25	22	24
	3			50	18	19	24
	4				19	25	3
	5					17	21
	6						15
Model fit information							
No. of free parameters		12	19	26	33	40	47
LL		−370.006	−293.622	−264.948	−236.487	−220.193	−207.583
AIC		764.011	625.244	581.896	538.974	520.386	509.166
BIC		794.273	673.158	647.462	622.193	621.258	627.690
ssaBIC		756.394	613.184	565.392	518.027	494.996	479.332
Diminishing returns			1 → 2	2 → 3	3 → 4	4 → 5	5 → 6
Diff. AIC			−138.77	−43.35	−42.92	−18.59	−11.22
Diff. BIC			−121.12	−25.70	−25.27	−0.93	6.43
Diff. ssaBIC			−143.21	−47.79	−47.37	−23.03	−15.66
Entropy		NA ^a	0.865	0.892	0.860	0.884	0.901
VLMRT		NA ^a	0.014	0.224	0.225	0.344	0.611
aLMRT		NA ^a	0.016	0.233	0.233	0.352	0.615
PBLRT		NA ^a	<0.001	<0.001	<0.001	<0.001	<0.001

LL, Loglikelihood; AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion; ssaBIC, Sample-size adjusted Bayesian Information Criterion; VLMRT, Vuong–Lo–Mendell–Rubin Likelihood–Ratio Test (value of *p*); aLMRT, Lo–Mendell–Rubin adjusted Likelihood–Ratio Test (value of *p*); PBLRT, Parametric Bootstrap–Likelihood–Ratio Test (value of *p*).

^anot available for the one-class model.

was significantly lower in Class 2 ($M = 3.11$, $SD = 0.39$) than in Class 4 ($M = 3.43$, $SD = 0.34$) and in Class 3 ($M = 2.61$, $SD = 0.25$) than in Class 1 ($M = 3.27$, $SD = 0.32$), Class 2 ($M = 3.11$, $SD = 0.39$), and Class 4 ($M = 3.43$, $SD = 0.34$). Competence strength was significantly lower in Class 2 ($M = 2.84$, $SD = 0.29$) than in Class 1 ($M = 3.21$, $SD = 0.28$) and 4 ($M = 3.37$, $SD = 0.33$) and in Class 3 ($M = 2.64$, $SD = 0.37$) than in Class 1 ($M = 3.21$, $SD = 0.28$) and Class 4 ($M = 3.37$, $SD = 0.33$). The same counted for relatedness

strength (Class 1: $M = 3.25$, $SD = 0.36$; Class 2: $M = 2.77$, $SD = 0.47$; Class 3: $M = 2.63$, $SD = 0.38$; Class 4: $M = 3.46$, $SD = 0.32$). All need satisfactions were lower in Class 3 (autonomy: $M = 2.63$, $SD = 0.29$; competence: $M = 2.56$, $SD = 0.31$; relatedness: $M = 2.51$, $SD = 0.46$) than in Class 1 (autonomy: $M = 2.88$, $SD = 0.27$; competence: $M = 2.81$, $SD = 0.26$; relatedness: $M = 2.89$, $SD = 0.25$) than in Class 2 (autonomy: $M = 3.33$, $SD = 0.27$; competence: $M = 3.19$, $SD = 0.22$; relatedness: $M = 3.53$, $SD = 0.26$) than in Class 4 (autonomy:

TABLE 4 Mean class membership probabilities.

Membership probabilities	Participants of Class 1		Participants of Class 2		Participants of Class 3		Participants of Class 4	
	<i>M</i>	<i>SE(M)</i>	<i>M</i>	<i>SE(M)</i>	<i>M</i>	<i>SE(M)</i>	<i>M</i>	<i>SE(M)</i>
MP for Class 1	0.903	0.025	0.048	0.016	0.047	0.019	0.001	0.001
MP for Class 2	0.042	0.021	0.910	0.028	0.003	0.002	0.045	0.021
MP for Class 3	0.041	0.014	0.002	0.001	0.957	0.015	0.000	0.000
MP for Class 4	0.000	0.000	0.050	0.027	0.000	0.000	0.950	0.027

MP, Membership probabilities.

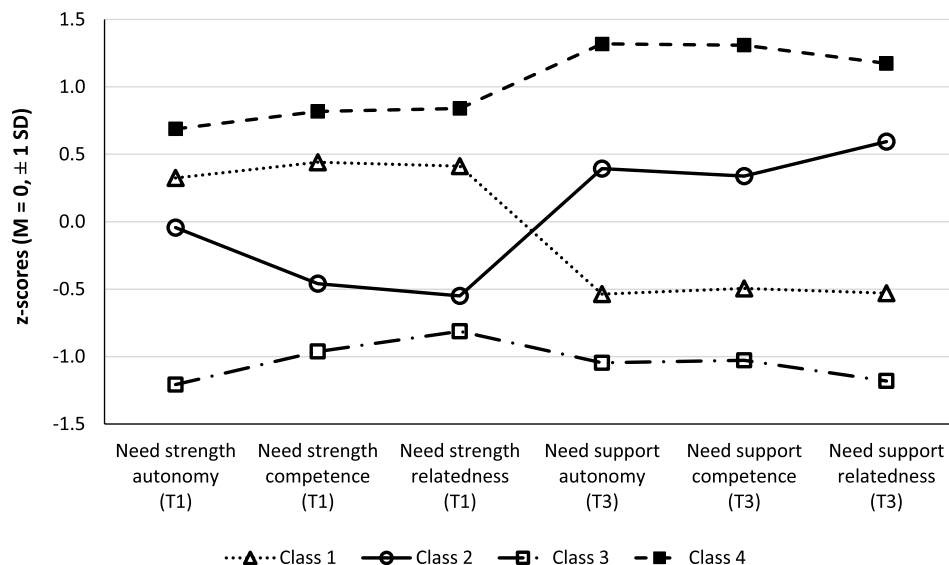


FIGURE 2

Class profiles concerning need strength (T1) and perceived need support (T3).

$M = 3.78$, $SD = 0.21$; competence: $M = 3.64$, $SD = 0.28$; relatedness: $M = 3.87$, $SD = 0.16$).

In summary, the four classes can be characterized in relation to each other as follows (Table 1; Figure 2):

- *Class 1 (high/low)*. Participants with *above-average* scores on need strength (autonomy, competence, relatedness) and *below-average* scores on perceived need support (autonomy, competence, relatedness)
- *Class 2 (low/high)*. Participants with *below-average* scores on need strength (competence, relatedness), an *average score* on need strength autonomy, and *above-average* scores on perceived need support (autonomy, competence, relatedness).
- *Class 3 (low/low)*. Consistently *below-average* values for both need strength and perceived need support.
- *Class 4 (high/high)*. Consistently *above-average* values for both need strength and perceived need support.

The four classes did not differ significantly concerning the person-related control variables (age, sex, average awakening time, and body mass index) and the exam-related control variables

(subjective importance of exam performance, intensity of preparation for the exam, and expected performance). Thus, the classes were comparable concerning the control variables, which had been measured before the exam at T1. Unexpectedly, the achieved grade at T4 also did not differ between classes. Only Class 3 and Class 4 displayed the expected tendency descriptively ($M = 3.13$ for Class 3, $M = 2.60$ for Class 2, $M = 2.59$ for Class 1, and $M = 2.47$ for Class 4, note that lower scores indicate better performance in the German grading system) (Table 1).

Class comparisons regarding needs, emotions, and stress

Comparison of baseline values

Table 5 shows the results of group comparisons of baseline values at T1. The four classes did not differ significantly concerning gain-related emotions, perceived stress, and cortisol values, all $p > 0.05$. However, Class 3 showed significantly higher values of loss emotions at T1 ($M = 2.61$, $SD = 0.87$) than Class 2 ($M = 1.83$, $SD = 0.59$; medium effect, $p = 0.007$, $\eta_p^2 = 0.128$).

TABLE 5 Class comparisons of baseline values at T1.

Variables	Class 1 Under-supported needs (need strength > need support)		Class 2 Over-supported needs (need strength < need support)		Class 3 Need strength and need support at low level		Class 4 Need strength and need support at high level		p^a	partial η^2	post-hoc ^b
	n	$M \pm SD$	n	$M \pm SD$	n	$M \pm SD$	n	$M \pm SD$			
	Baseline Values at T1										
Gain emotions	30	2.57 ± 0.99	25	2.12 ± 0.69	18	2.78 ± 0.58	19	2.53 ± 0.79	0.055	0.082	
Loss emotions	30	2.11 ± 0.72	25	1.83 ± 0.59	18	2.61 ± 0.87	19	1.98 ± 0.76	0.007	0.128	3 > 2
Perceived stress (VAS)	30	5.09 ± 3.12	24	4.40 ± 2.92	17	6.11 ± 3.11	19	4.36 ± 2.91	0.258	0.046	
Cortisol, nmol/L	27	14.7 ± 8.88	18	21.45 ± 14.51	17	13.08 ± 8.57	14	15.98 ± 6.84	0.081	0.089	

^aAll statistical comparisons performed via ANOVA.^bBonferroni correction.

TABLE 6 Class comparisons of mean changes.

Variables	Class 1 Under-supported needs (need strength > need support)		Class 2 Over-supported needs (need strength < need support)		Class 3 Need strength and need support at low level		Class 4 Need strength and need support at high level		<i>p</i> ^a	partial η^2	post-hoc ^b
	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>	<i>n</i>	<i>M</i> ± <i>SD</i>			
Mean changes ^c											
Gain emotions	30	0.67 ± 0.96	25	1.20 ± 0.67	18	0.29 ± 0.77	19	0.96 ± 0.72	0.003	0.145	3 < 2
Loss emotions	30	0.21 ± 0.76	25	0.18 ± 0.95	18	−0.03 ± 0.71	19	0.19 ± 1.04	0.797	0.011	
Perceived stress (VAS)	30	−1.17 ± 2.42	24	−0.85 ± 2.68	17	−1.30 ± 2.01	19	−1.42 ± 3.03	0.895	0.007	
Cortisol, nmol/L	27	9.98 ± 13.98	18	2.55 ± 13.52	16	21.35 ± 15.45	14	6.30 ± 13.09	0.002	0.188	3 > 2,4

^aAll statistical comparisons performed via ANOVA.^bBonferroni correction.^cMean baseline-corrected values from T2 to T4.

Class differences in mean changes over time and repeated measures ANOVAs

Table 6 shows the results of group comparisons of mean changes over time. Participants in Class 2 showed significantly higher values in the mean change (indicating increases over time) in gain-related emotions ($M = 1.20$, $SD = 0.67$) compared to participants in Class 3 ($M = 0.29$, $SD = 0.77$, $p = 0.003$, $\eta_p^2 = 0.145$). Furthermore, participants from Class 3 showed significantly higher mean changes (indicating increases over time) in cortisol values ($M = 21.35$, $SD = 15.45$) compared to participants from Classes 2 ($M = 2.44$, $SD = 13.52$) and 4 ($M = 6.30$, $SD = 12.09$, $p = 0.002$, $\eta_p^2 = 0.188$).

Repeated measures ANOVAs displayed significant *main effects* for *TIME* for all four stress-related state variables, indicating a significant increase of gain-related emotions ($p < 0.001$, $\eta_p^2 = 0.461$), decreases for perceived stress ($p < 0.001$, $\eta_p^2 = 0.602$), and cortisol concentration ($p < 0.001$, $\eta_p^2 = 0.267$), after a peak at T2, and a peak for loss emotions ($p < 0.001$, $\eta_p^2 = 0.135$) at T3, followed by a decrease (Table 7; Figure 3). In accordance with the results described for Table 1, we found significant *main effects* of *CLASS* for gain-related emotions ($p < 0.0001$, $\eta_p^2 = 0.145$) and cortisol concentration ($p < 0.003$, $\eta_p^2 = 0.199$) but not for loss emotions ($p = 0.797$, $\eta_p^2 = 0.011$) and perceived stress ($p = 0.895$, $\eta_p^2 = 0.007$). At T3, Class 2 displayed significantly higher gain-related emotions ($M = 1.41$, $SD = 0.81$) than

Class 1 ($M = 0.70$, $SD = 1.03$) and Class 3 ($M = 0.41$, $SD = 0.99$). At T4, Class 3 ($M = 0.59$, $SD = 1.36$) displayed significantly lower gain-related emotions than Class 2 ($M = 1.81$, $SD = 1.07$) and Class 4 ($M = 1.70$, $SD = 1.04$). At T3, Class 3 displayed significantly higher cortisol values ($M = 23.46$, $SD = 24.03$) than Class 2 ($M = 0.17$, $SD = 12.74$). At T4, Class 3 displayed significantly lower cortisol levels ($M = 13.38$, $SD = 14.43$) than Class 1 ($M = 2.07$, $SD = 10.50$), Class 2 ($M = -5.07$, $SD = 11.08$), and Class 4 ($M = 0.75$, $SD = 12.10$).³ A significant *interaction effect* between *TIME* and *CLASS* was found for loss emotions (Table 7; Figure 3B). Classes 1, 3, and 4 showed a decrease in loss emotions from T3, whereas class 2 showed a slight increase ($p < 0.011$, $\eta_p^2 = 0.091$).

Mediation analysis with class as multicategorical independent variable

Using Class 3 (low/low) as a reference group, the results of the mediation analyses indicated a significant indirect effect in the

³ The respective calculations were conducted for each point of measurement. The values may deviate slightly from the values in Figure 3D, because the values in Figure 3D are based on the values of the repeated-measurements ANOVA that utilizes listwise deletion.

TABLE 7 Repeated measures (repeated-measures ANOVAs).

Variable	Effect	df	F	Greenhouse–Geisser value of p	Partial η^2
Gain emotions	TIME	1.802	75.367	<0.001	0.461
	CLASS	3	4.985	0.003	0.145
	TIME \times CLASS	5.406	1.698	0.133	0.055
Loss emotions	TIME	1.840	13.785	<0.001	0.135
	CLASS	3	0.339	0.797	0.011
	TIME \times CLASS	5.521	2.950	0.011	0.091
Perceived stress	TIME	1.987	130.067	<0.001	0.602
	CLASS	3	0.201	0.895	0.007
	TIME \times CLASS	5.960	1.097	0.366	0.037
Cortisol	TIME	1.483	22.924	<0.001	0.267
	CLASS	3	5.213	0.003	0.199
	TIME \times CLASS	4.449	1.153	0.337	0.052

magnitude of -0.35 ($p < 0.05$) for Class 2 (low/high) and in the magnitude of -0.26 ($p < 0.05$) for Class 4 (high/high) on performance mediated by gain-related emotions: Individuals in Class 2 and Class 4 (the high-quality classes) experienced more gain-related emotions, which were in turn significantly associated with better grades (Figure 4). Using Class 1 (high/low) as a reference group within the mediation analysis, only the indirect effect for Class 2 (-0.201 , $p = 0.041$) remained significant, but not the indirect effect for Class 4 (-0.113 , $p = 0.227$). To summarize, the pattern of evidence indicates that Class 2 benefitted most in terms of gains associated with emotions that were perceived as positive. In the other models calculated (loss-related emotions, stress experience and cortisol levels as mediators), there were no significant mediation effects on performance for any of the considered classes.

Discussion

Summary and interpretation of findings in light of our hypotheses

The current study investigated basic need strength and perceived basic need support classes in a real-life oral exam. The person-centered perspective enables theoretical and practical implications for basic need support in stressful social-evaluative contexts in formal education. We identified four significantly distinct basic need configurations, supporting Hypothesis 1. Class 1 comprised students whose experienced basic need support and strength were incongruent, because their indicated levels of need strength were higher than their levels of perceived need support. Class 2 comprised students whose basic need strength and perceived support were also incongruent, with higher perceived need satisfaction compared to their indicated need strengths. Need strength and perceived need support were congruent in Class 3, with consistently below-average values, and in Class 4, with consistently above-average values for both need strength and perceived need support.

Classes 2 and 4 displayed higher perceived need satisfaction and more adaptive developments in gain-related emotions and cortisol, indicating higher quality. Classes 1 and 3 reflected lower-quality classes with less perceived need support and less beneficial gain-related emotions. In correspondence with the assumption of self-determination theory that the basic psychological needs are universal but the effects of their satisfaction may also be associated with the respective need strength (Ryan and Deci, 2017), basic need strength seemed to further differentiate the higher-quality (Classes 2 and 4) and lower-quality (Classes 1 and 3) classes by the perceived under-/over-support of the initially indicated need strength levels, i.e., when need strength and perceived need support levels were incongruent. Over-support seems to enhance gain-related emotion development and could buffer heightening cortisol concentrations, while under-support could have opposite effects (Figure 3).

The emerging classes underline the importance of integrating the typological approach into motivational research in education and conformed with prior research focusing on different types of intrinsic and extrinsic motivation (e.g., Vansteenkiste et al., 2009; Ryan and Deci, 2017; Baars and Wijnia, 2018). The basic needs occur together naturally, and the support of one need may simultaneously support the other needs (Chen et al., 2015; Ryan and Deci, 2017), which is reflected in the correlations between the perceived support levels of the three needs, and the strength levels of the three needs in the present study.

Basic need support is related to well-being (Ryan and Deci, 2017), so teachers' basic need support may reduce stress in college students (Gilbert et al., 2021). We assumed that higher-quality classes with more perceived need support could be associated with more beneficial stress-related outcomes than lower-quality classes (Hypothesis 2). Our data partly supported this assumption. Combinations of both low need strength and low perceived need support levels displayed the lowest gain-related emotions and highest cortisol concentrations compared to the higher-quality classes, particularly the class with over-supported needs. This is in line with the physiological links of basic need support to well-being: When the basic needs are satisfied as a response to need

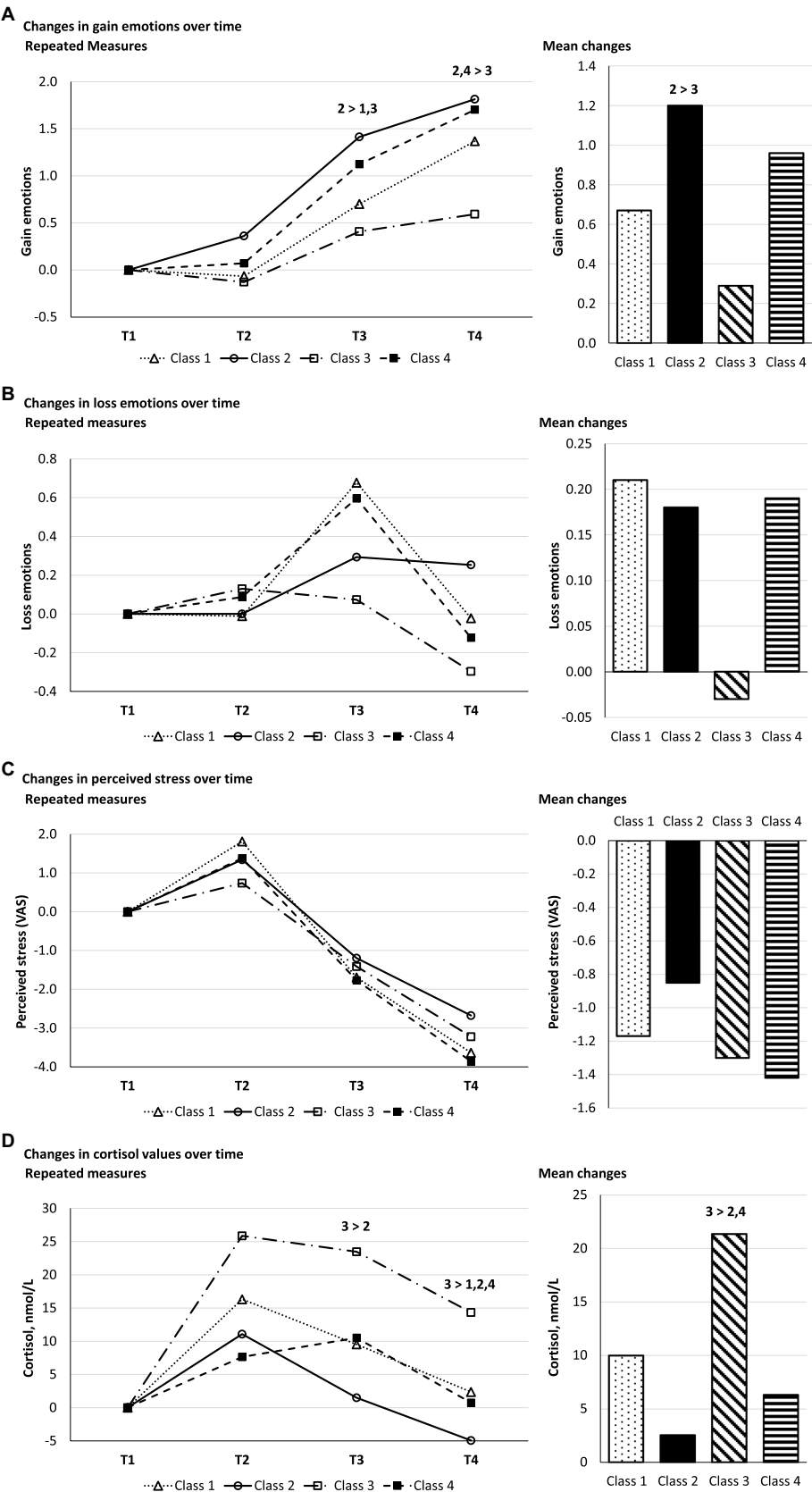


FIGURE 3
Gain- and loss-related emotion, perceived stress, and cortisol (mean) changes over time.

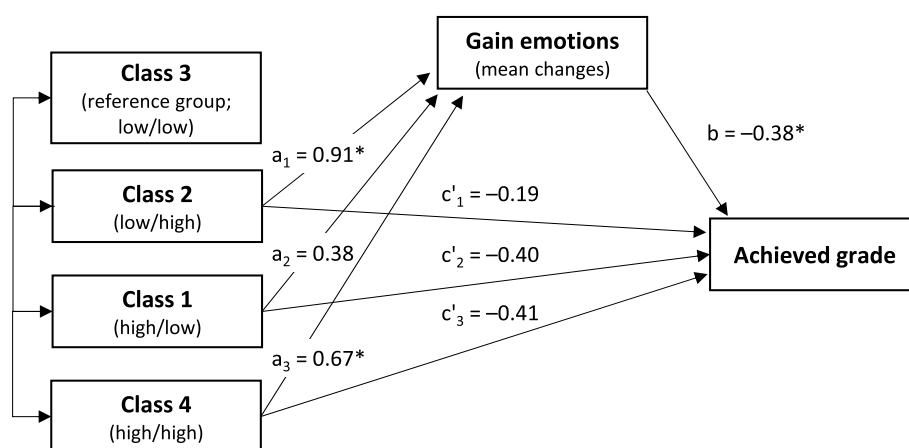


FIGURE 4

Mediation analysis with Class as multicategorical independent variable. Reference group: Class 3. Achieved grade according to the German grading system (lower values indicate better performance): 1="very good" (A) ... 5="failed" (E). * $p < 0.05$. Relative indirect effects: Class 2 ($a_1b = -0.35^*$), Class 1 ($a_2b = -0.14$), Class 4 ($a_3b = -0.26^*$). Unstandardized values.

support (Reeve and Tseng, 2011), the striatum, i.e., the brain's reward center (Delgado, 2007; Haber, 2011), is activated. Being rewarded feels good, hence the higher levels of perceived gain-related emotions and lower cortisol segregation of the HPA axis (Heller et al., 2013) in participants higher-quality compared to the lower-quality basic need configurations. However, while other authors reported associations between perceived stress and basic need satisfaction (e.g., Weinstein et al., 2016; Campbell et al., 2018) and although stress and uncertainty about the contents and performance gradually decreased from before until after the exam (Folkman and Lazarus, 1985; Carver and Scheier, 1994), there were no significant differences between the classes in our sample concerning changes in *perceived* stress and loss-related emotions.

We assume that different response areas (e.g., subjective stress perception, emotions, or performance) might be triggered differently by basic need support because of how basic need support works in the human body. Stress perception and cortisol levels could differ because HPA activation of cortisol needs 15–20 min after the onset of the stressor, while emotional responses happen immediately (Dickerson and Kemeny, 2004). The significant time-lagged correlations between perceived stress (T1) and cortisol values at T2 and T4 could be explained by anticipation in terms of a presumption of the stressful oral exam (see footnote 1). Further, perceived stress was questioned rather nonspecifically, while emotions were indicated more specifically with concrete indicators for emotional experience. Still, Cronbach's α of gain- and loss-related emotions were rather low for some measurement points, indicating that positive emotion ratings varied intra-individually before and after the exam. In contrast, negative emotion ratings varied a week before the exam but converged on the exam day. This pattern suggests that students' experiences of positive emotions might have been complex, precise, and multi-faceted during the exam, signifying high emotional granularity for positive

emotions, whereas emotional granularity for negative emotions could have been low. Previous research found positive emotional granularity to be associated with characteristic psychophysiological responses, greater psychological resilience, and more effective coping in the face of social-evaluative stress (Tugade et al., 2004). When cortisol is released in response to a perceived (lack of) reward, as indicated by perceived emotions, it might explain why more cortisol was released when low need strength was combined with little perceived need support, while increases in gain-related emotions were smaller compared to classes with strong perceived need support.

Literature shows that basic need support is related to better performance (Ryan and Deci, 2017), so we expected participants in higher-quality classes with high perceived need support to perform better in the oral exam than participants in lower-quality classes (Hypothesis 3). The classes did not differ significantly in the achieved grades after the exam, contrasting other research (e.g., Hayenga and Corpus, 2010; Kusurkar et al., 2013; Baars and Wijnia, 2018). Our findings suggest differentiated relations. At a correlational level, we found greater competence strength and more intense gain-related emotions to be associated with better achieved grades, which corroborates previous findings on the role of competence-related positive emotions for performance during need-supportive oral examinations (Pekrun, 2006). Notably, Classes 2 and 4 reported more intense gain-related emotions than Class 3, and these differences to gain-related emotions in Class 3 were positively associated with differences in achievement. Particularly Class 2, where perceived need satisfaction exceeded the indicated need strength, appeared to benefit most with regard to gains associated with positive emotions. Meeting or even over-supporting the indicated strength of the needs through need support could result in more intensive gain-related emotions, which are linked to higher achievement in exams. This finding highlights the necessity to constructively consider learners'

emotional states and needs in didactic efforts and to understand and acknowledge learning-related emotions as a constitutive element in the acquisition of knowledge (Sembill, 1992).

Our findings could imply that participants in lower-quality classes, particularly those with under-supported needs (Class 3), could show a tendency towards basic need frustration (e.g., Vansteenkiste and Ryan, 2013). Their indicated need strength levels met or were higher than the already low perceived need support levels, while participants in higher-quality classes with higher perceived need support might have felt need satisfaction during the exam because their high perceived need support levels met or exceeded the indicated need strength levels. Thus, high perceived need support appears to be beneficial for higher-quality basic need classes to occur, especially under consideration of an individual's need strength. More vulnerable students with low basic need strength, who might not be as actively claiming need support from their teachers as students with high need strengths, could profit from need-supportive teachers. Therefore, the findings underline that, while the basic psychological needs and the associations of their satisfaction are universal, the individual's need strength can alter the effects of the experienced support (Ryan and Deci, 2017) and could help examiners choose the most adequate behavior during oral exams.

Overall, the existence of different subgroups of examinees regarding their basic psychological need configurations and their distinct relations to stress-related state variables and achievement implies that it is relevant to consider these configurations in the preparation of examinees and examiners for oral exams.

Limitations and strengths of the study

Despite the study's strengths, some methodological limitations should be acknowledged. First, future studies might replicate the current investigation with larger samples that might reveal smaller but significant effects that we could not detect in this case (Field, 2009). However, multiple-measurement studies assessing both affective and endocrinological stress responses are complex and often limited to sample sizes between about 50 and 100 participants for practical reasons (e.g., Zeidner, 1998; Campbell and Ehler, 2012; Graham et al., 2022). Second, we used self-report measures for students' anticipated grades, personal relevance, emotions, stress, and perceived behavior. We were interested in students' respective *perceptions* because basic need satisfaction depends on *perceived* need support. Perceived and actual relatedness support are interrelated (Reeve and Jang, 2006; Haerens et al., 2013), but we cannot distinguish whether perceived basic need support stemmed from behavioral differences in need support *actually provided by the teacher* or students' perception. We followed Chan's (2009) advice to address construct validity, interpretation of correlations, social desirability response, and value of data collected from other sources as typical challenges of self-report data. Moreover, we utilized cortisol as an additional measure for stress. Third, although the co-examiner checked for standardized support

behavior during the exam, future research might profit from recordings of the exam situations to rate the examiner's support behavior, which was not possible due to data security in the current study. Fourth, our study focused on oral exams, so our findings are not generalizable to other exam forms like written exams without consideration of the respective specific characteristics of each method of examination (Tibubos et al., 2019). Fifth, future research could assess perceived need frustration configurations more directly and in various contexts. Need frustration could explain tendencies in perceived stress even more (Ryan and Deci, 2017; Schürmann and Quaiser-Pohl, 2022). It is conceivable that the present study did not report differences in loss-related emotions and stress perception between the higher- and the lower-quality classes, also in association with achievement, because we focused on perceived need support and, therefore, need satisfaction. Future research could consider need frustration as an option to explain group differences in negative affective state variables such as loss-related emotions or perceived stress due to the asymmetric relationship between need satisfaction and frustration (Vansteenkiste and Ryan, 2013; Santana-Monagas and Núñez, 2022). Moreover, the degree of change in the stress-related variables could make a difference. Perhaps there is a certain threshold that has to be met for effects to occur. Sixth, although the latent class analysis was the best approach to investigate whether there were subgroups that differed in their basic need configurations and associated stress-related state variables and achievement in an oral exam to better prepare both examinees and examiners for this situation, further research is needed as our findings might not be representative of other samples. Seventh, while difficult to realize in the context of real-life oral exams, future research could profit from bigger sample sizes when using LCA. Eighth, it can be assumed that the link between emotions and academic performance might go both ways. Emotions may not only foster academic achievement but could also follow from it. Thus, at T4, the announcement of the grade might influence students' emotions, as well.

Beyond these limitations, the study has distinct strengths compared to prior research. First, we assessed the data in a real-life situation, including real students in real exams with real consequences. This supports both external and ecological validity of oral exams as one of the most threatening social contexts for students (Zeidner, 1998; Dickerson and Kemeny, 2004). Second, we measured cortisol levels in a longitudinal design to track intraindividual cortisol changes and reveal class differences between the lower and higher-quality classes in the context of the typical development of cortisol levels in exams (Ringeisen et al., 2019). Third, to our knowledge, this study is the first to examine the relation of basic need configurations, stress symptomatology, and performance in oral exams from a typological perspective (e.g., Ryan and Deci, 2020). Knowing that students differ in motivational configurations, examiners could adapt their behavior to minimize possible negative influences of stress on academic performance and thereby better focus on students' actual intellectual ability. Moreover, the study shows that basic need support works even in very stressful, formal, standardized settings, offering important theoretical and practical implications.

Implications for instructional research and teaching practice

The findings underline the importance of integrating the typological perspective to research on basic needs in education. The present study adds to the research on configurations of different types of intrinsic and extrinsic motivation (e.g., Ratelle et al., 2007; Vansteenkiste et al., 2009; Baars and Wijnia, 2018) by focusing on the basic needs (e.g., Haerens et al., 2018). We identified four classes of basic need configurations, two higher-quality classes with high perceived need support and two lower-quality classes with lower perceived need support, in an oral exam.

It is an implication for practice that need support constitutes an efficient and harmless option to ease *all* students' perceptions of oral exams as a stressful event. Thus, examiners could support their students' basic needs in exam situations. Need support might result in higher perceived need satisfaction (Reeve and Jang, 2006; Haerens et al., 2013), which could, eventually, promote more autonomous types of motivation. Examiners may support their students' needs by slightly altering their behavior. For example, they could shift from disregarding students' feelings to welcoming them and being attentive to their basic needs by acknowledging their perception of the situation. Therefore, it is crucial to educate practitioners about motivation theory (Schürmann et al., 2021) and, more specifically, basic need support.

Conclusion

The current study closes the research gap concerning the relation between the basic needs, need support, stress symptomatology, and performance during oral exams. We found four classes that differed regarding stress symptomatology. The lowest-quality class with the lowest need strength and perceived need support displayed the highest cortisol levels and lowest gain-related emotions, while the higher-quality classes displayed reversed tendencies. Meeting or even over-supporting the needs appeared as most beneficial because particularly high levels of gain-related emotions mediated the positive relation of these classes to achievement. Overall, the findings suggest that the more supportive the examiner's behavior is perceived by the examinees, particularly exceeding their need strength, the greater their perceived need support and resulting need satisfaction and the greater the beneficial effects on the examinees' emotional and physiological stress reactions during the exam could be. Thus,

future research should include the typological perspective on the basic needs, extend its areas of interest to other contexts, and further investigate the predictive power of basic need support for emotions, perceived stress, cortisol, and performance.

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 University of Merseburg. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LS contributed to writing—original draft, review, editing, and verification. TK contributed to methodology, formal analysis, writing—original draft, review, editing, and visualization. TR contributed to conceptualization, verification, investigation, resources, writing—review, editing, and supervision. All authors contributed to the article and approved the submitted version.

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.

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Effects of media use, smart phone addiction, and adult ADHD symptoms on wellbeing of college students during the COVID-19 lockdown: Dispositional hope as a protective factor

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Introduction: The present study investigated the role of dispositional hope as a potential protective factor moderator in the relationship between adult ADHD symptoms, media use/smart phone addiction and wellbeing during the period of isolation because of the COVID-19 pandemic among students in Romania.

Methods: A sample of 333 college students (86.8% female and 13.2% male) between the age of 18 and 47 with a mean of 20.6 years old from West University of Timișoara completed online surveys. Mediation and moderation analyses were performed to assess the associations among the variables.

Results: Results confirmed the negative associations of both adult ADHD and smartphone addiction with overall wellbeing. The smartphone addiction/wellbeing association was moderated by dispositional hopefulness, such that high hopefulness served as a protective factor [$b = -0.008$, 95% percentile CI (-0.0134 ; -0.0012)].

Discussion: Implications for the educational environment are discussed.

KEYWORDS

hope, ADHD, wellbeing, smart phone addiction, college students

1. Introduction

With the COVID-19 outbreak, students have faced unprecedented challenges in adapting to distance learning and spending most of their daily activities online on a smartphone or computer. It is well-recognized that the use of informatics and communication technologies presents both opportunities and risks (Arrivillaga et al., 2020; Plante et al., 2020; Stavropoulos et al., 2021).

Prior studies showed that problematic media use and phone dependency can lead even to more problematic cognitions like suicidal thoughts (Arrivillaga et al., 2020) or emotional problems like anxiety for those who had low exposure to media before the pandemic (Magson et al., 2021). Furthermore, there are gender differences in problematic social media use; for instance, it becomes an independent risk factor for negative health behaviors of adolescents, especially girls (Buda et al., 2021). One of the aspects that experts on media and internet use agree upon is that individual differences in media use result in significant media effects on the user, some of which are harmful (Anderson C. A. et al., 2017; Arrivillaga et al., 2020; Stavropoulos et al., 2021). For this reason, it is important to explore potential protective factors that might reduce the harmful effects of internet (and smartphone) use.

In Romania, physical isolation caused by the quarantine period during the COVID-19 pandemic led students to increase their daily activities in online environments (e.g., classes). The students also spent significant time at night online (Buda et al., 2021). Essentially, online environments became the gateway to all forms of knowledge and leisure. Students moved from classrooms to online classes using computers, smartphones, and/or tablets. Similarly, the COVID-19 pandemic lockdown in the spring of 2020 prohibited many face-to-face leisure activities, increasing internet use for leisure and non-academic pursuits.

Worldwide researchers made efforts to depict the realities and evaluate the impact of the COVID-19 pandemic and its effects at the psychological level. For adolescents and young adults, one of the main concerns was related to psychological wellbeing. For example, results showed that young people reported poor outcomes in mental and psychological wellbeing when living under COVID-19 pandemic restrictions (Zolopa et al., 2022). In Romania, most public institutions were closed, including Romanian Universities. Classes and related university activities were moved online. Research on students' perceptions of and coping strategies used during the lockdown revealed not only that students reported more emotional issues (Waselewski et al., 2020) but also that they used coping strategies with positive outcomes like maintaining positivity and staying connected (Waselewski et al., 2020; Magson et al., 2021).

Although only 3 years have passed since the COVID-19 pandemic emerged and spread worldwide, some moderators for lockdown effects on psychological wellbeing have already been identified, such as emotional intelligence (Arrivillaga et al., 2020), gender (Magson et al., 2021; Sürücü et al., 2021), conflict with parents, COVID-19 distress, social disconnection, stay home adherence (Magson et al., 2021) and hope (Christens et al., 2013; Demirli et al., 2015; Stoyles et al., 2015; Li et al., 2021).

Our research team took a different approach to these pandemic-based problems. Specifically, we investigated dispositional hope as a potential moderating protective factor

in the links between adult ADHD symptoms,¹ smartphone addiction, and psychological wellbeing. Our main research question was whether, in times of physical isolation and higher online exposure and communication, hopefulness can positively influence students' wellbeing by reducing the known harmful links between self-reported adult attention deficit problems and addiction to smartphones. We chose to investigate the role of hope as a protective factor for students' wellbeing for two reasons, one based on theory and the other based on recent research on students' performance during the COVID-19 pandemic times. Theoretically, students' hope is investigated as one of the dimensions of psychological capital (PsyCap) (Luthans and Youssef, 2004; Luthans et al., 2007). Although a concept mainly studied in organizational psychology, the dimensions of PsyCap have been investigated as resources for wellbeing related to students' behavior during the COVID-19 pandemic. Studies showed that students needed coping strategies for meeting their needs during the COVID-19 pandemic (Griggs, 2017; Waselewski et al., 2020) and that hope, as a personal resource, enhanced student's wellbeing (Griggs, 2017; Putrawan et al., 2021). We explored if students' hope might have served as a protective factor in their general wellbeing during the pandemic, as the main effect (e.g., hope positively associated with wellbeing) and as an interactive moderator (e.g., reducing the negative association between ADHD symptoms and wellbeing). Recent research reveals worse psychological wellbeing during the isolation period of the COVID-19 pandemic for multiple age groups, from children and adolescents (Grey et al., 2020; Vallejo-Slocker et al., 2020; Waselewski et al., 2020; Magson et al., 2021) to college students (Savage et al., 2020; Evans et al., 2021; Thorisdottir et al., 2021). A similar protective effect also appeared for the people living in the city and apartments as opposed to those who had a green space (Mastorci et al., 2021). These findings led to the conclusion that further monitoring of the wellbeing of children, adolescents, and young people was needed (Vallejo-Slocker et al., 2020).

In a rapid review of 21 studies investigating psychological wellbeing during the COVID-19 pandemic, Zolopa et al. (2022) found that all the studies showed a decrease in psychological and mental wellbeing for children, adolescents, and young people. The same study also reviewed eight mainly qualitative studies that focused on resilience and coping strategies for adapting to the pandemic situation and lockdown. They demonstrated the supportive role of resilience and coping strategies - like staying connected, maintaining positivity, exercising, engaging in creative activities, or adopting problem-solving focus (Branquinho et al., 2020; Waselewski et al., 2020; Scott et al., 2021). Positive coping strategies included staying

1 This study focuses on ADHD symptoms using a well-validated self-report continuous measure. It does not have a dichotomous clinical diagnosis of ADHD as a variable.

connected, maintaining positivity (Waselewski et al., 2020), establishing a routine, and carrying out pleasurable activities (Branquinho et al., 2020). Among the resilience and coping strategies that helped young adults adapt to the situation of lockdown, Griggs (2017) identified 20 quantitative studies that focused on the role of hope in enhancing the wellbeing of students.

1.1. Hope as a psychological resource

Dispositional (trait) hope is considered an important factor in general wellbeing (Redlich-Amirav et al., 2018). An integrated review of 20 quantitative studies exploring hope and mental health in young adult college students concluded that dispositional hope appears to be a protective moderator between depression and negative life events, and a protective factor in suicide and healthy behavior engagement (Griggs, 2017). We embraced the conceptual framework of Snyder's theory on adult hope and chose Snyder's Adult Hope Scale (Snyder et al., 1991) as a measure of hope for two reasons. The first was related to the conceptual construction of hope as a unidimensional concept derived from the cognitive-behavioral approach related to personal goals and one of the main dimensions of the PsyCap. The second reason was the psychometric properties of the scale (Redlich-Amirav et al., 2018); the hope scale is a trait-like measure of hope (Feldman et al., 2009). Snyder's *Hope* theory views hope as a motivational trait that strengthens the individual's self in pursuing his or her relevant goals. Furthermore, hope adjustment for individuals is related to the way they experience success or failure in pursuing their goals (Feldman et al., 2009).

The reasons that we chose to test the moderating role of hope as a protective factor during the lockdown caused by the COVID-19 pandemic were the following: (a) hope proved to be a moderator in increasing wellbeing in relation to negative life events (Hirsch et al., 2012; Christens et al., 2013; Visser et al., 2013; Sun et al., 2014; Hellman and Gwinn, 2017; Munoz et al., 2020; Li et al., 2021; Sparks et al., 2021), (b) the moderating effect of hope appears unaffected by ethnicity (Hirsch et al., 2012; Visser et al., 2013), and (c) its moderating effect showed stability over time—at least at two years' difference (Marques et al., 2011).

To further test the possible moderating role of hope and lockdown-related maladaptive behaviors, we searched for problematic behavior related to heavy online exposure and settled on problematic internet use through computers/smartphones/tablets.

1.2. Media use and smartphone addiction

Problematic internet use is broadly defined as an individual's inability to control his or her use of the internet, spending

excessive amounts of time online, and leading them to distress and /or impairment in their everyday life (Anderson E. L. et al., 2017). There is a debate on the degree of overlap among the construct of problematic internet/media use and problematic smartphone use and whether researchers should consider the latter a subcategory of internet use or a separate construct (Cheever et al., 2018). In the present research, we assessed media use and problematic smartphone use separately, the latter conceived in terms of addiction. Even before the pandemic, problematic smartphone use was significantly associated with suicide ideation in Spanish adolescents (Arrivillaga et al., 2020). The frequent use of devices to connect to the internet has also been linked to psychological wellbeing. For example, Girela-Serrano et al. (2022) concluded that high bedtime use of phones or mobile devices was associated with lower wellbeing, whereas moderate use may improve psychological wellbeing by strengthening social connections and providing support. On the other hand, problematic smartphone use leads to behaviors that are conceptualized in a way that is very similar to behavioral addiction (Girela-Serrano et al., 2022). This approach defines problematic smartphone use as addiction and includes loss of control (trouble limiting smartphone use), tolerance (needing more smartphone use to achieve the same psychological rewards), and withdrawal (Harris et al., 2020).

Numerous studies found negative effects of excessive or problematic use of the internet on young people (Buda et al., 2021) and on young people's psychological states such as self-esteem (Midgley et al., 2021), wellbeing (Vanden Abeele et al., 2022), mental health (Girela-Serrano et al., 2022), attention and aggression (Swing and Anderson, 2014), and other behaviors (Girela-Serrano et al., 2022). More broadly, problematic internet use is viewed as a type of addiction (e.g., Brand et al., 2016; Bender et al., 2020).

Similarly, Zolopa et al.'s (2022) rapid review of the studies that investigated psychological wellbeing during the COVID-19 pandemic found that there were changes in the externalizing behavior of adolescents and young people with ADHD symptoms. For example, a longitudinal study of adolescents with or without ADHD showed significant increases in inattention but no change in hyperactivity (Breux et al., 2021; Zolopa et al., 2022). These longitudinal findings showed an increase in inattention among individuals when highly technologically stimulated, even in adolescents without prior ADHD symptoms, and therefore the need for additional research on protective psychological factors (Breux et al., 2021). A study on Italian children and adolescents with ADHD during lockdown due to the COVID-19 pandemic reported the participants' different mood patterns according to the severity of the ADHD. Those with a moderate and severe degree of ADHD showed an improvement in emotional mood and behavioral dimension, and the ones with a low-severity degree of ADHD showed increases in boredom, temper tantrums, argumentativeness, and aggression (Melegari et al., 2021).

In sum, prior research suggests that the negative association between ADHD symptoms and wellbeing may be at least partially mediated by smartphone addiction and that dispositional hope may act as a moderator.²

1.3. The present study

In this context, we examined the way online media seized the daily life of Romanian college students, how they perceived their state of wellbeing, and if hope served a protective function. Our main research goal was to investigate the potential protective role of hope on the effects of a highly technologically stimulated environment on wellbeing, both as a main effect *and* as a moderator (interactive effect). More specifically, we predicted: (a) a positive association between adult ADHD symptoms and smartphone addiction; (b) a negative association between ADHD symptoms/smartphone addiction and psychological wellbeing; and (c) a positive association between hope and wellbeing. We also tested: (d) potential moderating effects of dispositional hope on the association between ADHD symptoms and psychological wellbeing and on the association between smartphone addiction and wellbeing, such that those with high dispositional hope would show fewer associations between ADHD symptoms and smartphone addiction on wellbeing than would those with low dispositional hope.

2. Materials and methods

We conducted an online self-report survey to investigate the situation of Romanian students attending different specializations at WUT University, all of whom had their originally face-to-face classes moved online during the beginning of the pandemic. Data collection occurred 2 months after the lockdown in May 2020.

The online survey was programmed with QuestionPro and consisted of demographic data and five measurements of the main variables—adult ADHD, smartphone addiction, media use, dispositional hope, and wellbeing.

For measuring media use, we utilized a few items from the *General Media Habits Questionnaire - Adult Version (modified)* (Gentile et al., 2009). The items assessed total online times per week and combined into a media use score. We asked participants to respond two times to these items, first with reference to time spent on devices before the pandemic and the

second with reference to time spent during the lockdown. This allowed us to investigate retrospectively on-screen time at two moments of the pandemic—before the lockdown and 2 months after isolation.

For investigating ADHD symptoms, we used the Adult ADHD Self-Report Scale (ASRS), (Kessler et al., 2005) developed in cooperation with the World Health Organization. It assessed respondents' attention deficit symptoms present in the past 6 months. The screening tool consists of 18 questions and assesses responses on a scale of five points *never, rarely, sometimes, often, and very often*. Adult ADHD has two subscales—inattention and hyperactivity-impulsivity. Six of the 18 questions constitute the ASRS screener and seven of the questions are considered clinically significant symptom levels. We chose ASRS because it spots inattention symptoms as well as clinical conditions.

The Smartphone Addiction Scale—short version (SAS-SV; $\alpha = 0.911$) (Kwon et al., 2013) was administered to measure addictive behaviors related to smartphone use. It has 10 self-report items with responses on a six-point scale (1: strongly disagree to 6: strongly agree). It assessed three symptoms, addiction, tolerance, and withdrawal, with the cutoff points of 31 (sensitivity of 0.86 and specificity of 0.89) for boys and 33 (sensitivity of 0.87 and specificity of 0.88) for girls.

We assessed psychological wellbeing with the 30-item self-report Mental, Physical and Spiritual Well-Being scale (MPS) (Vella-Brodrick and Allen, 1995). Three subscales (10 items each) assess behaviors in mental, physical, and spiritual wellbeing with a five-point frequency format (*often to never*).

Finally, we chose Adult Hope Scale (AHS) (Snyder, 1994) for measuring dispositional hope. It has 12 self-report items answered on an eight-point scale (*definitely false to definitely true*) to measure the respondent's level of hope. The scale is divided into two subscales—agency and pathways—each of them consisting of four items, the remaining four items are fillers.

The main goals of the study were to investigate if media use, smartphone addiction, and attention problems became more problematic during the lockdown, if these variables were associated with wellbeing for Romanian students studying online during the COVID-19 pandemic lockdown, and if dispositional hope can serve as a protective factor for enhancing students' wellbeing, taking into consideration the particular situation of the lockdown learning environment.

2.1. Participants

The participants were 333 college students aged between 18 and 47 ($m = 20.66$, $SD = 4.8$), 86.8% women and 13.2% men from WUT courses specializing in psychology, sociology, languages, and sports (physical education and kineo-therapy).

² We acknowledge that testing mediation models with cross-sectional data is not the optimal way to test direction of causality. Experimental and longitudinal designs are needed to further test our hypotheses. Nonetheless, our theoretical model does predict what the cross-sectional data should look like, and therefore the study provides a good opportunity for the model to be disconfirmed.

2.2. Statistical analysis

The statistical analyses were conducted in SPSS. We excluded item seven from the smartphone addiction scale because of its low value in the reliability analysis. Also, we did not include a separate scale in the analysis of mental wellbeing as with a value of 0.58 it did not show a reliable internal consistency as a separate sub-scale.

We expected to find an increase in media use (*via* smartphones/tablets/computers) during the pandemic. We used mean differences to test pre- and post-lockdown media use. We also expected to find a negative association between wellbeing and both adult ADHD symptoms and smartphone addiction and a positive association between hope and wellbeing. Zero-order correlations and multiple regression analyses were used to test these hypotheses. Most importantly, we investigated whether hope had a protective influence by conducting a moderated mediation analysis.

3. Results

As can be seen in Table 1, all variables met the basic assumptions for performing the planned regression and moderation analyses.

3.1. Pre- vs. post-lockdown media use

As expected, there was an increase in media use from before the pandemic ($m_1 = 13.66$, $SD = 20.84$) compared to the reported media use during the first pandemic lockdown ($m_2 = 17.25$, $SD = 22.66$). A dependent t -test showed a small but significant increase $t_{(332)} = 3.44$, $p \leq 0.001$ with a Cohen $d = 0.37$.

3.2. Gender differences in hope and wellbeing

Because problematic internet and media use often differ by gender, we tested gender effects on the hope and wellbeing measures. The sample included 44 men and 289 women. The results revealed that the male and female participants differed in their levels of hope and physical and spiritual wellbeing (see Table 2).

Women scored higher than men on total dispositional hope, $t_{(331)} = 2.33$, $p < 0.05$, Cohen $d = 0.38$, as well as on both subscales — hope agency [$t_{(331)} = 2.07$, $p < 0.05$, $d = 0.34$] and hope pathways [$t_{(331)} = 2.31$, $d = 0.37$].

There was no gender difference in the general level of wellbeing of the participants. However, women scored lower than men on physical wellbeing, $t_{(331)} = -2.95$, $p < 0.05$, Cohen $d = -0.48$. Conversely, women scored higher than men on

spiritual wellbeing, $t_{(331)} = 2.06$, $p < 0.05$, two-tailed, Cohen $d = 0.33$.

3.3. Zero-order correlations

Table 3 reports the correlations among the key variables. As predicted, dispositional hope (Hope_Tot) was significantly and positively related to physical ($r = 0.243$, $p < 0.01$), spiritual ($r = 0.342$, $p < 0.01$), and overall wellbeing ($r = 0.495$, $p < 0.01$). Also note that both hope subscales were positively associated with all three wellbeing subscales.

Also as expected, dispositional hope yielded significant negative correlations with adult ADHD symptoms ($r = -0.267$, $p < 0.01$) and smartphone addiction ($r = -0.240$, $p < 0.01$). Note that these were non-significantly smaller than the hope/wellbeing correlations. Furthermore, we found a significant positive correlation between ADHD symptoms and smartphone addiction ($r = 0.503$, $p < 0.01$).

Table 3 also reveals a strong correlation between media use during the lockdown and before the pandemic ($r = 0.621$, $p < 0.01$). Media use was positively correlated with both ADHD and smartphone addiction, but the correlation was significant only for media use *before* the pandemic, (for ADHD $r = 0.162$, $p < 0.01$; for smartphone addiction $r = 0.118$, $p < 0.05$).

3.4. Regression and moderated mediation analyses

We first tested a simple main effects regression model in which hope, smartphone use, and ADHD were predictors of general wellbeing. As a set, these three variables significantly predicted general wellbeing $F_{(3,329)} = 45.83$, $p < 0.001$. About 30% of the wellbeing variance was accounted for ($R^2 = 0.295$). Furthermore, each of these predictors was *uniquely* associated with wellbeing (see Table 4). Hope yielded a large positive unique association with wellbeing ($\beta = 0.427$, $p < 0.001$). Adult ADHD ($\beta = -0.135$, $p < 0.05$) and smartphone addiction ($\beta = -0.133$, $p < 0.05$) had small negative unique associations with wellbeing. Thus, dispositional hope served as a main effect type of protective factor.

We then tested a mediation model in which smartphone use mediated the effect of ADHD on wellbeing. The mediation analysis yielded a significant mediation (indirect) effect [$b = -0.104$, 95% percentile CI (-0.170 ; -0.038)]. The direct effect of ADHD on wellbeing was also significant ($b = -0.23$, $p < 0.001$), showing partial mediation. Figure 1 illustrates these effects.

We then tested our moderated mediation model using Hayes PROCESS Macro (Model 15). The index for moderated mediation was significant, $b = -0.008$, 95% percentile CI (-0.0134 ; -0.0011), which did not contain zero, providing evidence for moderated mediation (Hayes, 2017). The model

TABLE 1 Descriptive statistics.

Variable	<i>M</i>	<i>SD</i>	Min	Max	Skewness	Kurtosis
Adult hope scale_agency	24.80	5.06	4	32	−0.96	1.07
Adult hope scale pathways	25.79	4.87	5	32	−1.24	2.12
Adult hope scale _total	50.6	9.34	9	64	−1.13	1.75
ADHD_adult	25.77	10.98	0	59	0.148	0.011
Smartphone addiction	30.6	12.57	10	60	0.215	−0.813
Wellbeing_physical	30.2	6.2	12	50	−0.110	0.223
Wellbeing spiritual	34.54	7.44	15	50	−0.032	−0.555
Wellbeing total	99.95	11.74	68	143	0.160	0.146

N = 333.

TABLE 2 Descriptive statistics for variables hope and wellbeing related to gender.

Sex	N	Hope agency		Hope pathways		Adult hope total		Wellbeing_physic		Wellbeing_spiritual	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Men	44	23.34	6.22	24.22	5.49	47.56	11.1	32.75	5.46	32.4	8.34
Women	289	25.03	4.84	26.03	4.74	51.06	8.97	29.82	6.23	34.87	7.26

TABLE 3 Correlation matrix and results of reliability analysis.

Nr	Variable/R/	1	2	3	4	5	6	7	8	9	10
1	Hope_agency	0.81									
2	Hope_pathways	0.765**	0.82								
3	Adult hope total	0.942**	0.937**	0.89							
4	Adult ADHD	−0.294**	−0.206**	−0.267**	0.88						
5	Smartphone addiction	−0.222**	−0.230**	−0.240**	0.503**	0.90					
6	Wellbeing physic	0.246**	0.211**	0.243**	−0.439**	−0.339**	0.68				
7	Wellbeing spiritual	0.387**	0.252**	0.342**	0.012	−0.056	−0.099	0.76			
8	Wellbeing total	0.533**	0.395**	0.495**	−0.316**	−0.304**	0.456**	0.731**	0.68		
9	Media use pandemic time	−0.080	−0.045	−0.067	0.086	0.076	−0.086	0.005	−0.072	–	
10	Media use before pandemic	−0.057	−0.008	−0.035	0.162**	0.118*	−0.038	−0.015	−0.056	0.621**	–

N = 333.

**p < 0.01.

*p < 0.05.

Diagonal values are internal reliabilities for multi-item scales.

TABLE 4 Regression coefficients of hope, adult ADHD and smartphone addiction on wellbeing.

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i> -Value	95% CI
Constant	99.95	0.543	184.1	<0.001	98.88 to 101.01
Adult hope total	0.537	0.061	8.82	<0.001	0.417 to 0.657
Adult ADHD	−0.145	0.058	−2.39	<0.05	−0.259 to −0.030
Smartphone addiction	−0.124	0.050	−2.45	<0.05	−0.223 to −0.025

N = 333.

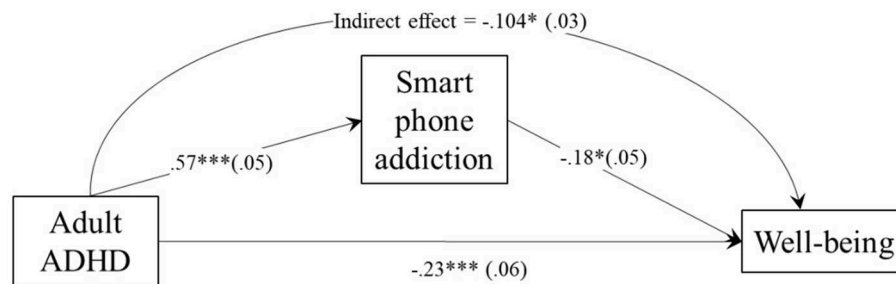
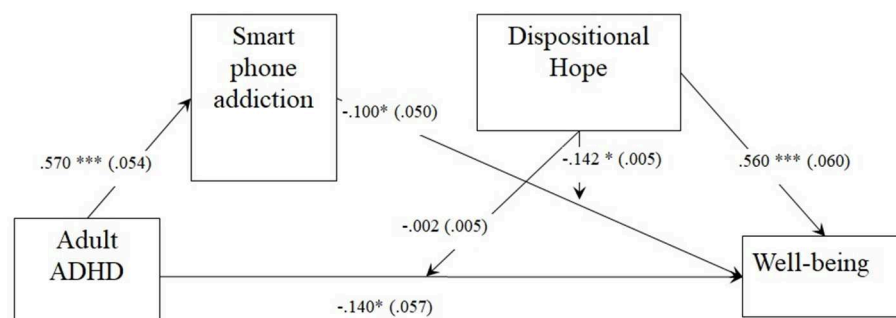


FIGURE 1

Mediation model of the ADHD effect on wellbeing through smartphone addiction. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.



* $p < .05$; ** $p < .01$; *** $p < .001$.

FIGURE 2

Moderated mediation model of the ADHD effect on wellbeing through smartphone addiction, moderated by dispositional hope. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

explains 32% of the variance of wellbeing ($R^2 = 0.317$). The results, shown in Table 5 and Figure 2, revealed that dispositional hope moderated the effect of smartphone addiction on wellbeing. However, there was no significant moderation by dispositional hope on the effect between ADHD and wellbeing, $b = -0.02$, $p > 0.05$, $\Delta R^2 = 0.0005$. The full regression results can be seen in Table 5.

Although hope did significantly moderate the smartphone effect on wellbeing (i.e., their interaction was significant), the form was different from what we expected. As shown in Figure 3, the harmful effect of smartphone addiction on wellbeing was the largest for those with high scores on dispositional hope. That is, the decline in wellbeing associated with high smartphone addiction was greatest for those with high dispositional hope (+1 SD), $b = -0.133$, 95% percentile CI $(-0.208; -0.051)$. The harmful effect of smartphone addiction on wellbeing was weaker but also significant for those who scored at the average level of dispositional hope, $b = -0.057$, 95% percentile CI $(-0.116; -0.002)$. The slope linking smartphone addiction to wellbeing was not significantly different from zero for those who had

TABLE 5 Regression results for the a-path from adult ADHD to smartphone addiction, path b from smartphone addiction to wellbeing, and path c' from adult ADHD to wellbeing.

Variable	<i>b</i>	<i>SE</i>	<i>p</i> -Value
Model 1 a-path			
Adult ADHD	0.57	0.054	<0.001
Model 2 b/c' path			
Adult ADHD	-0.14	0.057	<0.05
Smartphone addiction	-0.10	0.050	<0.05
Adult hope	0.56	0.06	<0.001
Adult ADHD × Adult hope	-0.002	0.005	>0.05
Smartphone addiction × Adult hope	-0.142	0.005	<0.05

N = 333.

Model for the a-path $R^2 = 0.25$, $F_{(1,331)} = 111.9$, $p < 0.001$, Model for b-path and c'-path $R^2 = 0.317$, $F_{(5,327)} = 30.46$, $p < 0.001$.

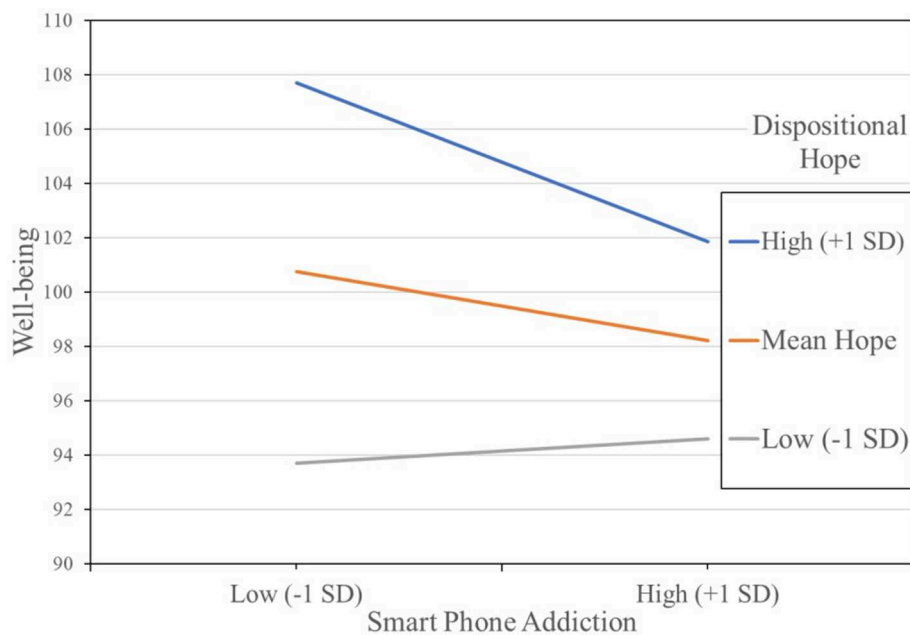


FIGURE 3
Effect of hope in the association between smartphone addiction and wellbeing.

the lowest dispositional hope, $b = 0.018$, 95% percentile CI ($-0.074; 0.091$). In other words, dispositional hope was not a protective factor in the traditional sense of making a known risk factor (i.e., smartphone addiction) less impactful on the outcome (wellbeing).

Nonetheless, dispositional hope was a protective factor in that its main effect on wellbeing was so large that, even when paired with high smartphone addiction, the estimated mean on wellbeing was higher than any of the four low or medium dispositional hope estimated means in Figure 3. In sum, the combined main and moderation effects of dispositional hope on wellbeing during the COVID-19 pandemic were quite positive.

4. Discussion

The present study found most of the expected relationships among the study variables, thereby depicting harmful effects wellbeing of ADHD symptoms and smartphone addiction on wellbeing. At the same time, the results confirmed that dispositional hope served as a protective factor but only as the main effect (positive association with wellbeing) that essentially overrode the heightened harmful effect of smartphone addiction on those with high dispositional hope.

The study also found that self-reported time using internet-connected devices increased during the lockdown. Furthermore, the positive relationship between media use and

adult ADHD found in other studies was replicated ($r = 0.162$, $p < 0.05$). Relatedly, we also found that overall time online was positively associated with smartphone addiction ($r = 0.118$, $p < 0.01$). The results are consistent with prior work suggesting that overall amount of electronic media consumption is associated with attention problems (e.g., [Swing and Anderson, 2014](#)).

Our results also showed that male students felt physically better during the pandemic than did female students, consistent with prior research ([Magson et al., 2021](#); [Sürücü et al., 2021](#)). Contrary to our expectations, we did not find any significant differences related to gender for smartphone addiction and ADHD symptoms. However, we found a high value for smartphone use by Romanian college students, $M = 30.6$ ($SD = 12.57$). This mean was higher than the value of 25.26 ($SD = 10.78$) reported by [Kwon et al. \(2013\)](#) for the general population. Being close to the cutoff points of 31 for boys and 33 for girls ([Kwon et al., 2013](#)), we can conclude that during the pandemic many Romanian students developed an addictive behavior to their smartphones.

Related to smartphone addiction, our correlation analysis revealed a moderate negative correlation with wellbeing ($r = -0.304$, $p < 0.01$) and a strong positive relation with adult ADHD symptoms ($r = 0.503$, $p < 0.01$). These zero-order associations were confirmed through the multiple regression analysis. Comparable results have been reported by other researchers studying the effects of excessive or problematic

use of electronic devices—as in addictive behavior leading to poor wellbeing (Vanden Abeele et al., 2022) and mental health problems (Girela-Serrano et al., 2022). In particular, these results are consistent with the ones of Kwon et al. (2018, 2022) who found that smartphone addiction significantly influenced ADHD symptoms in university students. Other recent studies of the pandemic also showed that smartphone addiction is negatively related to wellbeing (Topan and Kuzlu Ayyildiz, 2021; Nayak and Pai, 2022) and hope (Çevik et al., 2020). Current studies on students' behavior during the COVID-19 pandemic period found an increase in addictive behavior related to alcohol consumption among college students associated with a decline in psychological health (Evans et al., 2021; Ryerson, 2022). Conversely, hopefulness proved to be positively related to wellbeing in difficult times (Evans et al., 2021; Putrawan et al., 2021; Ryerson, 2022).

Note, however, that there are studies that show that the lockdown due to the pandemic did not always have a significant harmful impact on mental health. In a meta-analysis of longitudinal studies and natural experiments on the psychological impact of the COVID-19 pandemic, Prati and Mancini (2021) concluded that the psychological impact of COVID-19 lockdowns was small in magnitude and highly heterogeneous, suggesting that lockdowns did not have uniform detrimental effects on mental health and that most people were psychologically resilient to their effects.

Perhaps our most important findings were as follows: (a) smartphone addiction appeared especially harmful for the wellbeing of those with high dispositional hope and (b) the beneficial effects of dispositional hope appeared to counteract the effect of smartphone addiction on wellbeing. It is interesting to note that, even among those students who reported high smartphone addiction, those with high dispositional hope reported greater levels of wellbeing than those with low levels of hope *regardless of smartphone addiction*. In other research, hope has been shown to moderate the relationship between overall wellbeing and negative life events (Hirsch et al., 2012; Christens et al., 2013; Visser et al., 2013; Sun et al., 2014; Hellman and Gwinn, 2017; Munoz et al., 2020; Li et al., 2021; Sparks et al., 2021).

Our research question was whether hopefulness still had the same effect in the new challenges related to lockdowns due to the COVID-19 pandemic. The moderated mediation analysis in our research showed that dispositional hope played a protective role in students' wellbeing, just not in the way that we had expected. The study also replicated the well-established relationship between attention deficit symptoms and problematic behavior—addiction to smartphones—and wellbeing among Romanian college students. Interestingly, there was no significant moderation of hope in the relation between attention problems and wellbeing in our participants.

4.1. Limitations and future directions

The most obvious limitation (see text footnote 2) is that cross-sectional studies do not provide strong tests of causal direction. Thus, our findings should be interpreted cautiously.

Another limitation is the relatively small number of men in the sample. This limits the generalizability of the findings somewhat. However, it is important to note that (to our knowledge) there is no theoretical or empirical reason to expect that the associations of the key variables, i.e., their slopes, should differ between women and men. There are good reasons to expect some gender main effects whenever one is studying media effects and wellbeing, but not slope differences. Another sample limitation is that all participants were social sciences and humanities students.

In contrast to the limitations, among the strengths of this particular data set is that it used a vastly understudied population, namely, college students in Romania. That the study replicated several common findings from primarily Western samples strengthens the notion that the findings regarding hope, media use, media addiction, ADHD, and wellbeing replicate across a wide range of cultures.

Additional research is needed to address the causal direction of the discovered associations. Experimental studies are best suited to this task, but large-scale intervention studies are very expensive and time-consuming. Longitudinal studies would also be helpful in testing which variable changes precede vs. follow other variable changes.

An additional aspect that needs further clarification is the relationship between media use, smartphone addiction, and attention problems. Numerous cross-sectional, and a few longitudinal and experimental studies now suggest that high exposure to some types of electronic media may actually harm basic attention skills and thereby lead to significant behavior problems.

5. Conclusion

In conclusion, our findings confirmed that during lockdown there were significant negative associations between attention problems, smartphone addiction, and wellbeing and that dispositional hope may be an important protective factor. The findings also suggest that developing and instituting programs that reduce smartphone addiction and increase dispositional hope could be effective ways to improve the wellbeing of a substantial portion of students.

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 present study received the approval of the Ethics Committee (no. 13003/0-1/04.03.2020, RCE 2020-28) of the West University of Timișoara. The patients/participants provided their written informed consent to participate in this study.

Author contributions

RT and CA contributed to conception and design of the study. AF, BA-G, and AC collected the data and organized the database. RT and MM performed the statistical analysis. RT wrote the first draft of the manuscript. CA, KB, MM, AF, BA-G, and AC wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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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.

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