UNDERSTANDING SOCIOEMOTIONAL AND ACADEMIC ADJUSTMENT DURING CHILDHOOD AND ADOLESCENCE, VOLUME I

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Socioemotional Resources Account for Academic Adjustment in Moroccan Adolescents

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This study aimed to analyze the relationship of both positive socioemotional resources [emotional intelligence (EI) and social support] and negative states (test anxiety and depression) with academic adjustment, as measured by academic performance and self-concept, among Moroccan adolescents. The participants were 845 students from Morocco (372 boys, 473 girls; mean age 15.58 years; SD = 1.69; range = 13–18) who were attending secondary education (79.8%) or high school. The participants completed a questionnaire that included scales to measure the variables of interest, adapted for and validated in Moroccan adolescents. A multiple mediation serial model with four mediator variables confirmed that academic self-concept was positively and directly predicted by EI, academic performance, and social support, whereas test anxiety and depression had a negative effect. Second, EI predicted self-concept through its indirect effects on test anxiety and academic performance, social support, and depression. EI was the most protective factor. This model has good performance in explaining the variation in test anxiety (1.6%), depression (14.2%), social support (9.5%), academic performance (6.8%), and self-concept (35.7%). This study helps clarify the relationship of positive and negative socioemotional states with the academic performance of adolescents in Morocco. This study contributes to the literature by enhancing knowledge of adolescents in societies that, like Morocco, have a less elaborated tradition at these levels of education and that are considering education in their agenda as a way of enhancing national development and promoting EI to allow youth development in a healthier society.

Keywords: academic performance, adolescents, anxiety, depression, emotional intelligence, self-concept, Morocco, social support

INTRODUCTION

For Arab countries, including Morocco, studies on socioemotional and academic adjustment, especially studies focusing on adolescents, are still scarce. The linguistic conception of adolescence as not an age but rather a transition stage based on biology and the lack of instruments validated in the Moroccan context to measure these aspects (Zarhbouch, 2020) have provoked a gap in our understanding of this life stage. Moreover, assessments of the relation between adolescence and educational context in Morocco face an added difficulty due to the strong family and social constraints faced by adolescents, especially girls (Tazi, 2008). Previous studies that have considered Moroccan adolescents have focused on immigrants living in other, mainly European countries (Curtis et al., 2018), but recently, Morocco has displayed an interest in using the education system to enhance its development (World Bank Group, 2019), prompting growth in efforts to analyze which areas should be focused on. These areas include physical and mental health, emphasizing medical models (i.e., Zouini et al., 2019a,b), and psychosocial aspects [i.e., social support or emotional intelligence (EI); Lopez-Zafra et al., 2019]. However, the interplay between these psychosocial (socioemotional) aspects and academic adjustment still needs to be addressed. Thus, in this study, we propose to deepen the understanding of these relations by analyzing the impact that protective (social support and EI) and negative (depression and test anxiety) factors have on academic adjustment (academic self-concept and academic performance), thereby proposing a comprehensive model of relations to further our knowledge of Moroccan adolescents.

Our starting point is the study by Lopez-Zafra et al. (2019), in which the authors prove that social support and EI are protective factors for well-being, positively increasing life satisfaction and reducing depression. Here, we further test whether socioemotional adjustment relates to academic adjustment in Moroccan adolescents.

Previous studies in other countries have shown that socioemotional variables are more relevant than cognitive skills for academic success (see the review by Ambiel et al., 2015). Indeed, socioemotional variables are recognized as important in the academic context and are associated not only with academic success (MacCann et al., 2020) but also with success in life (Lussier and Fitzpatrick, 2016). Among these variables, EI has been found to be related to adolescents' psychological adjustment (Resurrección et al., 2014) and academic performance (MacCann et al., 2020). However, the latter relation is usually indirect, involving the promotion of other positive results (i.e., social attitudes; Jiménez and Lopez-Zafra, 2011), influencing academic performance due to a better cope with stress (Extremera and Fernández-Berrocal, 2004). Thus, EI may mediate the relation between mental health and academic performance and further analyses of the possible variables involved are needed.

Regarding academic adjustment, the notion of academic self-concept involves one's emotional and cognitive self-evaluation (see Hattie, 2014) and relates to success and academic performance at all levels of education (Marsh et al., 2016). Indeed, studies have confirmed the positive relation between academic self-concept and academic performance (see Barker et al., 2005). However, there are doubts about the direction of causality. There are studies indicating that self-concept is reinforced by academic performance (Peralta Sánchez and Sánchez Roda, 2003), whereas other studies consider the relation to be the other way around (Ferla et al., 2009). Thus, in this study, we also analyze the direction of this relation.

Academic performance may be reduced due to negative factors. For example, adolescents have to cope with test anxiety and depression, which are relatively common at this stage (Foster et al., 2018). Test anxiety is defined as a set of physiological, behavioral, and cognitive responses related to an individual's feelings over his/her expected exam performance (Nicaise, 1995), and it is associated with lower academic performance in all cultures (Raymo et al., 2019). However, personal and socioemotional variables also interact in this relation, which may be attenuated by EI or social support. In fact, EI is negatively related to depression and anxiety (Fernández-Berrocal et al., 2006) and has been proven to act as a protective factor jointly with social support in determining levels of life satisfaction in Moroccan adolescents (Lopez-Zafra et al., 2019).

Bearing all these aspects in mind, we propose and test the following hypotheses.

> *Hypothesis 1. EI is positively related to academic self-concept.*
> *Hypothesis 2. Academic performance positively predicts academic self-concept.*
> *Hypothesis 3. The relation of EI with anxiety affects academic performance and self-concept, leading to an improvement in academic performance and, therefore, academic self-concept.*
> *Hypothesis 4. The positive impact of EI on social support produces lower levels of depression and an improved academic self-concept.*

In sum, our study focuses on the role that socioemotional variables such as social support, EI, test anxiety, and depression play in academic adjustment, measured by academic performance and self-concept, among Moroccan adolescents. This is a novel approach to a sample that has received little attention.

MATERIALS AND METHODS

Participants and Procedure

The participants in this study were 845 students from Morocco (372 boys, 473 girls; mean age 15.58 years; SD = 1.69; range = 13–18) who were attending secondary education ($n = 675$) or high school ($n = 168$), with two missing values. The participants completed a questionnaire with scales measuring the variables of interest, adapted for and validated in Moroccan adolescents.

The Research and Ethics Committee at the Faculty of Letters and Human Sciences-Dhar el Mehraz of the University of Sidi Mohamed Ben Abdellah in Fez (Morocco) and the Regional Academy of Education and Training gave ethical support and allowed access to public schools. Administrative and

education officials approved the questionnaire and procedure to be administered in public schools and gave the researchers a letter to present in the schools. All schools in the region of Fez – Mequinez were invited to participate. In those accepting, students' families were informed about the study with a written letter explaining the research to obtain verbal parental consent for all participants. If parents did not consent, they could return the letter with a request to be excluded. All parents agreed to allow their children to participate, and the schools reported this information to the researchers. The Ethics Committee approved all consent procedures.

The questionnaires were administered by a group of 12 assistants who had received previous instructions about the scales, meanings of items, and procedure. They were also instructed to follow the ethical procedure guidelines approved by the Ethics Committee and the Regional Academy of Education and Training. Inclusion criteria were to be Moroccan, student in public school, and consent to participate. Participants over 18 years old were excluded.

Measures[1]

Wong and Law Emotional Intelligence Scale

The WLEIS (WLEIS; Wong and Law, 2002; moroccan version by El Ghoudani et al., 2020a; $\alpha = 0.79$ and adequate validity), is a short instrument comprising 16 items scored on a 7-point Likert scale. The Moroccan version comprises 15 items measuring four competencies: self-emotional appraisal, emotional appraisal of others, use of emotions, and regulation of emotions. A higher score indicates that an adolescent is more able to perceive/assess, use and regulate his/her emotions and those of others.

Multidimensional Scale of Perceived Social Support

We use the Multidimensional Scale of Perceived Social Support Arabic Language – Moroccan Adolescents (MSPSS. AL-MA). This is the adaptation of the Multidimensional Scale of Perceived Social Support – Arab Adolescents by Ramaswamy et al. (2009) for Moroccan adolescent samples (El Ghoudani et al., 2020b; $\alpha = 0.65$, similar to the original, and adequate validity). This version is composed of 12 items with a dichotomous response format (Yes or No). The scale reliability indices are similar to those of Ramaswamy et al. (2009), which is based on the original scale by Zimet et al. (1988; see Cortés-Denia et al., 2020). The instrument assesses the social support that an adolescent receives from family, friends and school personnel.

Test Anxiety Scale

The Test anxiety scale, Arabic Language – Moroccan Adolescents (Sarason TAS. AL-MA by Zarhbouch et al., 2020a, $\alpha = 0.96$ and adequate validity), is an adaptation of the original Test Anxiety Scale for Children (TASC; Sarason et al., 1960). This Moroccan version is composed of 38 items answered

[1] All measures are fully described in *Escalas de evaluación psicológica: adaptación cultural y validación psicométrica al ámbito educativo. En lengua árabe para adolescentes marroquíes*, eds B. Zarhbouch and K. El Ghoudani (Fez: Université Sidi Mohamed Ben Abdellah). All yielded adequate psychometric properties and validation.

on a 4-point Likert scale (from 4, totally disagree, to 1, totally agree) that measures one factor, namely, anxiety caused by academic evaluations of performance.

Academic Performance

To obtain objective and comprehensive data to evaluate academic performance, students' grade was considered. This grade is the weighted average of the grades obtained in all subjects, where the degree of relevance of each subject changes depending on the specialty. The range is 20 points, with a grade under 10 indicating failure of the academic year and a grade over 17 indicating excellence. In our sample, the range was from 5 to 19.99 points, with a mean grade of 12.88 (SD = 2.67).

Self-Concept of Academic Ability Scale

This Arabic Language – Moroccan Adolescents scale (SCAAS. AL-MA by Zarhbouch et al., 2020b; $\alpha = 0.85$ and adequate validity), is based on Aal-Hussain (1991), who adapted that of Brookover et al. (1962) into Arabic. It is composed of 8 items scored on a Likert scale (from 1, very poor, to 4, outstanding), distributed over two factors: general, that is, the individual's ability to complete their studies in absolute terms and in comparison with the ability of other students (5 items); and undergraduate, that is, the expectations an individual has in relation to the university context (3 items). In this study, participants are from secondary and high school, and thus, we focus only on the general self-concept.

Beck Depression Inventory-II

The BDI-II (Beck et al., 1996) measures the severity of depression through a series of symptoms related to different depressive disorders. The Moroccan version is a 19-item inventory that assesses depressive symptomatology (Alaoui et al., 2020; $\alpha = 0.88$ and adequate validity). Each item is rated on a scale ranging from 0 (normal) to 3 (most severe), with summary scores ranging between 0 and 57. The BDI-II has yielded high internal consistency among college students ($\alpha = 0.93$; Beck et al., 1996).

Data Analysis

IBM SPSS v. 22 was used to compute descriptives (means, standard deviations, reliability, asymmetry, and kurtosis) and Pearson correlations. PROCESS v. 3.4 (Hayes, 2018) with a confidence interval (CI) of 95% was used to perform multiple mediation in series and in parallel.

RESULTS

Descriptive Statistics

Table 1 shows the means, standard deviations, internal consistency, and correlations among all the variables of the study. All scores were normally distributed as indicated by asymmetry and kurtosis. The Pearson correlation coefficients showed that EI related positively to social support, self-concept, and academic performance, whereas the relation with anxiety and depression was negative. Similarly, self-concept displayed a positive relation with social support and academic performance and a negative relation with test anxiety and depression.

TABLE 1 | Descriptive statistics and correlations among the main variables.

	Mean	SD	α	Skewness	Kurtosis	1	2	3	4	5	6
1. Emotional intelligence	3.11	0.44	0.80	−0.67	1	–					
2. Test anxiety	2.70	0.62	0.96	−0.34	−0.20	−0.12***	–				
3. Academic performance	12.88	2.67	–	−0.01	−0.36	0.10**	−0.25***	–			
4. Social support	1.61	0.19	0.62	−0.30	0.33	0.32***	−0.03	0.08*	–		
5. Depression	2.15	1.37	0.89	0.93	−0.29	−0.33***	0.32***	−0.18***	−0.28***	–	
6. Academic self-concept	3.04	0.49	0.85	−0.25	0.82	0.31***	−0.28***	0.50***	0.22***	−0.29***	–

*Note. α indicates the Cronbach's alpha value for the reliability of the questionnaire; *p < 0.05; **p < 0.01; ***p < 0.001.*

Multiple Mediation Analyses in Series and in Parallel

To examine the implications of EI for academic self-concept and the existence of possible mediating variables that could influence this relationship, a multiple and serial mediation model of four moderating variables was tested with the PROCESS macro (Model 82; Hayes, 2018), where EI acted as a predictor and academic self-concept as a result variable, with anxiety, academic performance, social support, and depression analyzed as possible mediating variables. For the analysis, 10,000 bootstraps, Davidson–Mackinnon's heteroscedasticity-consistent inference, and a CI of 95% were used. The results showed a significant total effect of EI on self-concept (β = 0.31, SE = 0.04, p < 0.001, CI 95% [0.270, 0.433]). Furthermore, the direct effect of EI on self-concept remains significant, even considering anxiety, academic performance, social support and depression (β = 0.19, SE = 0.04, p < 0.001, CI 95% [0.138, 0.289]) (see **Table 2**).

TABLE 2 | Parallel and serial multiple mediation model: Total, direct, and indirect effects between emotional intelligence and self-concept through anxiety, academic performance, social support, and depression.

	β	SE	p	95% CI [lower, upper]
Total	0.31	0.04	<0.001	[0.270, 0.433]
Direct	0.19	0.04	<0.001	[0.138, 0.289]
	Std. Effect	Bootstrap SE	P	Bootstrap 95% CI [lower, upper]
Indirect total	0.12	0.02	–	[0.076, 0.165]
Ind1: X→M1→Y	0.02	0.01	–	[0.004, 0.028]
Ind2: X→M2→Y	0.03	0.02	–	[0.001, 0.060]
Ind3: X→M3→Y	0.03	0.01	–	[0.008, 0.056]
Ind4: X→M4→Y	0.03	0.01	–	[0.008, 0.044]
Ind5: X→M1→M2→Y	0.01	<0.01	–	[0.006, 0.023]
Ind6: X→M3→M4→Y	0.01	<0.01	–	[0.002, 0.011]

Note. Model 82 (four mediators). β = standardized coefficients; bootstrap = 10,000; CI = confidence interval; M1 = anxiety; M2 = academic performance; M3 = social support; M4 = depression; SE = standard error; X = emotional intelligence; Y = self-concept.

Moreover, EI negatively and significantly influenced anxiety (β = −0.13, SE = 0.05, p < 0.001) and depression (β = −0.26, SE = 0.12, p < 0.001) and positively influenced academic performance (β = 0.07, SE = 0.21, p < 0.05) and social support (β = 0.31, SE = 0.02, p < 0.001). In a similar vein, self-concept was negative and significantly predicted by anxiety (β = −0.11, SE = 0.03, p < 0.001) and depression (β = −0.10, SE = 0.01, p < 0.01) and positively predicted by academic performance (β = 0.43, SE = 0.01, p < 0.001) and social support (β = 0.10, SE = 0.09, p < 0.01). In turn, significant and negative implications of anxiety were found for academic performance (β = −0.24, SE = 0.16, p < 0.001) and of social support for depression (β = −0.20, SE = 0.26, p < 0.001) (see **Figure 1** and **Table 3**).

This model shows the significant relationships among the six indirect effects connecting EI and self-concept, specifically anxiety (M1; 95% CI [0.004, 0.028]), academic performance (M2; 95% CI [0.001, 0.060]), social support (M3; 95% CI [0.008, 0.056), depression (M4; 95% CI [0.008, 0.044]), and serial paths from M1 to M2 (95% CI [0.006, 0.023]) and M3 to M4 (95% CI [0.002, 0.011]) when zero is not included within the CI (see **Table 2**). This model explains 1.6% of the variation for test anxiety, 14.2% for depression, 6.8% for academic performance, 9.5% for social support, and 35.7% for self-concept.

DISCUSSION

Due to the importance of understanding socioemotional and academic adjustment for the future of Moroccan adolescents, our motivation for testing a model of relations is clear. This study contributes by considering both protective (EI and social support) and negative (anxiety and depression) variables affecting academic performance in the same model. Furthermore, our results contribute to the Moroccan educational system by suggesting the inclusion of emotional abilities in the educational process.

The positive relationship between EI and academic self-concept (H1) is a novel result, as most studies have focused on the impact of EI on academic performance (MacCann et al., 2020). Moreover, academic performance mediates this relation, confirming that EI is a predictor of academic success and supporting the results of other studies (Romanelli et al., 2006). However, the path of relations in this study implies that self-concept results from academic performance to a greater extent than the other way around, also confirming that our H2 that is in

FIGURE 1 | Results of model of multiple mediation in series and in parallel. *Note*. Values are standardized coefficient. The values in parentheses represent the total effect. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
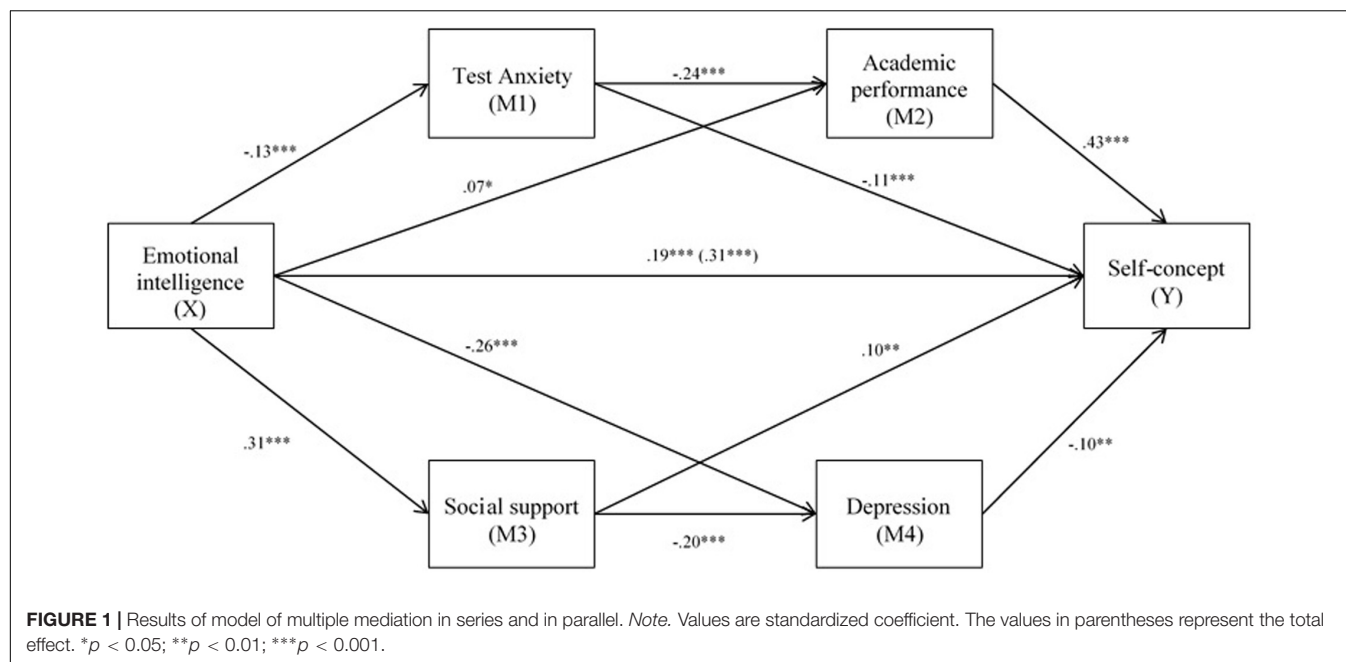
TABLE 3 | Relationships between model variables.

	Consequent														
	M1			**M2**			**M3**			**M4**			**Y**		
Antecedent	β	SE	*P*	β	SE	*p*	β	SE	*p*	β	SE	*p*	β	SE	*p*
X	−0.13	0.05	<0.001	0.07	0.21	<0.05	0.31	0.02	<0.001	−0.26	0.12	<0.001	0.19	0.04	<0.001
M1	–	–	–	−0.24	0.16	<0.001	–	–	–	–	–	–	-0.11	0.03	<0.001
M2	–	–	–	–	–	–	–	–	–	–	–	–	0.43	0.01	<0.001
M3	–	–	–	–	–	–	–	–	–	-0.20	0.26	<0.001	0.10	0.09	<0.01
M4	–	–	–	–	–	–	–	–	–	–	–	–	-0.10	0.01	<0.01
Constant	*3.27	0.17	<0.001	*14.36	0.86	<0.001	*1.18	0.06	<0.001	*6.99	0.48	<0.001	*1.25	0.20	<0.001
	R^2 0.016			R^2 0.068			R^2 0.095			R^2 0.142			R^2 0.357		
	$F_{(1,820)} = 11.448$,			$F_{(2,819)} = 27.392$			$F_{(1,820)} = 58.870$			$F_{(2,819)} = 55.448$			$F_{(5,816)} = 76.471$		
	$p < 0.001$			$p < 0.001$			$p < 0.001$			$p < 0.001$			$p < 0.001$		

*Note. β = standardized coefficient; M1 = anxiety; M2 = academic performance; M3 = social support; M4 = depression; SE = standard error; X = emotional intelligence; Y = self-concept; *unstandardized coefficient.*

line with social identity theory, in which positive comparisons in results improve adolescents' self-concept (Sinclair et al., 2019).

Furthermore, anxiety and depression were included, as they might mediate this relation due to their proven negative relation with self-concept (Najafi Kalyani et al., 2013). Indeed, our results showed that greater EI reduces anxiety. Moreover, anxiety mediates the relation between EI and self-concept, therefore supporting H3, in which the impact of EI on anxiety promotes an improvement in academic performance and, in turn, self-concept. This result is consistent with all studies that highlight the protective effect of EI in stressful situations (Resurrección et al., 2014). This result supports the importance of intervention programs for adolescents with clear implications for educational practice. Finally, other studies finding that EI and social support prevent depression (Lopez-Zafra et al., 2019) are extended by our finding that this effect also influences self-concept by reducing the

negative impact of depression, thus supporting H4. This result in Moroccan students is in line with results in other countries reported by MacCann et al. (2020) in which indicate that the contribution of EI in the regulation of negative emotions (i.e., anxiety or boredom) is responsible of the positive effects of EI on academic performance.

In sum, our hypotheses are mainly supported, showing a model of relations that include positive and negative variables impacting self-concept (see **Figure 1**). This relational model can help researchers and practitioners address academic adjustment by considering the importance of socioemotional adjustment among Moroccan adolescents. Promoting interventions that enhance EI, as a clear predictor of self-concept, and social support from families and schools, as protective resources against anxiety and depression, will have benefits for academic performance and self-concept. Overall, the education system should attend

to socioemotional aspects to enhance academic adjustment (performance and self-concept) among Moroccan adolescents.

In terms of limitations, the use of a convenience sample and the transversal design prevents us from widely generalizing the results and points to the need for longitudinal studies to further analyze the mechanisms of the EI/performance relationship. For example, MacCann et al. (2020) suggest analyzing this further with research on (a) social relationship building, (b) regulation of academic emotions, and (c) content overlap between EI and academic subject matter. However, regarding the sampling method, our sample is large and heterogeneous in terms of academic performance and the scores on the different scales, which is a strength in assessing the impact of psychological and socioemotional variables.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research and Ethics Committee at the Faculty of Letters and Human Sciences-Dhar el Mehraz of the University of Sidi Mohamed Ben Abdellah in Fez (Morocco). Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors provided substantial contributions to the work. EL-Z, MP-M, KE, JA-L, and BZ conceived of and designed the study. BZ, KE, and SA adapted the scales to the Moroccan context, trained the surveyors, and collected the data. MR-Á performed the measurements. DC-D processed the data, performed the analyses, interpreted the data, and helped with the references. MP-M, JA-L, and OL-R contributed to the conceptual model. DC-D, EL-Z, and KE drafted the manuscript. EL-Z integrated and coordinated the work. All authors critically revised the manuscript, approved this version, and agreed to be accountable for all aspects of this work and its integrity.

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Lifetime Mental Health Problems in Adult Lower Secondary Education: A Student Survey

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Background/Objective: Adult Lower Secondary Education is an education program for basic qualifications for the labor market. Our study aimed to compare lifetime mental health problems between current Adult Lower Secondary Education students and higher Vocational Education students, as the former constitutes a highly distinct and understudied group.

Methods: Findings were based on a cross-sectional self-report survey. Lifetime relative odds of occurrence of mental disorders [i.e., psychiatric disorders typically diagnosed in adults, learning difficulties or deficit hyperactivity disorder (ADHD)] were compared between Adult Lower Secondary Education students ($n = 134$) and Vocational Education students ($n = 149$).

Results: While the frequency of mental health problems was high in both groups, psychiatric disorders typically diagnosed in adults were more common in Adult Lower Secondary Education students than among other students. Vocational Education students reported higher rates of ADHD.

Conclusion: There is a need for additional psychological resources for Adult Lower Secondary Education students, an educational level that is the last path for many to acquire a basic degree.

Keywords: vocational education, adult education, mental health, psychiatric disorders, adult lower secondary education

INTRODUCTION

Attaining compulsory education is a key gateway for the job market and any person without such education is at a high risk of social exclusion. Adult Lower Secondary Education (ALSE) programs become the last option for many to get basic qualifications either before beginning the search for a job or even after many years of labor (Feito Alonso, 2015). We refer to ALSE as any program of instruction designed to prepare adults for the award of a lower secondary education degree (obtained in Spain after the completion of the four post-primary education courses, typically at age of 16). ALSE students constitute a highly distinct and understudied population with a history of

past educational failure who nevertheless desire to continue studying. Qualitative studies on ALSE programs have shown that, although students have very varied profiles, the presence of mental disorders, disabilities and learning difficulties was a recurrent theme in their educational history (Feito Alonso, 2015). There are few studies on the frequency of mental health problems in this population. Moreover, the relationship between mental health and education is complex. Mental health issues might lead to educational difficulties and educational difficulties might lead to mental health issues. As a result, a cycle with deleterious consequences can be created for the individual.

Additionally, the age between 14 and 25 is the time when many mental health problems are first diagnosed (World Health Organization, 2013). A big portion of ALSE students are in this age range and may have specific mental health trajectories when compared to other students in the educational system. Several large studies have compared the mental health of university students against non-students of the same age (Sellström et al., 2011; Auerbach et al., 2017) and have shown that there is a lower prevalence of mental health problems in undergraduates than in individuals that are not studying, especially if they also do not work (Kovess-Masfety et al., 2016). This, nevertheless, has not been a universal finding (Alonso et al., 2004).

The risk of unemployment in Spain goes in hand with low educational levels in 2018, unemployment rates for adults with Lower Secondary Education or below was of 21%, nearly doubling the average of European countries (OECD, 2019). As for people with mental health problems, their access to jobs is not easy: only 5% are regularly employed in Spain (Muñoz et al., 2009). In this context, ALSE centers handle a big challenge in the integration of their students into the labor market (OECD, 2015). In Europe, lower secondary education is typically compulsory until the age of 16. Thus, the number of adults who have not completed this educational level is limited [less than 20% in younger adults (ages 25–34) on average across OECD countries] (OECD, 2018). Therefore, the study of prevalence of mental disorders in this group has been hampered. Indeed, samples under the age of 25 with uncompleted lower secondary education have been relatively small even in the largest surveys. For example, Auerbach et al. (2016) pooled data from over 5,000 individuals under the age of 22 that were included in the World Health Organization (WHO) mental health surveys of different countries. After combining data from different samples, there were only 157 individuals with uncompleted secondary studies in Europe. Moreover, comparisons between this group and either college students or students with completed secondary studies were not carried out. There was some indication that this was a key comparison, because the mental health of college students and secondary graduates were very similar, but there were marked differences between college students and individuals that never entered college. Similarly, Kovess-Masfety et al. (2016) included data from 2,424 French adults under the age of 24 and compared mental health of college students, secondary students (including secondary school pupils and apprentices), working individuals, and individuals who were neither employed nor students or trainees (i.e., NENST). The overall group of secondary students had a sample size of 386 individuals and the NENST

group had a sample size of 266 individuals. This latter group had the worst outcomes in the study. Moreover, mental distress has been shown to be on the rise among young adults (Ross et al., 2017) and the most relevant studies use data from old surveys. WHO surveys, for example, were mostly carried out between the years 2001 and 2005 (Auerbach et al., 2016) whereas the data in Kovess-Masfety et al. (2016) was based on data from 2005. Therefore, the acquisition of new data is likely an area of great interest for researchers and practitioners.

Summarizing profiles of non-traditional learners, specifically adults, is still a scarcely studied subject (Gerber, 2012; Rothes et al., 2017). More research is needed in order to explain different trajectories of these learners, such as those enrolled in ALSE, compared to other groups. Both practice and research suggest that they may have different needs, demands, and abilities (Kaufman et al., 2008). The main objective of the present work was to assess the mental health status of ALSE students. In addition, we were also interested in assessing specific difficulties that ALSE students face in their education. For this purpose, a comparison group of higher vocational education (VE) students was also evaluated. The latter group was selected because all students would also be adults and part of a higher education itinerary (as opposed to lower levels of VE from Spain). On the other hand, less favored social classes are more likely to enter VE than more privileged classes, who choose university education more frequently (Vallejo and Dooly, 2013). Since ALSE students are potential candidates for social exclusion, higher VE students were expected to be a better comparison group than university students.

To the best of our knowledge, this is the first study comparing the occurrence of lifetime mental disorders between a sample of current ALSE students and a sample of higher VE students. Results could have organizational implications as they could help to understand some of the specific difficulties that ALSE students face in their education.

MATERIALS AND METHODS

Procedure

The study and its consent procedure were approved by the ethics committee of the University of Navarra and carried out following the 1964 Helsinki declaration and its later amendments. All participants provided written consent. Capacity to consent was assumed for any student following the ALSE or VE curricula after a researcher duly explained the study and resolved any doubts raised in the class. As part of the safety protocol for students with mental health problems, a psychologist or educator from the research team was always present during data collection. All the participants were given the same instructions and completed the questionnaires under the same conditions. Data was acquired in November 2016 in two local schools in Pamplona (Spain), one school for each group. The ALSE school was selected as it is the only one in the capital city and the biggest of the region. Therefore, the sample is likely representative of the ALSE population, at least for larger cities. The VE school was selected for convenience reasons.

Participants

There are 6 years of primary education in Spain, starting at age of six. After completing these academic years, students will study four courses of compulsory lower secondary education (working is not allowed until the age of 16). Most students will complete this compulsory lower secondary education and then choose either a 2-year baccalaureate or intermediate VE. The obtainment of the baccalaureate diploma permits either college entry after passing a national entry exam or, alternatively, access to higher VE. VE is one of the secondary educational options that a Spanish student is offered. There are two types of post-lower secondary VE itineraries: intermediate and higher education. To access intermediate VE a student needs to be in possession of the lower secondary education title (typically obtained at the age of 16). Higher VE can be accessed after 2 years of either baccalaureate or mid-level VE and, hence, it is typically initiated at the age of 18. It consists of two courses and it is considered a form of higher education that provides access to specialized positions in the labor market or, less frequently, to university degrees (Ministerio de Educación y Formación Profesional, 2018a; see **Figure 1**). In the 2016/2017 academic year, there were 313,180 students in intermediate VE and 326,982 in higher VE in Spain. ALSE in Spain is an alternative pathway to obtain the title of lower secondary education for those over the age of 18. Hence, it becomes the last option to obtain a basic educational degree for many students with a previous history of educational failure and/or who left school early. In the 2016/2017 academic year, 124,092 individuals were studying lower secondary education in this modality, accounting for 7% (Ministerio de Educación, 2017) of the overall students of lower secondary education. ALSE in Spain comprises four academic years, each covering the contents of the four courses of compulsory lower secondary education. ALSE can be offered either in-person (students attend class every day) or through distance-learning modalities (Ministerio de Educación y Formación Profesional, 2018b).

A cross-sectional self-reported survey was completed by students who were enrolled in: (1) any of the four courses of the in-person ALSE curricula or (2) higher VE (convenience control group). Students on a study break were not included. There were no other inclusion or exclusion criteria, as any student present during the days of the evaluation was offered to participate. Samples were obtained using convenience sampling. A representative sample of the day-to-day of the school was approached. After presenting the research study, four ALSE and one VE students declined to participate. A total of 134 ALSE students and of 149 VE students from two local schools in the region's capital (out of 1 ALSE and 16 VE schools in the capital) were enrolled in the study. ALSE participants accounted for 27.6% of the total ALSE students in the region following the in-person program; the VE sample included 4.3% of higher VE students enrolled in the in-person program (Ministerio de Educación y Formación Profesional, 2019).

Higher VE was considered the best comparison group among the different levels of the educational system because they are also adults at a non-university level, and differences in demographic variables were expected between groups.

Materials

The survey included *ad-hoc* questions on demographics and mental health. The socio-demographic questionnaire was created by the researchers for the study and included multiple-choice questions on age (coded as between 18 and 25, 26–30, 31–35, 36–40, or over 40), sex, cultural origin, family, level of parental education, educational history, work status, and mental health.

Regarding mental health, participants were asked to indicate if they had ever been diagnosed with disorders by a health professional. In this study, mental health problems were divided into three main groups: (1) Mental disorders typically diagnosed during adolescence or adulthood (i.e., depression, anxiety, social phobia, OCD, personality disorder, eating disorder,

FIGURE 1 | Overview of the Spanish education system.
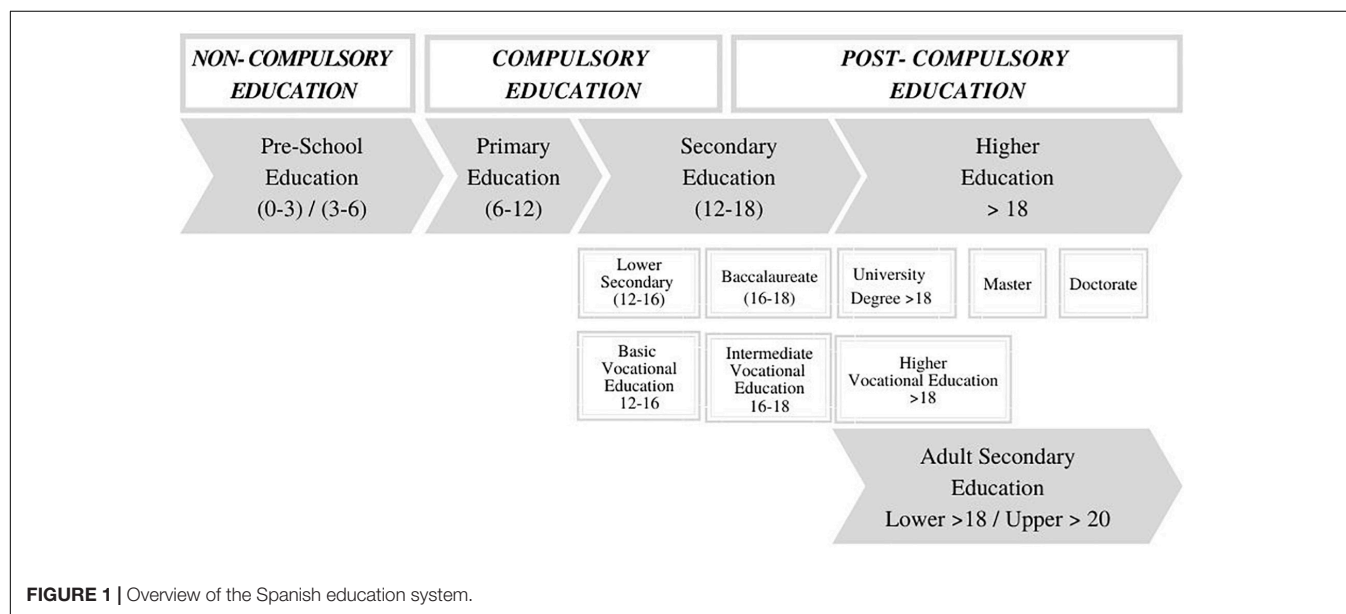
schizophrenia, bipolar disorder, PTSD, substance abuse, and problem gambling). These categories were the same as the ones included in the MINI International Neuropsychiatric Interview (Lecrubier et al., 1998) and they corresponded to the most frequent mental disorders; (2) Four problems that mainly or heavily affect school results (i.e., dyslexia, dyscalculia, language disorder, and intellectual disability) were also investigated; (3) Finally, ADHD was included as a stand-alone disorder. Whereas it is typically diagnosed in childhood, ADHD symptoms continue to adulthood and, in many cases, its consequences reach far over than school results. Moreover, ADHD is highly comorbid with many disorders included in the first or second groups.

We chose lifetime diagnoses because mental health problems in childhood and adolescence are predictors of work incapacity across the lifespan (Goodman et al., 2011). Additionally, lifetime existence of mental health problems is better suited to compare small groups or low frequency disorders as overall numbers will be greater.

The study also included the Spanish versions of the Motivated Strategies for Learning Questionnaire (Pintrich, 1991; Roces et al., 1995), the Discomfort Intolerance Scale (Harrington, 2005; Medrano et al., 2018) and a modified version of a questionnaire on perception of competency for employment (Martínez-Rodríguez and Carmona, 2010). Results from these questionnaires, along those of many of the questions of the sociodemographic questionnaire were aimed at providing additional insights of the samples and will not be reported here. All instruments were answered by participants in optical automatic reading response sheets.

Analyses

The percentage of female individuals, of participants under the age of twenty-five, those from a foreign country, and that had a parent with a post-secondary degree or superior educational level were obtained for each of the educational groups and compared between ALSE and VE using Chi-squared tests. The number of subjects who had ever received a diagnosis of any of the mental disorders were identified in each of the groups (ALSE, VE). Observations were independent because each participant was only counted as one observation. Variables in our study were dichotomous and presented a binomial distribution. Odds of a previous diagnosis of a mental disorder were then compared between ALSE and VE (reference group) students. Odds ratios (OR) and 95% confidence intervals were calculated based on exact logistic regression analyses [dependent variable = lifetime history of mental disorder, independent variable = group (ALSE, VE)] reporting a measure of association between mental health and educational level. ORs were calculated for: (1) any and each of 11 mental disorders typically diagnosed in adulthood, (2) ADHD, and (3) any and each of the other learning difficulties.

ORs including all ALSE and VE students were calculated. As expected, socio-demographic differences were found between groups. Almost all individuals (95.3%) in VE were under the age of 25, and this was not the case in ALSE (~40% of students were over 25 years old). Individuals under the age of 25 also differed in the proportion of men and women in ALSE and VE (42.7% female in ALSE and 28.9% female in VE). Because

sex and age are important risk factors for many mental health problems, we were interested in exploring the effect of these confounding variables in our results. For this purpose, ORs including only individuals under the age of 25 were calculated in another analysis. Additionally, we obtained ORs in those subjects who were under the age of 25, including sex as a covariate in the logistic regression analysis.

Statistical analyses were performed in Stata v13 and p-values under 0.05 were considered significant.

RESULTS

The ALSE and VE groups differed significantly in key socio-demographic variables. More students in ALSE: (1) were over the age of 25 [38.8 vs. 4.7% in VE, $\chi^2(1) = 44.06$, $p < 0.001$], (2) were female [49.3 vs. 30.9% in VE, $\chi^2(1) = 9.97$, $p < 0.01$], (3) were born in a foreign country [51.9 vs. 14.1%, $\chi^2(1) = 46.17$, $p < 0.001$], and (4) their parents had lower education grades [57% of students in ALSE had a parent with a post-secondary degree vs. 81.9% in VE, $\chi^2(1) = 20.40$, $p < 0.001$]. Additionally, socio-demographic variables related to subjects with a lifetime history of mental disorders can be found in **Tables 1**, **2**.

Lifetime, self-reporting of mental health problems was high. For example, 27% of individuals in ALSE reported a history of mental health problems of adulthood, and 17% of VE students reported a history of ADHD. Students in ALSE showed a significantly higher probability of having a history of mental health problems typically diagnosed in adulthood, which was mainly attributable to an increased probability of being diagnosed with depression and anxiety (**Table 1**). Students in VE reported higher rates of previous diagnoses of ADHD, although differences were not statistically significant when controlling for age and sex.

Lastly, comorbidity was found among participants. We found that the number of students who ever received a diagnosis of at least one of the mental disorders was 48 in ALSE and 46 in VE. Out of these, 21 subjects in ALSE and 10 subjects in VE showed a positive diagnosis for more than one mental disorder.

DISCUSSION

Our study showed that present or past mental health issues in students enrolled in ALSE are frequent and, indeed, more prevalent than in other forms of under-college adult education. Lifetime risk of depression and anxiety in VE was close to that found in college students worldwide as seen in the World Health Organizations surveys. However, these same rates were much higher in ALSE students than in students that did not enter college in the WHO surveys (Auerbach et al., 2017) even when only students under age of 25 were considered. This reaffirms the distinct status of ALSE enrollees compared to other students of the education system. Whereas several comparisons did not reach statistical significance when controlling both by age and sex, ORs still suggested differences between the groups. Hence, the lack of statistical significance likely results from the reduced power of the comparison to detect effects.

TABLE 1 | Lifetime mental health problems in Adult Lower Secondary Education and Vocational Education.

	ALSE (n = 134)						VE (n = 149)						
	Cases (n)	%	>25 (%)	FM (%)	FR (%)	P.E. (%)	Cases (n)	%	>25 (%)	FM (%)	FR (%)	P.E. (%)	Raw OR (95% CI)
Any mental health problem of adulthood[b]	36	26.7	44.4	69.4	41.7	77.8	19	12.8	5.3	26.3	26.3	89.5	2.5 (1.31–4.92)*
Depression	21	15.7	47.6	76.2	52.4	76.2	7	4.7	0.0	57.1	28.6	85.7	3.75 (1.47–10.83)*
Anxiety	23	17.2	34.8	60.9	26.1	78.3	8	5.4	0.0	37.5	25.0	87.5	3.63 (1.50–9.78)*
Social phobia	5	3.7	20.0	80.0	0.0	60.0	0	0.0	–	–	–	–	7.68 (1.03–Inf)*
OCD	5	3.7	40.0	40.0	0.0	100.0	2	1.3	0.0	0.0	50.0	100.0	2.83 (0.45–30.29)
Personality disorder	6	4.5	16.7	66.7	50.0	83.3	2	1.3	0.0	0.0	50.0	100.0	3.43 (0.60–35.34)
Eating disorder	5	3.7	40.0	100.0	20.0	80.0	4	2.7	25.0	75.0	50.0	75.0	1.40 (0.29–7.22)
Schizophrenia	1	0.8	0.0	0.0	100.0	100.0	1	0.7	0.0	0.0	0.0	100.0	1.11 (0.01–87.93)
Bipolar disorder	1	0.8	0.0	100.0	0.0	100.0	0	0.0	–	–	–	–	1 (0.95–Inf)
PTSD	3	2.2	33.3	66.7	66.7	66.7	1	0.7	0.0	0.0	0.0	100.0	3.37 (0.27–179.11)
Substance abuse	3	2.2	33.3	66.7	66.7	66.7	4	2.7	0.0	0.0	50.0	100.0	0.83 (0.12–5.01)
Problem gambling	0	0.0	–	–	–	–	3	2.0	0.0	0.0	33.3	66.7	0.29 (0.00–2.68)
ADHD	11	8.2	27.3	45.5	36.4	54.5	25	16.8	4.0	4.0	12.0	100.0	0.44 (0.19–0.99)*
Other learning difficulties[c]	11	8.2	45.5	45.5	54.5	72.7	9	6.0	0.0	33.3	11.1	100.0	1.39 (0.50–3.93)
Dyslexia	2	1.5	50.0	50.0	100.0	100.0	3	2.0	0.0	66.7	33.3	100.0	0.74 (0.06–6.54)
Dyscalculia	5	3.7	40.0	60.0	60.0	60.0	2	1.3	0.0	50.0	50.0	100.0	2.84 (0.45–30.29)
Language disorder	0	0.0	–	–	–	–	4	2.7	0.0	0.0	25.0	100.0	0.21 (0.00–1.67)
Intellectual disability	4	3.0	50.0	25.0	25.0	75.0	2	1.3	0.0	0.0	0.0	100.0	2.25 (0.32–25.31)

*ALSE, Adult Lower Secondary Education; VE, Vocational Education; OR, odds ratio; PTSD, post-traumatic stress disorder; OCD, obsessive-compulsive disorder; ADHD, attention deficit hyperactivity disorder. Total number of cases and percentages are reported. ORs and their respective 95% confidence intervals are calculated as a measure of association between mental health and educational level [ALSE, VE (reference group)]. Columns ">25 (%)" (percentage of subjects over 25 years old), "FM (%)" (percentage of females), "FR (%)" (percentage of students who were born in a foreign country), and "P.E. (%)" (percentage of students who had at least a parent with post-secondary degree or superior educational level) represent sociodemographic data of subjects who reported a lifetime history of mental disorders. *Indicating significant results (p < 0.05).
[b]Any of the 11 common mental disorders typically diagnosed in adulthood: depression, anxiety, social phobia, OCD, personality disorder, eating disorder, schizophrenia, bipolar disorder, PTSD, substance abuse, and problem gambling. [c]Any of the 4 learning difficulties: dyslexia, dyscalculia, language disorder, and intellectual disability.*

TABLE 2 | Lifetime mental health problems in Adult Lower Secondary Education and Vocational Education, including only subjects under 25.

	ALSE ≤ 25 (n = 82)					VE ≤ 25 (n = 142)					Raw OR ≤ 25	Adjusted OR ≤ 25[a]
	Cases (n)	%	FM (%)	FR (%)	P.E. (%)	Cases (n)	%	FM (%)	FR (%)	P.E. (%)		
Any mental health problem of adulthood[b]	20	24.4	75.0	45.0	95.0	18	12.7	22.2	22.2	88.9	**2.21 (1.03–4.80)***	2.01 (0.92–4.40)
Depression	11	13.4	81.8	45.5	90.9	7	4.9	57.1	28.6	85.7	2.97 (1.01–9.46)*	2.44 (0.79–8.00)
Anxiety	15	18.3	66.7	33.3	93.3	8	5.6	37.5	25.0	87.5	3.72 (1.40–10.69)*	3.32 (1.23–9.63)*
Social phobia	4	4.9	75.0	0.0	75.0	0	0.0	–	–	–	9.46 (1.17–Inf)*	7.68 (0.93–Inf)
OCD	3	3.7	66.7	0.0	100.0	2	1.4	0.0	50.0	100.0	2.65 (0.30–32.30)	2.59 (0.28–32.13)
Personality disorder	5	6.1	60.0	60.0	100.0	2	1.4	0.0	50.0	100.0	4.51 (0.72–48.45)	4.37 (0.68–47.50)
Eating disorder	3	3.7	100.0	0.0	100.0	3	2.1	66.7	33.3	66.7	1.75 (0.23–13.42)	1.31 (0.16–10.33)
Schizophrenia	1	1.2	0.0	100.0	100.0	1	0.7	0.0	0.0	100.0	1.74 (0.02–137.6)	2.16 80.27–172.31)
Bipolar disorder	1	1.2	100.0	0.0	100.0	0	0.0	–	–	–	1.73 (0.04–Inf)	1.17 (0.03–Inf)
PTSD	2	2.4	50.0	50.0	100.0	1	0.7	0.0	0.0	100.0	3.5 (0.18–209.40)	3.59 (0.18–218.70)
Substance abuse	2	2.4	50.0	100.0	100.0	4	2.8	0.0	50.0	100.0	0.86 (0.08–6.17)	0.96 (0.08–7.00)
Problem gambling	0	0.0	–	–	–	3	2.1	0.0	33.3	66.7	0.45 (0.00–4.19)	0.55 (0.00–5.21)
ADHD	8	9.8	50.0	25.0	62.5	24	16.9	4.2	12.5	100.0	0.53 (0.20–1.31)	0.60 (0.22–1.49)
Other learning difficulties[c]	6	7.3	33.3	66.7	83.3	9	6.3	33.3	11.1	100.0	1.17 (0.33–3.83)	1.17 (0.33–3.90)
Dyslexia	1	1.2	0.0	100.0	100.0	3	2.1	66.7	33.3	100.0	0.57 (0.01–7.27)	0.51 (0.01–6.68)
Dyscalculia	3	3.7	66.7	66.7	66.7	2	1.4	50.0	50.0	100.0	2.64 (0.30–32.30)	2.29 (0.25–28.52)
Language disorder	0	0.0	–	–	–	4	2.8	0.0	25.0	100.0	0.32 (0.00–2.61)	0.40 (0.00–3.24)
Intellectual disability	2	2.4	0.0	50.0	100.0	2	1.4	0.0	0.0	100.0	1.74 (0.12–24.5)	2.18 (0.15–31.06)

ALSE, Adult Lower Secondary Education; VE, Vocational Education; ALSE ≤ 25 and VE ≤ 25, individuals under the age of 25 in ALSE and VE, respectively; OR, odds ratio; PTSD, post-traumatic stress disorder; OCD, obsessive-compulsive disorder; ADHD, attention deficit hyperactivity disorder. Total number of cases and percentages are reported. ORs and their respective 95% confidence intervals are calculated as a measure of association between mental health and educational level [ALSE, VE (reference group)]. Columns "FM (%)" (percentage of females), "FR (%)" (percentage of students who were born in a foreign country), and "P.E. (%)" (percentage of students who had at least a parent with post-secondary degree or superior educational level) represent sociodemographic data of subjects who reported a lifetime history of mental disorders. *Indicating significant results (p < 0.05). [a]Controlled for sex. [b]Any of the 11 common mental disorders typically diagnosed in adulthood: depression, anxiety, social phobia, OCD, personality disorder, eating disorder, schizophrenia, bipolar disorder, PTSD, substance abuse, and problem gambling. [c]Any of the 4 learning difficulties: dyslexia, dyscalculia, language disorder, intellectual disability.

Unexpectedly, frequency of ADHD reporting was more common in VE students than in ALSE students, although this difference was not statistically significant when controlling for age. Lifetime self-reported diagnosis of ADHD has been estimated to occur in 11% of individuals under 18 (National Institute of Mental Health, 2017) a rate close to the one found in ALSE students, but much lower than that of VE students. Both the high frequency of reporting and the counter-intuitive difference between groups open future paths of research. It could be hypothesized that such patterns might be related to generational issues on the diagnosis of ADHD. Alternatively, some aspects related to the demographics of ALSE students, such as an origin in foreign countries with different health systems, might also be influencing the rates of ADHD diagnoses.

The fact that we used lifetime diagnoses should also be stressed. We cannot know if individuals who received a diagnosis in the past had a current episode. Nevertheless, having a mental health disorder at any point of the educational life course could potentially have some relevant impact years after. Additionally, the fact that diagnoses were self-reported could lead to recall bias. However, other noteworthy studies such as the National Health Interview Survey (NHIS) in the US have used, similarly, posed questions for over 50 years. In our case, such a design permitted the concurrent evaluation of whole classes in a short period of time. There are several possible explanations for the greater risk of mental health diagnoses in ALSE students. First, the results could be simply attributable to age differences between groups. ALSE students have are older than other type of students and, therefore, have a greater cumulative time to receive a diagnosis. However, the fact that most differences remained after controlling for age is evidence against this hypothesis. Similarly, other demographics could also be related to greater mental health diagnoses in the ALSE group. For example, living in a foreign country or having a lower socioeconomic status are both related to higher rates of psychiatric disorders. ALSE and VE students differ on many sociodemographic variables, any of which could be driving the differences in reported psychopathology. However, the fact that the origin of these differences cannot be known from our analyses should not distract from the importance of our results. From an organizational perspective, higher frequencies of self-reported psychopathology, independent of their cause, could indicate a necessity for more educational or psychological resources in these programs. Second, past or chronic mental health problems are likely bidirectionally linked with educational difficulties: mental health problems could lead to educational difficulties and likewise, educational difficulties could lead to mental health problems. Therefore, mental health issues would be related to higher rates of dropouts in the educational system and, indirectly, to greater rates when individuals come back to ALSE programs. Finally, ALSE programs might be seen as an interesting resource for a minority of individuals with current mental health problems. Some individuals may have difficulties finding a job due to their specific handicaps, and ALSE programs might be used as some form of occupational therapy.

Our study has several important limitations. First, mental health assessment through self-report scales is not ideal and there are other preferred methods, such as clinical interviews. However, such instruments also increase administration time. Participants' responses might be biased due to the presence of a person from the research team during data collection. In addition, it is important to note that ORs corrected by age are not representative of the whole ALSE population, because they only include young adults. Sample sizes might not have been large enough to reliably study differences between ALSE and VE groups in the less common diagnoses. According to power analyses, our data lacked statistical power to detect differences between groups in mental health problems which were smaller than 5%. To minimize this issue, we used both lifetime frequency of diagnoses and groups of disorders to increase counts in each of the groups. In this case we traded specificity for improved reliability. Moreover, samples are probably not fully representative of their respective populations because they were recruited from only one institution. This is likely more marked in the case of VE than ALSE, as in ALSE groups, we evaluated a large proportion of the students in a key school in the region. It could also be argued that ALSE students form a pre-selected sample. Those who enrolled ALSE are those who, for some reason, decided that it was important for them to obtain a lower secondary education degree. However, some percentage of students who dropped out do not continue with their education, and they were not part of our research. Because our results cannot be generalized to all students that dropped out from the educational system, it is highly relevant to describe the ALSE population as they likely differ both from other students (as shown here) and other individuals who never come back to the educational system. Future studies could aim to compare ALSE to this latter group. Finally, it is important to note that distance learning students were not included in the present work. Future research should take this population into consideration.

Despite the limitations derived from being a small survey, our study highlights the need for additional educational, psychological, and economic resources in an understudied educational level that is the last path for many to acquire a basic degree. There are higher rates of mental health problems in ALSE and this will influence day-to-day school interactions. According to previous work, teachers usually play a key role in the detection of mental health problems and in students' well-being (Wang et al., 2013; Brandseth et al., 2019). However, research also indicates that teaching is a highly demanding career (Yang et al., 2019) with teachers reporting high rates of poor mental health (McLean et al., 2017). Further research should investigate the relationship between psychosocial factors at schools and mental well-being of teachers and students. In order to respond effectively to students' needs, teachers' psychological support and training are vital. Internal and external guidance departments should play a key role in this labor.

Whole-school mental health promotion programs have demonstrated some efficacy (Kern et al., 2017; O'Reilly et al., 2018). They are probably more cost-effective in settings with high prevalence of mental health issues, and specially for the

prevention of anxiety and depression (Mendelson and Eaton, 2018). These two disorders were found to be most frequent in ALSE compared to VE. ALSE might be an ideal setting to benefit from these programs. An interpretation of the higher prevalence of mental health problems among students attending ALSE could be that students who have mental health issues drop out from the mainstream education and eventually must enroll in ALSE programs. Therefore, mental health hygiene in regular education could also lead to fewer dropouts and, indirectly, fewer students taking the ALSE route because of mental health problems. Larger epidemiological studies on mental health of ALSE students in developed countries are needed for an improved understanding of the needs of ALSE students.

DATA AVAILABILITY STATEMENT

Participant-level data and further information on data acquisition procedure have been uploaded to an online repository (Aznárez-Sanado et al., 2020).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics committee of the University of Navarra. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MA-S and GA analyzed the data and drafted the initial version of the article. All authors designed the study, obtained funding, acquired the data, and contributed to its interpretation and approved the final version.

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A 10-Year Prospective Study of Socio-Professional and Psychological Outcomes in Students From High-Risk Schools Experiencing Academic Difficulty

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Early academic difficulty reduces the probability of pursuing higher education and has consequences for a wide range of personal and socio-professional outcomes. However, the role of academic performance is often difficult to assess independently from school-based influences. This prospective investigation uses a nested high-risk paradigm to examine the role of personal, familial and school-based factors in the prediction of 10-year outcomes. A sample of 131 secondary school students were selected based on scores in the highest or lowest quartiles in national exams, and both groups were selected equally from regular or low-performing schools. Ten years later, 100 of these individuals participated in a follow-up assessment of academic, socio-professional and personal outcomes. Academic difficulty and specific parental professions were strongly associated with a lower probability of pursuing higher education and with a greater likelihood of part-time or minimum-wage employment. No effect was observed for school status and it did not interact with academic performance in predicting the majority of outcomes. Strategies designed to improve individual academic performance and that address familial difficulties should remain priorities for improving long-term outcomes. The lack of influence of school-based characteristics may indicate the efficacy of strategies aimed at reducing inequalities in resources at the institutional level.

Keywords: adolescents, academic performance, outcome, higher education, employment, psychological adjustment

INTRODUCTION

Academic difficulties occurring early in an individual's education can sometimes evolve into a self-perpetuating series of problems that have long-term consequences at both personal and professional levels. Recent prospective investigations have found that math and reading skills assessed as early as kindergarten predicted math and reading performance in the fifth grade (Rabiner et al., 2016), and that reading difficulty among children 7–8 years old increased by four-fold the risk of secondary school non-completion (Smart et al., 2017). Other longitudinal studies have found that prior academic performance is the single strongest predictor of high school grades (McCarty et al., 2008; Casillas et al., 2012) and a recent meta-analysis of 46 effect sizes from studies including

a total of 34,724 students demonstrated that academic success or difficulty in high school is strongly predictive of performance at the university level (Schneider and Preckel, 2017). These consistent findings suggest that difficulties at any phase of education have important consequences for performance at the subsequent phase, from kindergarten through higher education. Added to the persistence of these difficulties over time are the negative consequences outside of academia, as several decades of research have documented the diverse consequences of poor academic performance on socio-professional integration as well as on physical and psychological health (Becker, 1962; Mirowsky and Ross, 2003; Hussenet and Santana, 2004; Lucio et al., 2012; Sörberg Wallin et al., 2018, 2019). While these associations are complex and implicate a large diversity of risk factors, there is clear international consensus that combatting academic difficulty is both a social and economic priority (American Public Health Association, 2010; Organisation for Economic Co-Operation and Development [OECD], 2010).

The strategies applied to reduce academic difficulty early in the educational trajectory have traditionally involved either individual-specific approaches such as tutoring, special classes and other educational interventions, or broader approaches that address inequalities at the institutional level. Although student-specific strategies have demonstrated positive, albeit variable, effects on academic performance and retention (Cohen et al., 1982; Bowman-Perrott et al., 2013; Steenbergen-Hu and Cooper, 2014; Warmbold-Brann et al., 2017), few of these interventions address the frequent sources of social disadvantage that have been shown to predict school performance across all stages of education (Rabiner et al., 2016). These factors notably include family based characteristics such as parental occupation and income, as well as single-parent or migrant family status which not only affect household income but also the resources necessary to provide home-based educational support (Sirin, 2005; Chiu, 2007; Goodman et al., 2010; Najimi et al., 2013; Chittleborough et al., 2014; Camara-Costa et al., 2016; Nonoyama-Tarumi, 2017; Hagan et al., 2018). An important additional consideration is the fact that these different sources of social disadvantage are not randomly distributed in the general population, but rather they are often concentrated within schools, school districts or specific geographic communities (Massey et al., 1991; Jargowsky, 2006; De Langea et al., 2014; Meade, 2014). For this reason, a principal objective of institutional-level strategies is to reduce systemic inequalities and thereby combat academic difficulties for all disadvantaged students (Chittleborough et al., 2014; Jury et al., 2017; Bayless et al., 2018).

Similar to interventions with individual students, school-based approaches appear to have a positive but variable impact on improving academic performance (Farrell et al., 2010; Wilson and Tanner-Smith, 2013; Hahn et al., 2015; Stipek and Chiatovich, 2017; Ruiz et al., 2018). However, long-term outcomes of students with low academic performance have often been difficult to characterize independently from the consequences or benefits of school-based characteristics. For this reason, the present investigation identified secondary school students manifesting academic difficulty or achievement based on their performance on national exams for the core subjects of language and

mathematics, and then selected both groups equally from schools with or without a record of poor academic performance (Salamon et al., 2011). Recruited students were then contacted a decade later relative to their pursuit of higher education or employment, as well as concerning their personal living conditions and psychological status. These 10-year outcomes are examined in this investigation as a function of the main effects of baseline academic performance and school type, as well as by family and psychological characteristics. In addition, the interaction of academic performance with school type is examined in order to identify those individuals at potentially highest risk for negative outcomes due to the accumulation of risk factors at both the individual and institutional levels.

MATERIALS AND METHODS

Participants

Between 2005 and 2007, 131 junior high school students experiencing academic difficulty ($n = 65$) or success ($n = 66$) participated in the baseline phase of this study. The age of this original sample was 11.44 years (SD = 0.62) and 54% were females. The two academic performance groups did not differ by sex, $X^2(1) = 0.61$, $p > 0.05$, but those in academic difficulty were older, $t(129) = 3.91$, $p < 0.01$, and more likely to be behind in their schooling relative to their age $X^2(1) = 37.82$, $p < 0.01$. Starting in 2017, 104 participants from the original sample were recontacted for the present study, and 100 accepted to participate (average follow-up duration 11.26 years, SD = 0.84, range 10–13 years; average participant age = 23.25 years, SD = 0.93, range 21–26 years).

Procedure

The procedures for baseline recruitment are described elsewhere (Salamon et al., 2011). In summary, 10 junior high schools in the Bordeaux region of France were selected according to their classification by the French Department of Education as either a regular school ($n = 5$) or as an education priority school ($n = 5$). The official texts defining "Zone d'Education Prioritaire" (Education Priority Zone) status were published in 1981, and specify that its aim is to combat social inequality through reinforced educative actions in schools where both academic and social difficulties are concentrated (Saramon, 2002). Schools obtaining this status must have academic results for their students that are below the national average as well as have students from families experiencing greater socio-economic difficulty than the national average (Bongrand and Rochex, 2016; Stéfanou, 2018). These criteria changed in 2015 (Stéfanou, 2017), after the present sample left the secondary education system. Education priority schools receive additional financial resources and teaching personnel, as well as increased decisional autonomy to obtain academic objectives (Stéfanou, 2018). This study was conducted in full compliance with the World Medical Association's Declaration of Helsinki. Written informed consent was acquired from both the students as well as their parents before study enrollment, and the study was approved by the regional school district as well as by the French national board

for the rights of research participants and data protection (Commission Nationale de l'Informatique et des Libertés).

Within each type of school, two groups of eligible participants were selected based on academic performance. An "academic difficulty" group was constituted based on scores in the lowest 25% on national examinations in both French and mathematics, and an "academic success" group based on scores in the highest 25% in both of these subjects. From these eligible pools of students within each school, individuals were then selected at random until relatively equal numbers of students were selected in each group at each school. These selected participants completed a baseline battery of paper-based sociodemographic and clinical measures. Follow-up measures were administered approximately 10 years later through a telephone interview and a web-based sociodemographic and clinical battery.

Sociodemographic Measures (Baseline Assessment Only)

Diverse individual characteristics were assessed at baseline, including age, sex, advanced or late in academic year relative to age, dual versus single-parent household and, for mothers and/or fathers, profession, place of birth (France or other country), and native language (French or other language).

Clinical Measures (Baseline and Follow-Up Assessments)

Baseline depression levels were assessed using the French version of the 27-item Children's Depression Inventory (CDI); (Kovacs and Beck, 1977; Moor and Mack, 1982). The CDI evaluates depressive symptoms (sad mood, anhedonia, and items specific to academic and social domains) on a three-point scale, and has internal consistencies of 0.86 for the original instrument and 0.82 in the present sample. At follow-up, depression levels were assessed by the 21-item Beck Depression Inventory (BDI); (Beck et al., 1961; Bourque and Beaudette, 1982). The BDI evaluates diverse emotional, behavioral and cognitive symptoms of depression in adults on four-point scales, and has internal consistencies of 0.86 for the original instrument and 0.88 in the present sample. Baseline anxiety was measured by the State-Trait Anxiety Inventory (STAI) for Children, a 20-item measure developed to assess anxiety in elementary school children using four-point scales (STAI; Spielberger, 1973; Vila et al., 1999), and its adult version (Schweitzer and Paulhan, 1990) was used at follow-up. The STAI has strong psychometric qualities and internal consistencies for trait anxiety (state anxiety was not assessed in this study) of 0.90 for either the original child or adult versions (0.84 and 0.92, respectively, in the current sample). Self-esteem was assessed at both baseline and follow-up by the 10-item French version of the Rosenberg Self-Esteem Scale (Rosenberg, 1965; Vallières and Vallerand, 1990; GrayLittle et al., 1997; Yarcheski et al., 2003). These items evaluate general self-esteem on four-point scales, and internal consistencies reported for the original instrument were 0.87 in adolescents and 0.88 in young adults. For the present sample, internal consistencies for this instrument were 0.76 at baseline (adolescents) and 0.87 at follow-up (adults).

Socio-Professional Outcomes (Follow-Up Assessment Only)

Professional and education outcomes included mutually exclusive categories of education status (current enrollment, year of study, and highest diploma obtained), occupational status (unemployed, apprentice or intern, and full or part-time employed), and living conditions (living alone, with parents or relatives, with partner or spouse, or with roommates).

Statistical Analyses

Linear and logistic regression analyses were used in the prediction of continuous or dichotomous outcomes, respectively. The principal predictor variable in these analyses was either baseline academic status (difficulty or success), or type of school (normal or education priority), adjusted for age and sex. All outcomes variables were those assessed at the 10-year follow-up only. A power analyses demonstrated that the final sample size of 100 individuals provided above 0.80 power for detecting small to medium effects ($f^2 = 0.12$) with three predictors (age, sex, and either academic status or type of school) at $p < 0.05$. All analyses were conducted using SPSS version 23.

RESULTS

From the original baseline sample of 131 junior high school students, 104 were located and contacted 10 years later. One hundred of these individuals agreed to participate in the second wave of the survey (**Table 1**). Contact information could not be found for 27 persons, or 87% of the 31 non-participating individuals. A significantly greater proportion (81%) of non-participants were in the academic difficulty group at baseline $X^2(1) = 15.64$, $p < 0.001$. These individuals were significantly less likely to have either a mother or father in higher-level professions, $X^2(1) = 6.75$, $p < 0.05$, and more likely to have foreign-born parents $X^2(1) = 4.54$, $p < 0.05$. At baseline, these individuals also reported significantly higher depressive symptomatology, $t(129) = 2.33$, $p < 0.05$.

For the participating sample ($n = 100$), follow-up outcomes were first examined by baseline academic status (**Table 2**). Individuals in academic difficulty (versus achievement) were more likely to have a socio-professional status other than pursuing higher education (OR = 12.82, 95% CI = 4.58–35.87; Nagelkerke $R^2 = 0.37$, $\chi^2 = 32.66$, $p < 0.001$; 78.0% correct classification). They were also more likely to already be in the workforce (OR = 4.28, 95% CI = 1.74–10.53; Nagelkerke $R^2 = 0.17$, $\chi^2 = 13.20$, $p < 0.01$; 69.0% correct classification). Of the 31 employed individuals who were not pursuing higher education, the nature of employment most frequently involved unskilled and semi-skilled work or service-oriented positions (84%). Fourteen of these individuals (44% of the working sample) were employed on a part-time basis only, with an average gross income of 1066 euros. Individuals employed full-time ($n = 17$) earned 1550 euros on average, with 44% earning minimum wage. Among all participants who did pursue higher education, those who experienced academic difficulty at baseline were less advanced

TABLE 1 | Baseline characteristics of participants recontacted and non-recontacted at 10 years.

Baseline variable	Recontacted (*n* = 100)			Non-recontacted (*n* = 31)			*p*
Academic difficulty	40%			81%			0.001
Education priority school	42%			58%			ns
Behind for age	19%			32%			ns
In advance for age	7%			0%			ns
Familial characteristics							
Single parent household	23%			32%			ns
Higher profession (father)	39%			19%			ns
Higher profession (mother)	39%			16%			0.028
Parental birth place	89%			73%			0.042
Parental maternal language	89%			77%			ns
	M	**SD**	**%**	**M**	**SD**	**%**	*p*
Sociodemographic characteristics							
Age	11.42	0.61		11.52	0.68		ns
Sex (% female)			56%			48%	ns
Psychological characteristics							
Anxiety	31.89	6.70		32.65	6.46		ns
Depression	8.21	5.61		11.01	6.58		0.021
Self-esteem	31.98	4.31		30.41	5.00		ns

Academic difficulty = students with performance levels in the lowest 25% on national exams for both French and mathematics (compared to students in the highest 25% for both subjects); Education priority school = schools characterized by average student academic performance that is significantly lower than the national average (compared to regular schools).

TABLE 2 | Baseline academic difficulty (versus academic success) as a predictor of 10-year outcomes (*n* = 100).

10-year outcome	*B*	SE	OR	*T*	*p*
Education/professional status					
Current university studies	−2.551	0.525	12.819		0.000
Apprentice or trainee	−0.115	0.945	0.891		ns
Paid employment	1.454	0.459	4.281		0.002
Non-employment	−1.520	0.866	0.219		ns
Housing status					
Living alone	−0.103	0.594	0.902		ns
Living with family	0.639	0.443	1.895		ns
Living with partner	0.640	0.552	1.896		ns
Living with friends/roommates	1.734	0.685	0.177		0.011
Psychological characteristics					
Depression	0.450	1.433		0.314	ns
Anxiety	1.166	2.267		0.514	ns
Self-esteem	−0.548	0.941		−0.582	ns

Academic difficulty = students with performance levels in the lowest 25% on national exams for both French and mathematics (compared to students in the highest 25% for both subjects).

in their attainment of degrees, $X^2(1) = 8.96$, $p < 0.05$. However, no significant association of baseline academic difficulty was observed relative to anxiety or depression symptomatology, or self-esteem levels. **Figure 1** provides a visual summary of these findings for a selection of primary outcomes.

Ten-year outcomes were then examined as a function of the type of schools in which students were enrolled (regular schools, or education priority schools benefiting from additional resources due to lower academic success rates). As demonstrated by **Table 3**, school status had no main effect relative to any of the follow-up outcomes in the socio-professional, housing, or psychological domains. When the interaction of levels of academic status with types of school was examined, again no association was found for follow-up outcomes with the exception that living with a spouse or partner was concentrated in majority among individuals who were in both academic difficulty and education priority schools at baseline (OR = 24.49, 95% CI = 1.81–332.05; Nagelkerke $R^2 = 0.24$, $\chi^2 = 15.78$, $p < 0.01$, 81.0% correct classification).

FIGURE 1 | Academic difficulty or success in adolescence as a predictor of selected 10-year socio-professional and psychological outcomes. **$p < 0.01$ and ***$p < 0.001$.
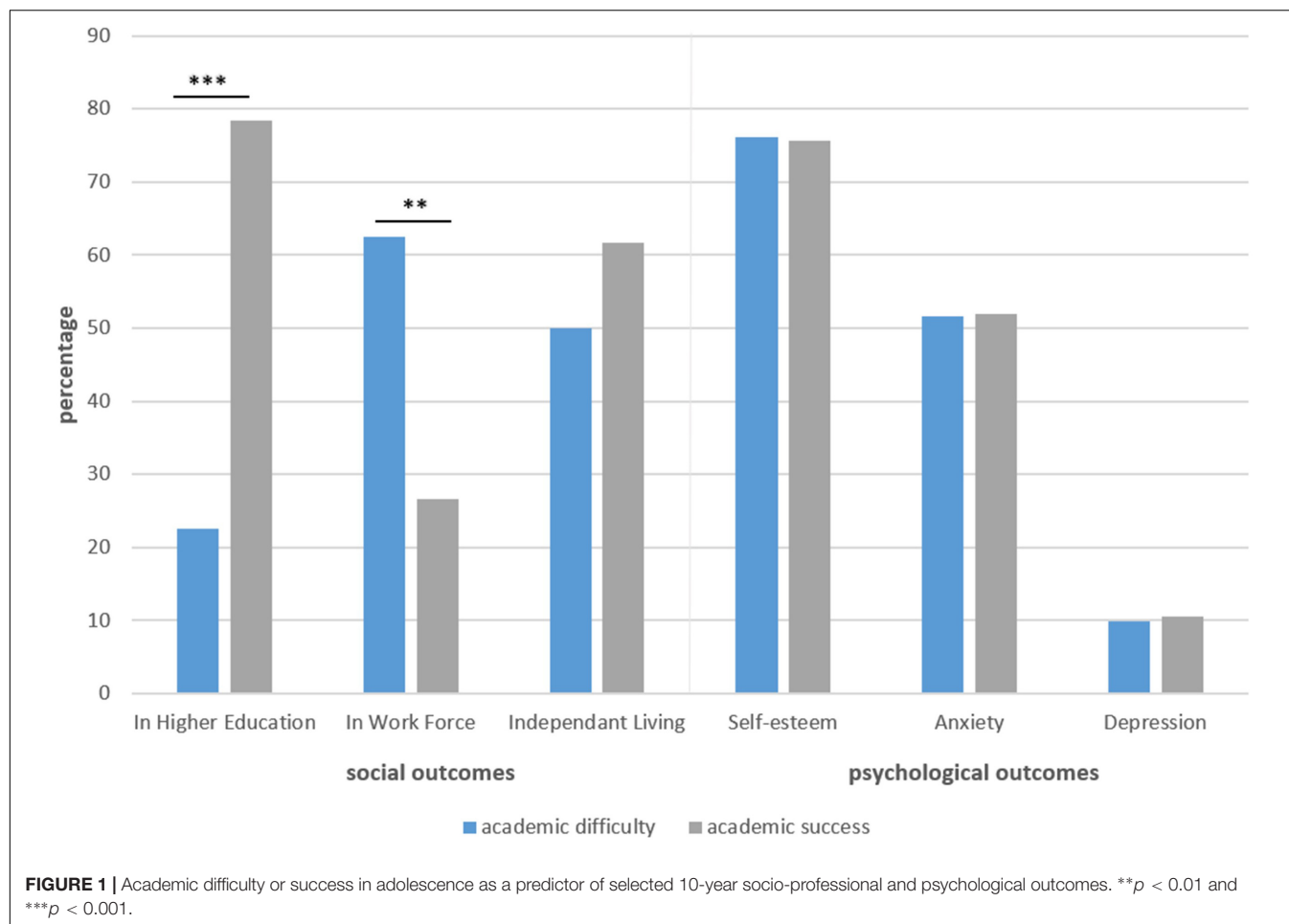
TABLE 3 | Baseline education priority school (versus standard school) as a predictor of 10-year outcomes ($n = 100$).

10-year outcome	B	SE	OR	T	p
Education/professional status					
Current university studies	0.721	0.427	2.057		ns
Apprentice or trainee	−0.503	0.911	0.605		ns
Paid employment	0.405	0.423	1.500		ns
Non-employment	0.196	0.765	1.216		ns
Housing status					
Living alone	0.295	0.413	1.344		ns
Living with family	−0.933	0.622	0.393		ns
Living with partner	1.061	0.556	2.888		ns
Living with friends/roommates	−0.628	0.518	0.534		ns
Psychological characteristics					
Depression	0.534	1.357		0.394	ns
Anxiety	2.732	2.132		1.281	ns
Self-esteem	−0.403	0.891		−0.452	ns

Education priority school = schools characterized by average student academic performance that is significantly lower than the national average (compared to regular schools).

In addition to the main effects of personal or school academic status, other baseline variables were examined for their association with 10-year outcomes. The sex of students was unrelated to socio-professional or housing status. However, females reported lower self-esteem at follow-up, $B = −2.75$ $p < 0.01$, as well as higher levels of both anxiety, $B = 5.67$, $p < 0.01$, and depressive symptomatology, $B = 3.40$, $p < 0.05$, than did males. Students who were behind in academic progress

relative to their age at baseline were more likely to have a socio-professional status other than pursuing higher education at follow-up (OR = 7.97, 95% CI = 1.95–32.52; Nagelkerke R^2 = 0.17, χ^2 = 13.55, p < 0.01, 67.0% correct classification), while those having a father in a higher-level profession were more likely to pursue higher education (OR = 5.96, 95% CI = 2.25–15.79. Nagelkerke R^2 = 0.24, χ^2 = 19.32, p < 0.001, 67.7% correct classification) and less likely to be in the workforce (OR = 0.21, 95% CI = 0.83–0.55. Nagelkerke R^2 = 0.18, χ^2 = 14.07, p < 0.01, 65.7% correct classification). Having a mother with a higher-level profession was also associated with increased probability of pursuing higher education (OR = 4.83, CI = 1.91–12.22. Nagelkerke R^2 = 0.20, χ^2 = 16.20, p < 0.001, 67.0% correct classification), as well as with higher self-esteem at follow-up, B = 1.892, p < 0.05. Living in a single-parental family was associated with lower self-esteem, B = −2.114, p < 0.05, but with no other follow-up outcome.

DISCUSSION

Academic difficulty early in the individual's education has important consequences for later academic success as well as for a range of personal outcomes (Pustjens et al., 2004; McCarty et al., 2008; Casillas et al., 2012; Rabiner et al., 2016; Schneider and Preckel, 2017; Smart et al., 2017). While strategies used to combat academic difficulty are often delivered to individual students, other approaches attempt to address inequalities between schools that vary in overall levels of student performance and socioeconomic resources. A higher concentration of social disadvantage relative to parental employment, income or family structure have direct associations with academic difficulty in youth (Rabiner et al., 2016). This study therefore attempted to clarify the role of early academic difficulty separately from school-based characteristics using a nested, behavioral high-risk paradigm. Students in secondary school experiencing either difficulty or mastery of two core academic subjects were selected in approximately equal proportions from schools designated as having either regular or below-average levels of academic achievement. The 10-year outcomes of these individuals were then examined as a function of academic performance and school status, as well as for the interaction of these variables, and relative to several personal or familial characteristics.

A first notable finding concerns the nature of the participating sample at follow-up. Of the initial baseline sample of 131 students, 100 participated in the survey 10 years later. Despite this high acceptance rate, the majority of students (n = 27) who did not participate no longer lived at the same address as when in secondary school and they were not contactable through an exhaustive search of electronic databases and social media. These individuals were also considerably more likely to have been in academic difficulty at the baseline inclusion, as well as to have foreign-born parents who did not have higher-level professions. While the association of migrant status with academic difficulty is inconsistent (Fuligni, 1997; Hagan et al., 2018), families with lower income are at greater risk for such problems (Sirin, 2005; Chiu, 2007; Goodman et al., 2010;

Najimi et al., 2013; Chittleborough et al., 2014; Dietrichson et al., 2017; Hasl et al., 2019). The broader role that socio-economic status plays may be both direct (through determining access to educational resources or materials, and providing means for academic support), or indirect through the lack of integration of parents into the school system where they would normally gain knowledge of its potential resources (Sirin, 2005; Hill and Tyson, 2009; Vellymalay, 2012; Benner et al., 2016; Dietrichson et al., 2017). Targeted interventions through schools that integrate and train parents as educational partners can improve the academic performance of children from even the most disadvantaged socioeconomic backgrounds (Dietrichson et al., 2017). In the present study, students who were not contactable and therefore who did not participate in the follow-up may have been at greatest risk for continued academic difficulty due to the lack of such resources.

Concerning students who participated in the 10-year follow-up, a primary but expected finding was that individuals in academic difficulty as adolescents were far less likely to pursue higher education. Moreover, when they did pursue their education, they were more often behind in their attainment of a diploma or degree relative to other students. Academic difficulty also predicted a greater likelihood of entering the workforce instead of pursuing university education. The nature of this employment most often included unskilled or semi-skilled jobs, and a large minority (44%) were employed only part-time and without pursuit of their education in parallel. As for income, 44% of full-time workers earned the minimum wage and the average income of part-time workers was only 1066 euros. Considering that the French poverty threshold in 2018 was 1026 euros for a single adult (Argouarc'h and Picard, 2018), it is likely that the professional situation of a large majority of these individuals was insufficient to sustain independent living needs. The association of early academic difficulty or school drop-out with the probability of precarious or lower-paying employment is well-documented (Rumberger, 1987; Stillwell, 2009; UK Office for National Statistics, 2011; Rabiner et al., 2016; Smart et al., 2017), leading to fewer socio-economic resources for the individual and potentially to reduced educational opportunities for their own children (Sirin, 2005; Dietrichson et al., 2017). The present findings therefore underscore the need for intensive efforts early in the educational trajectory to address the inter-generational persistence of academic difficulty and social disadvantage.

In contrast to findings for individual academic performance, school status did not appear to influence the pursuit of higher education or other 10-year outcomes. Importantly, only very limited evidence was found for the interaction of school type with academic achievement group. In understanding these findings, it is important to interpret them within the context of the French public school system and relative to national educational policies. In particular, French schools classified as "education priority institutions" receive additional resources from the government, including increased financial support, additional staff to lower teacher-to-student ratios, and increased autonomy in developing strategies for improving academic performance (Stéfanou, 2018). The lack of findings for school type in this context may therefore indicate the potential success of such governmental policies put

into place to address school inequalities and combat academic difficulty at the institutional level. The lack of interaction between school status and individual academic performance indicates that students who are in difficulty or who are succeeding academically in lower-performing schools have no less of a chance of pursuing higher education than if they attended a regular-performing school. While the success of this French policy cannot be fully verified by the present investigation alone, confirmation of its efficacy would provide an important model for overcoming certain sources of educational inequality.

The strengths of this study include its prospective design as well as its application of a high-risk paradigm that nested high or low academic performance groups within high or low risk schools. However, the present findings should be interpreted in light of both conceptual characteristics and methodological limitations. A first consideration is that the non-participation at follow-up of nearly one-fourth of the original sample, individuals who were more often in academic difficulty at baseline, may in fact underestimate the frequency of negative outcomes among students in the high-risk group. The moderate sample size at follow-up may also have hindered the identification of more subtle but important associations between the risk groups and specific socio-professional or personal outcomes. In additional to the strategies used in France to address inequalities between schools, the findings should be interpreted relative to its higher education system that has important differences with other developed countries. A long-standing tradition in France is that all students graduating high school are allowed to enroll in French public universities regardless of prior grades or test scores. Other educational systems may therefore observe even greater disparities between individuals who experience early academic difficulty or success if university enrollment is based on competitive selection criteria. While France has recently adopted reforms for universities that place restraints on the choices of students for certain academic disciplines, these changes were adopted after the present sample participated in the 10-year follow-up. The coming years will clarify if these new reforms exacerbate the negative consequences of early academic

difficulty relative to the pursuit of higher education. Nonetheless, the present findings underscore both the importance of early intervention relative to academic difficulties as well as the need for further prospective research capable of investigating the independent influences of frequently confounded risk factors.

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 study was reviewed and approved by CCPPRB Ethics Review Board, and the Académie de Bordeaux. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RS was solely responsible for the design and conceptualization of the study, for all data collection and analyses, and for manuscript preparation.

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Emotional Intelligence, Empathy, Self-Esteem, and Life Satisfaction in Spanish Adolescents: Regression vs. QCA Models

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Adolescence is a complex period, in which the individual is subject to profound emotional, physical, and psychological changes. Healthy development during adolescence is crucial for future positive development; self-esteem and life satisfaction are fundamental. The importance of sociodemographic variables (sex and age), empathy, and emotional intelligence (EI) on self-esteem and life satisfaction was studied, comparing complementary methodologies, regression models, and fuzzy-set qualitative comparative analysis (fsQCA) models. This is a cross-sectional design in a convenience sample of 991 adolescents (528 females, 53.3%; aged between 12 and 19 years; M = 14.01, SD = 1.40) from Spanish schools. Data were collected using the Rosenberg Self-Esteem Scale (RSES), the Satisfaction With Life Scale (SWLS), the Basic Empathy Scale (BES), and Trait Meta-Mood Scale (TMMS)24. The results of the regression models suggest that cognitive empathy, emotional clarity, and emotional repair are the main predictor variables for self-esteem. Meanwhile, the results of the fsQCA suggest that being older and low levels of cognitive empathy, emotional clarity, and emotional repair predict higher levels of self-esteem. On the other hand, life satisfaction in regression models is significantly predicted by the emotional clarity and emotional repair dimensions of the TMMS24 and self-esteem. Meanwhile, in the prediction of life satisfaction, the results of the fsQCA suggest that the most important interactions were high emotional clarity, emotional repair, and low self-esteem. As research has already shown, promoting empathy and EI leads to higher levels of self-esteem and life satisfaction.

Keywords: adolescent, emotional intelligence, empathy, life satisfaction, qualitative comparative analysis, regression models, self-esteem

INTRODUCTION

Adolescence is a complex period in which the individual is subject to profound emotional, physical, and psychological changes (Fonagy et al., 2004; Bucchianeri et al., 2013; Normandin et al., 2015; Powers and Casey, 2015). It is, therefore, a sensitive period in the development of mental disorders (Ensink et al., 2015; Sharp and Wall, 2017). Healthy development during adolescence is therefore crucial not only in avoiding problems in the adolescent himself but also for his future development

(Huebner et al., 2013). Within positive or healthy development, there appears to be some agreement on the importance of both self-esteem and well-being in general (Alfaro et al., 2015).

In this respect, adequate self-esteem is particularly important since self-esteem influences the way of perceiving and evaluating oneself. It is defined as confidence in oneself, in one's values or abilities (McCrae and Costa, 2012), and is therefore considered a protective factor in adolescence since it contributes to preserving one's biological, psychological, and social well-being (Alvarez Aguirre et al., 2010). High self-esteem is considered vitally important for people's quality of life since it affects the way they value themselves and their relationship with others (John et al., 2010). Healthy self-esteem is considered a protective factor in life and is essential in adolescence, as it influences human motivation and is associated with a wide range of desirable outcomes (Pyszczynski et al., 2004): general psychological adjustment, positive emotion, social confidence, and prosocial behavior among others (Brown and Ryan, 2003; Leary and MacDonald, 2003; Pepping et al., 2013).

Life satisfaction can be considered to be the cognitive component of subjective well-being and is defined as a conscious cognitive judgment of life in which individuals compare their life circumstances with a self-imposed standard (Diener, 2012; Diener et al., 2013). Life satisfaction is closely related to positive personal, psychological, and social outcomes (Özer et al., 2016). Adolescents with high life satisfaction have a better quality of life (Pavot and Diener, 2008), better levels of physical and psychological health (Friedman and Ryff, 2012; Uchino et al., 2016), positive lifestyle habits (Kim et al., 2014), academic success, increased self-confidence, self-efficacy, mental health, and more supportive relationships (Suldo and Huebner, 2006). Self-esteem and satisfaction with life are therefore related concepts (Judge and Bono, 2001; Frederick et al., 2016; Wichstrom and von Soest, 2016) that appear to affect the individual's physical and mental health (Sowislo and Orth, 2013). Individuals who feel good about who they are likely make positive evaluations about their life in overall terms (Thomaes et al., 2017). Both concepts seem to be quite stable over time (Anusic and Schimmack, 2016), so intervention to improve them could ensure a healthier present and future development among both children and adults. Life satisfaction has also been consistently positively associated with self-esteem (Proctor et al., 2009).

According to the literature, both concepts seem to be influenced by emotional aspects (Proctor et al., 2009). Within the emotional variables, emotional intelligence (EI) and empathy are particularly important and influential in many aspects of the life of individuals (Kong et al., 2014; Özer et al., 2016). EI is defined as the ability to recognize, express, understand, and regulate one's own emotions and those of others to improve personal growth and quality of life in social relationships (Mayer et al., 2001) or as a measure of a person's needs, self-awareness capacities, social awareness, and social skills (Goleman et al., 2002). Previous studies have shown how EI relates positively to different measures of psychological well-being and negatively to affective disorders such as anxiety and depression (Zeidner et al., 2012). Likewise, various studies suggest that EI is negatively

related to depression and maladaptive coping styles and positively related to social relationships between peer competition and adaptive coping styles (Palmer et al., 2002; Petrides et al., 2006; Mavroveli et al., 2007). Meanwhile, empathy is considered as a multidimensional construction that implies affective and cognitive responses to another person (Jolliffe and Farrington, 2006; Van der Graaff et al., 2018). Affective empathy includes the right emotional response, while cognitive empathy refers to understanding the other person's state of mind. Empathy in adolescents has been associated with self-esteem and positive social behaviors (Findlay et al., 2006). Despite the importance of these emotional aspects in the self-esteem and well-being of individuals, the literature is scarce, particularly relating to adolescence, and including both components in the same study. In summary, previous research points to a relationship of emotional variables: EI and empathy with self-esteem and life satisfaction in adolescence. Moreover, life satisfaction has also been consistently positively associated with self-esteem. These relationships suggest the following hypotheses: *H1: Higher empathy and EI will predict higher levels of self-esteem. H2: Higher empathy, EI, and self-esteem will predict higher levels of life satisfaction.*

Along with these aspects, the literature suggests that sociodemographic aspects such as age and sex could influence both self-esteem and satisfaction with life. There are studies that indicate differences in levels of empathy according to the sex variable; girls had higher levels in the affective component while there were no differences in the cognitive component according to sex variable (Lafferty, 2004). In addition, other studies (Goldbeck et al., 2007; Salmela-Aro and Tuominen-Soini, 2010; Moksnes and Espnes, 2013) present gender differences for life satisfaction and self-esteem, indicating that males obtain better results for both life satisfaction and self-esteem than females. Moksnes and Espnes (2013) found that self-esteem plays a positive role in the association with adolescent life satisfaction, and this relationship is equally robust for both genders and across ages (Moksnes and Espnes, 2013). The aforementioned shows gender differences for life satisfaction and self-esteem; this relationship is not affected by age, which suggests the following hypotheses: *H3: Males obtain better results for both life satisfaction and self-esteem than females. H4: Self-esteem and life satisfaction are not influenced by age.*

Despite the importance of sociodemographic and emotional aspects in the health of individuals, understood as a combination of self-esteem and satisfaction with life, we were unable to find any study that considers both emotional and demographic aspects simultaneously. This study focuses not only on sociodemographic variables but also EI and empathy on self-esteem. In addition, it involves all these variables on life satisfaction and incorporates two types of methodology. Most of the studies on adolescents have focused on linear models (Vecchio et al., 2007; Çivitci and Çivitci, 2009; Moksnes and Espnes, 2013; Huang and Su, 2014; Chen et al., 2017), ignoring the interactions and the way in which different paths could lead to the same result, which could be evaluated using qualitative comparative analysis (QCA) models (Blackman et al., 2011). These two methodologies are complementary (Ragin, 2008;

Eng and Woodside, 2012). Linear regression models indicate the individual contribution of each variable, while the QCA model is based on the combination of variables, considering equifinality, i.e., the different paths that lead to the same results (Ragin, 2008).

The objective of this study was, therefore, to identify the importance of sociodemographic variables (sex and age), empathy, and EI on the psychological health of adolescents (self-esteem and satisfaction with life), comparing complementary methodologies, regression models, and fuzzy-set qualitative comparative analysis (fsQCA) models.

METHODS

Participants

A convenience sample of 991 adolescents (528 females, 53.3%, and 463 males, 46.7%) aged between 12 and 19 years (M = 14.01, SD = 1.40) was recruited from Spanish schools from the Valencian Community. The majority were in the first (28.4%) or second (27.4%) year of Compulsory Secondary Education, 19.9% were in the third year, and 19.9% in the fourth year; 2.7% were in the first year of high school and 1.5% in the second year of high school. This study respected the fundamental principles of the Declaration of Helsinki (World Medical Association, 2013), with particular emphasis on the anonymization of the data collected, and confidentiality and non-discrimination of participants. After the schools in the Valencian Community had been selected, they were contacted and the project was outlined to them, and then sessions were organized with the psychologist who wanted to participate. The assessment was performed after receiving authorization from both parents of the underage students and the older students themselves. In order to ensure anonymity, the schools that participated voluntarily were given the total number of questionnaires requested according to the number of students that voluntarily agreed to participate, and sealed boxes where the questionnaire could be deposited thereby guarantee the participating subjects' anonymity. The evaluation was carried out by the psychologist in the classrooms, collectively and during school hours. The participants completed the self-reported questionnaires, which took around 40 min.

Measures

- Sociodemographic variables of the adolescents and their age, sex, and school year group were registered.
- Self-esteem was measured using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989). This contains 10 items, rated on a 5-point Likert scale from 1 (*strongly agree*) to 5 (*strongly disagree*). The items are divided into two factors: positive self-esteem and negative self-esteem. Sample items from this scale are "I feel that I have a number of good qualities" (positive) "At times, I think I am no good at all" (negative). Higher scores indicate higher self-esteem. The scale showed adequate psychometric properties in the original version (α = 0.89) and previous studies [α = 0.87, Huang et al. (2019), and α = 0.89, Schwinn et al. (2019)], which is also observed in this study (α = 0.81).

- Life satisfaction was assessed using the Satisfaction With Life Scale (SWLS; Diener et al., 1985). It contains five items and a 7-point Likert scale format, from 1 (*strongly disagree*) to 7 (*strongly agree*). A sample item from this scale is "In most ways, my life is close to my ideal." Higher values indicate greater satisfaction. It had adequate psychometric properties in the original version (α = 0.87) and previous studies [α = 0.71, Bendayan et al. (2013), and α = 0.80, Miller et al. (2019)], which is also observed in this study (α = 0.78).

- *Empathy* was assessed using the Basic Empathy Scale (BES; Jolliffe and Farrington, 2006), which was translated and adapted into Spanish for adolescents (Villadangos et al., 2016). It is composed of 20 items and uses a 5-point Likert scale answer format, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The items are divided into two subcategories: Cognitive Empathy, or the ability to rationally understand the emotions of others, and Emotional Empathy, or the ability to have an emotional response similar to that of others. Sample items from this scale are "I get caught up in other people's feelings easily" (affective) and "I can often understand how people are feeling even before they tell me" (cognitive). A high score indicates a high level of empathy. The instrument has shown adequate internal consistency in the original version (α = 0.79 cognitive empathy; α = 0.85 affective empathy) and previous studies (α = 0.96 cognitive empathy; α = 0.92 affective empathy) (Villadangos et al., 2016). In the present study, internal consistency was a Cronbach alpha of 0.68 for both dimensions of the scale.

- *EI* was evaluated from the perspective of emotional processing using the Trait Meta-Mood Scale (TMMS)24. It is a reduced version of the TMMS48 (Fernandez-Berrocal et al., 2004) and assesses each person's understanding of his or her emotional states (Inglés et al., 2017) using 24 items with a 5-point Likert scale with anchors of 1 (*do not agree at all*) and 5 (*agree completely*). They are organized into three factors of eight items each: (i) Attention, or the ability to realize one's own feelings and those of others; (ii) Clarity, or the ability to perceive emotions as well as the cause of emotions; and (iii) Repair, or the ability to regulate one's own and others' emotions. Examples of these items are "I pay a lot of attention to my feelings" (attention), "I am usually very clear about my feelings" (clarity), and "Although I am sometimes sad, I have a mostly optimistic outlook" (repair). A high score indicates a high level of EI. All three scales have shown adequate psychometric properties in the original version (all Cronbach alphas were above 0.85) and previous studies. Specifically, emotional attention presented a Cronbach's α ≥ 0.91. Emotional clarity showed a Cronbach's α ≥ 0.84. Finally, for emotional repair, Cronbach's α ≥ 0.86 was observed (Gomez-Baya et al., 2016). Another study showed satisfactory internal consistency α = 0.85 for emotional attention, α = 0.81 for emotional clarity, and α = 0.82 for emotional repair (Inglés et al., 2017). In this study, reliability was α = 0.85 for

attention, α = 0.83 for emotional clarity, and α = 0.78 for emotional repair.

Statistical Analyses

Statistical analysis was carried out using hierarchical regression models and fsQCA models. In the case of hierarchical regression models, three steps were considered for the prediction of self-esteem: sociodemographic variables (sex and age) (step 1), the two dimensions of the BES questionnaire (step 2), and the three dimensions of the TMMS24 (step 3). For the SWLS prediction, and as suggested by the literature, one more step was added to the overall self-esteem using the RSES (step 4). For the calculation of fsQCA prior to the calculation of the necessary and sufficiency analyses, the missing data were eliminated, and the variables were recalibrated with values between 0 (without having the characteristic, completely out of the set, low values) and 1 (having the characteristic, completely in the set, high values). For sex, 0 = man and 1 = woman were assigned.

QCA models identify the percentage of variance explained, or cases where the model is applicable, coverage, as well as indicators of goodness of fit and consistency (Ragin, 2008; Eng and Woodside, 2012). A condition is considered necessary in QCA models when it must always be present for a given result, and its consistency is ≥0.90 (Ragin, 2008). A condition is considered sufficient when the consistency is around or above 0.75 (Eng and Woodside, 2012); it does not always have to be present for a given result and implies a combination of conditions that can lead to a particular result. The values of each variable were subsequently recalibrated with the fsQCA 2.5 software (Claude and Christopher, 2014). To perform this calibration, the three thresholds suggested by the literature (Woodside, 2013) are used: the first (0) considers that observation with this value is totally outside the set (under agreement/value, low level) of the 10% percentile; the second (0.5) considers a midpoint, neither inside nor outside the set (an intermediate level of agreement/value, intermediate level) 50%; and the last value (1) considers that the observation is totally inside the set (high level of agreement/value, high level) 90% percentile (Ragin, 2008; Giménez-Espert and Prado-Gascó, 2018). Necessary and sufficient condition tests were used to evaluate the effect of sociodemographic variables (sex and age), empathy, and EI on the psychological health of individuals (self-esteem and satisfaction with life). The identification of sufficient fsQCA conditions is done through an algorithm that calculates the truth table and then generates three possible solutions: complex, parsimonious, and intermediate (Eng and Woodside, 2012). The intermediate solution is the one recommended in the literature (Ragin, 2008), and it is shown here.

QCA models have advantages. They analyze the logical relationships between associate conditions and an outcome, providing more detailed results (Ragin, 2008; Eng and Woodside, 2012). They do not establish linear relationships. They allow to identify combinations of multiple causes. This means that the conditions that lead adolescents to have a high tolerance for diversity will not necessarily be the same (in the opposite direction) as those that lead to a low tolerance for diversity.

The IBM SPSS Statistics version 24.0 software package (IBM Corp, 2016) was used to calculate the hierarchical regression model (HRM) and calibration values, and the fsQCA 2.5 software package (Claude and Christopher, 2014) was used to calculate fsQCA models.

RESULTS

Descriptive Statistics and Calibration Values

The main descriptors and calibration values for the variables studied in fsQCA are shown in **Table 1**. The different calibration values were calculated by multiplying the items in each dimension of the instruments in order to maximize the variance (Ragin, 2008).

Hierarchical Regression Models

A predictive analysis of the effect of both sociodemographic variables, empathy, and EI on self-esteem and sociodemographic variables, empathy, EI, and self-esteem on the life satisfaction of adolescents was then carried out using hierarchical regression according to the objectives of the study. On the effect of sociodemographic variables, empathy, and EI on self-esteem, the criterion variable was the self-esteem, and the predictor variables were sociodemographic variables (sex and age) and the dimensions of the BES and TMMS24. Three differential steps were established: the sociodemographic variables (sex and age) were included in the first step, the two dimensions of the BES questionnaire were included in the second step, and the three dimensions of TMMS24 were included in the last step.

When evaluating the effect of sociodemographic variables, empathy, EI, and self-esteem on the life satisfaction of adolescents, the criterion variable was the life satisfaction of adolescents and the predictor variables were sociodemographic variables (sex and age), dimensions of the BES, TMMS24, and global self-esteem according to RSES. Four differential steps were established. Sociodemographic variables (sex and age) were included in the first step, the two dimensions of the BES questionnaire were included in the second step, the three dimensions of TMMS24 were included in the third step, and global self-esteem was included in the last step.

When evaluating the effect of sociodemographic variables (sex and age), empathy and EI accounted for 25% of self-esteem ($R^2_{adjusted} = 0.25$, $p \leq 0.001$), and the effect of sociodemographic variables (sex and age), empathy, EI, and self-esteem explained 36% of life satisfaction ($R^2_{adjusted} = 0.36$, $p \leq 0.001$) (**Table 2**).

According to the self-esteem that can be found in **Table 2**, in the first step, the sociodemographic variables significantly increased the variance by 1% ($\Delta R^2 = 0.01$, $p \leq 0.01$) including the dimensions of the BES scale, accounting for 3% of the variance ($\Delta R^2 = 0.03$, $p \leq 0.001$), and accounting for 21% of the variance ($\Delta R^2 = 0.21$, $p \leq 0.001$) with the addition of the TMMS24 variables. In this last step, sex (β = 0.01, $p \leq 0.05$) and emotional attention (β = 0.07, $p \leq 0.05$) showed statistically significant and positive beta coefficients for self-esteem. On the

TABLE 1 | Main descriptions and calibration values.

| | Age | SWLS | RSES | BES | | TMMS24 | | |
				CE	EE	EA	EC	ER
M	14.05	947.56	64,216.95	360,926.71	2,068,338.13	67,646.21	46,816.65	62,161.83
SD	1.41	993.13	476,602.33	442,076.87	4,314,398.33	165,099.19	81,638.78	120,205.57
Min	12	1	1	9	3	1	1	1
Max	19	12,900	9,765,625	360,926.71	39,062,500	4,296,875	619,200	2,484,375
Calibration values								
P10	12	40	4	19,200	10,368	450	288	360
P50	14	625	400	187,500	468,750	20,480	13,824	18,432
P90	16	2,500	51,712	1,000,000	6,000,000	200,000	128,000	187,500

M, mean; SD, standard deviation; Min, minimum; Max, maximum; P10, 10th percentile; P50, 50th percentile; P90, 90th percentile; SWLS, satisfaction with life; RSES, Rosenberg Self-Esteem Scale; BES, Basic Empathy Scale; TMMS24, Trait Emotional Meta-Mood Scale; CE, cognitive empathy; EE, emotional empathy; EA, emotional attention; EC, emotional clarity; ER, emotional reparation.

TABLE 2 | Hierarchical regressions for the dimensions of BES, TMMS24, RSES, and SWLS.

| Variable | RSES | | SWLS | |
Predictors	ΔR^2	β	ΔR^2	β
Step 1	0.01**		0.00	
Sex		0.02		−0.05
Age		0.10**		−0.04
Step 2	0.03***		0.04***	
Sex		0.01		−0.04
Age		0.13***		−0.10
Emotional empathy		−0.01		0.10**
Cognitive empathy		−0.18***		0.14***
Step 3	0.21***		0.19***	
Sex		0.01*		−0.04
Age		0.06		−0.04
Emotional empathy		0.02		0.06
Cognitive empathy		−0.09**		0.05
Emotional attention		0.07*		−0.05
Emotional clarity		−0.25***		0.24***
Emotional repair		−0.34***		0.31***
Step 4		–	0.14***	
Sex		–		−0.03
Age		–		−0.01
Emotional empathy		–		0.07
Cognitive empathy		–		0.02
Emotional attention		–		−0.02
Emotional clarity		–		0.14***
Emotional repair		–		0.17***
RSES		–		−0.43***
Total $R^2_{adjusted}$	0.25***	–	0.36***	

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001; –, do not calculate according to the theoretical model. SWLS, satisfaction with life; RSES, Rosenberg Self-Esteem Scale; BES, Basic Empathy Scale; TMMS24, Trait Emotional Meta-Mood Scale.

other hand, cognitive empathy (β = −0.09, $p \leq 0.01$), emotional clarity (β = −0.25, $p \leq 0.001$), and emotional repair (β = −0.34, $p \leq 0.001$) showed statistically significant and negative beta coefficients for self-esteem.

For life satisfaction shown in **Table 2**, in the first step, sociodemographic variables did not increase variance, including the dimensions of the BES scale, and accounted for 4% of the variance ($\Delta R^2 = 0.04$, $p \leq 0.001$), including the TMMS24 variables, which explained 19% of the variance ($\Delta R^2 = 0.19$ $p \leq 0.001$) and explaining 14% of the variance ($\Delta R^2 = 0.14$, $p \leq 0.001$) with the addition of self-esteem. In this last step, emotional clarity (β = 0.24, $p \leq 0.001$) and emotional repair (β = 0.31, $p \leq 0.001$) showed statistically significant and positive beta coefficients for life satisfaction. On the other hand, self-esteem (β = -0.43, $p \leq 0.001$) showed statistically significant and negative beta coefficients for life satisfaction among adolescents.

Fuzzy-Set Qualitative Comparative Analysis

Necessary Conditions

Table 3 shows the test of necessary conditions, none of the associate conditions can be considered necessary for high or low levels of self-esteem and life satisfaction since the consistency is below 0.90 (Ragin, 2008).

Sufficient Conditions

Table 4 shows the models resulting from the sufficiency analyses, with consistency around or above 0.75 being a sufficient condition (Eng and Woodside, 2012).

In the prediction of self-esteem of the adolescents, nine paths were observed that explained 41% of the cases with high levels of self-esteem (Overall Consistency = 0.73; Overall Coverage = 0.41). The most relevant path or combination for predicting high levels of self-esteem (explaining 21% of cases) was the result of the interaction of being older, with high attention to emotions, low cognitive empathy, and low emotional clarity and emotional repair (Raw Coverage = 0.27; Consistency = 0.81). However, in the prediction of low levels of self-esteem in the adolescents, 17 paths were observed that explained 68% of the cases (Overall Consistency = 0.83; Overall Coverage = 0.68). Meanwhile, the most relevant path or combination for predicting low levels of self-esteem (explaining 29% of cases) was the

TABLE 3 | Necessity analysis for RSES and SWLS.

	RSES		~RSES		SWLS		~SWLS	
	Cons	Cov	Cons	Cov	Cons	Cov	Cons	Cov
Girl	0.57	0.41	0.51	0.59	0.53	0.48	0.54	0.54
Boy	0.43	0.36	0.49	0.64	0.47	0.47	0.46	0.53
Age	0.65	0.51	0.57	0.71	0.59	0.55	0.62	0.68
~Age	0.63	0.49	0.61	0.73	0.66	0.60	0.59	0.62
Cognitive empathy	0.54	0.47	0.56	0.76	0.62	0.63	0.52	0.61
~Cognitive empathy	0.72	0.52	0.61	0.68	0.62	0.53	0.69	0.68
Emotional empathy	0.57	0.52	0.51	0.73	0.59	0.63	0.50	0.63
~Emotional empathy	0.70	0.50	0.66	0.71	0.66	0.53	0.71	0.67
Emotional attention	0.56	0.51	0.52	0.73	0.58	0.61	0.51	0.63
~Emotional attention	0.70	0.48	0.65	0.70	0.65	0.53	0.69	0.65
Emotional clarity	0.46	0.41	0.59	0.83	0.66	0.70	0.45	0.55
~Emotional clarity	0.81	0.56	0.58	0.62	0.57	0.47	0.76	0.72
Emotional repair	0.46	0.41	0.59	0.83	0.67	0.71	0.44	0.55
~Emotional repair	0.81	0.56	0.58	0.62	0.57	0.47	0.76	0.73
RSES	–	–	–	–	0.36	0.43	0.61	0.85
~RSES	–	–	–	–	0.87	0.66	0.58	0.51

RSES, Rosenberg Self-Esteem Scale; SWLS, Satisfaction with the life; Cons, consistency; Cov, coverage; ~, absence of condition (low levels). Condition needed: consistency ≥0.90;– do not calculate according to the theoretical model.

TABLE 4 | Summary of the three main sufficient conditions for the intermediate solution for RSES and SWLS.

Frequency cutoff: 1	RSES			~RSES			SWLS			~SWLS		
	Consistency cutoff: 0.80			Consistency cutoff: 0.88			Consistency cutoff: 0.88			Consistency cutoff: 0.90		
	1	2	3	1	2	3	1	2	3	1	2	3
Girl												
Older	●	●	●		○	○						
CE	○											
EE		●	●			○		●				
EA	●	●	●		○				●		●	
EC	○	○	○	●	●		●		●	●		○
ER	○	○	○	●		●	●	●	●			○
RSES							○	○		●	●	●
Raw coverage	0.27	0.25	0.23	0.42	0.29	0.28	0.48	0.41	0.38	0.52	0.45	0.41
Unique coverage	0.04	0.03	0.01	0.03	0.02	0.00	0.04	0.02	0.01	0.01	0.01	0.00
Consistency	0.81	0.81	0.80	0.89	0.89	0.90	0.84	0.86	0.85	0.89	0.89	0.92
Overall solution consistency		**0.73**			**0.83**			**0.77**			**0.86**	
Overall solution coverage		**0.41**			**0.68**			**0.70**			**0.66**	

●, presence of condition; ○, absence of condition (low levels); ~, absence of condition (low levels); CE, cognitive empathy; EE, emotional empathy; EA, emotional attention; EC, emotional clarity; ER, emotional repair; RSES, Rosenberg Self-Esteem Scale; SWLS, Satisfaction With The Life. Expected address vector for RSES: 1,0,1,1,0,1,1 (0: absent; 1: present) using format (Fiss, 2011). Expected address vector for ~RSES: 1,1,0,0,1,0,0 (0: absent; 1: present). Expected address vector for SWLS: 0,1,1,1,0,1,1,1 (0: absent; 1: present) using format (Fiss, 2011). Expected address vector for ~SWLS: 1,1,0,0,1,0,0,0 (0: absent; 1: present). Terms/values in bold, type information on the model as a whole considering all the conditions, not only the most important.

result of the interaction of high emotional clarity, being younger, and low emotional attention (Raw Coverage = 0.29; Consistency = 0.89).

Furthermore, in the prediction of high levels of life satisfaction for the adolescents, 16 paths were examined that explained 70% of the cases with high levels of life satisfaction (Overall Consistency = 0.77; Overall Coverage = 0.70). The most relevant

path or combination for predicting high levels of life satisfaction (accounting for 48% of cases) was the result of the interaction of high emotional clarity and emotional repair and low self-esteem (Raw Coverage = 0.48; Consistency = 0.84). Finally, in the prediction of low levels of life satisfaction in the adolescents, 11 paths were observed that explained 66% of the cases (Overall Consistency = 0.86; Overall Coverage = 0.66). Meanwhile, the

most relevant path or combination for predicting low levels of life satisfaction (explaining 52% of cases) was the result of the interaction of high emotional clarity and self-esteem (Raw Coverage = 0.52; Consistency = 0.89).

DISCUSSION

This study extends the research on self-esteem and life satisfaction in adolescence by exploring the importance of sociodemographic variables, empathy, and EI on self-esteem, as well as sociodemographic variables, empathy, EI, and self-esteem on life satisfaction. It compares complementary methodologies, regression models, and fsQCA models.

In general, based on the obtained results, hypothesis one (higher empathy and EI will predict higher levels of self- esteem) can be accepted in the regression model and partially in the fsQCA model. The regression models suggest that sex, cognitive empathy on the BES, and the dimensions of the TMMS24 (emotional attention, emotional clarity, and emotional repair) are significant predictors of self-esteem, as reported in previous studies supporting the influence of emotional skills (empathy and EI), where it was found to be significantly associated with prosocial behaviors, and more positive beliefs about the self (Oberle et al., 2010). The most predictive variable was EI, accounting for 21% of variance explained. In line with the literature, EI has been associated with positive self-esteem and academic, social, and psychological outcomes in adolescence (Di Fabio and Saklofske, 2014; Perera and DiGiacomo, 2015). The most important interactions in predicting self-esteem in sufficiency analyses in the fsQCA, explaining 21% of the cases, were being older, high emotional attention, low cognitive empathy, and low emotional clarity and emotional repair. These results may show that in later adolescence, the cognitive component of empathy, as well as emotional clarity and regulation, plays a less relevant role. These findings can be considered the first step because our study and others show the weak correlations that are usually reported between demographic variables (sex and age), self-esteem, and subjective well-being (Proctor et al., 2009). It highlights the need for future theories and research.

Regarding hypothesis two, higher empathy, EI, and self-esteem will predict higher levels of life satisfaction and can be accepted in the regression model and partially in the fsQCA model. Life satisfaction in the regression model is significantly predicted by the emotional clarity and emotional repair dimensions of the TMMS24 and self-esteem, as shown in the literature, and various environmental variables, sociodemographic variables, and intrapersonal variables such as self-esteem have been recognized as being associated with adolescents' life satisfaction (Proctor et al., 2009). The most predictable variable again is EI, which explained 19% of the variance. EI influences adaptation to deal with social problems and interpersonal conflicts. Reducing negative emotions, increasing positive ones, and improving emotional regulation promote positive relationships with others, providing positive

self-esteem and satisfaction with life (Zeidner and Olnick-Shemesh, 2010; Friedman and Kern, 2014). Meanwhile, in the prediction of life satisfaction, the most important interactions were high emotional clarity and emotional repair and low self-esteem in the fsQCA. These results show the importance of EI, the ability to understand and regulate emotions, and its impact on life satisfaction (Perera and DiGiacomo, 2015; Di Fabio and Kenny, 2016).

No conditions necessary for predicting self-esteem and life satisfaction were observed in the fsQCA. With regard to the third and fourth hypotheses, sex and age on self-esteem and life satisfaction, our results are less conclusive. In regression models, sociodemographic variables increase the variance 1% or nothing. In fsQCA models, age is a condition in predicting high levels of self-esteem. As in other studies, sociodemographic variables are weak predictors (Huebner et al., 2004, 2005), environmental variables are moderate predictors, and intrapersonal variables such as self-esteem are strong predictors (Boden et al., 2008; Deng et al., 2015, 2016; Chen et al., 2017). In general, the results of both methodologies (regression and fsQCA models) indicate emotional variables, empathy, and EI are strong predictors on self-esteem, and all these variables are strong predictors on life satisfaction. When comparing both methodologies, fsQCA models seem to have a higher predictive value than the HRM, and there are variables such as age that appear in the fsQCA and not in the HRM. This is important from the perspective of intervention since some conditions are susceptible to intervention, such as the improvement of emotional skills, self-esteem, and life satisfaction. Adequate self-esteem is associated with life satisfaction (Brown and Ryan, 2003; Leary and MacDonald, 2003; Pepping et al., 2013). EI and empathy encourage prosocial behaviors (Inglés et al., 2014) and are associated with better social relationships (Batanova and Loukas, 2011; Gázquez et al., 2015; Van der Graaff et al., 2018), better mental health (Gomez-Baya et al., 2016), and life satisfaction (Zeidner et al., 2012). In short, promoting empathy and EI, especially focusing on emotional clarity and emotional regulation, in adolescents leads to higher levels of self-esteem and life satisfaction.

In conclusion, this study was an attempt to explore the relationships between empathy, EI, self-esteem, and life satisfaction in a sample of Valencian adolescents. One of the strengths of this study was the comparison of two types of complementary methodologies in predicting self-esteem and life satisfaction of adolescents; fsQCA models involve a greater number of factors than regression models. However, it is not exempt from limitations that will be considered in future research. The type of sampling, not probabilistic, and the inclusion of subjects from only one geographical area make it difficult to generalize the results. Another limitation of this study is the use of self-report for data collection as it may introduce social desirability biases (Dalton and Ortegren, 2011). Despite the limitations of the study, our results show how EI in general and especially emotional clarity and emotional repair and cognitive empathy predict self-esteem in adolescents. In other words, the

ability to perceive emotions as well as the cause of emotions and the ability to regulate one's own and others' emotions, as well as the ability to understand the other person's state of mind, predict adolescent self-esteem. In addition, self-esteem and EI, especially emotional clarity and emotional repair, are closely related to positive personal, psychological, and social outcomes and life satisfaction.

This study has implications for theoretical and empirical research of self-esteem related to life satisfaction by identifying conditions, variables, or combinations, such as emotional skills, that appear to have a positive impact on them. The high levels of self-esteem and life satisfaction are psychological resources that promote healthy adaptation in adolescence. Therefore, these results constitute the first step for intervention programs in adolescents' emotional skills, which in turn will have a direct and positive impact on their self-esteem and life satisfaction, as well as on positive functioning in adolescence.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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ETHICS STATEMENT

AUTHOR CONTRIBUTIONS

MG, DN-M, MG-E, and VP-G made substantial contribution to the concept or design of the work or acquisition, analysis, or interpretation of data; drafted the article or revised it critically for important intellectual content; and participated sufficiently in the work to take public responsibility for appropriate portions of the content. All authors contributed to the article and approved the submitted version.

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Illness Perception in Adolescent Patients With Anorexia: Does It Play a Role *in socio*-Emotional and Academic Adjustment?

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People's beliefs about their illness have been shown to affect their adjustment. The aim of this study was to describe illness perception in adolescent patients with anorexia nervosa (AN) and assess its relationship with socio-emotional and academic adjustment following Leventhal's Self-Regulation Model. Thirty-four female AN patients, with a mean age of 15.76 (SD = 2.00), completed the Revised Illness Perception Questionnaire (IPQ-R), the Psychosocial Adjustment to Illness Scale (PAIS) and the Hospital Anxiety and Depression Scale (HAD). Adolescent anorexia patients perceived that they had control over their illness and treatment would improve their condition. However, they also believed that it was highly distressing, going to last a long time and would have serious consequences. As for the causes of the disorder, they were attributed primarily to a specific eating disorder and psychological factors. The results showed that anorexia patients' illness perceptions were related to socio-emotional and academic adjustment. In this sense, identity with the illness was associated with a worse academic adjustment, while emotional representation was associated with a worse emotional and social adjustment. These findings highlight how important it is for patients' beliefs about their disease to be considered in the treatment of anorexia. In this respect, clinicians treating these patients should consider how certain beliefs affect their academic and socio-emotional adjustment. It would be interesting for patients to become aware of how these beliefs influence the strategies they use to cope with their disease as well as their adjustment to it.

Keywords: anorexia nervosa, adolescents, illness perception, socio-emotional adjustment, academic adjustment

INTRODUCTION

Anorexia nervosa (AN) is a chronic and complex mental illness with serious physical and social consequences (Patel et al., 2016). Its prevalence ranges between 4 and 6% for women and under 1% in the case of men (DSM-5, American Psychiatric Association, 2013; Ward et al., 2019). It is characterized by a high resistance to treatment with serious family and social repercussions, including the highest mortality rate of any psychiatric illness (López and Treasure, 2011; Ward et al., 2019). Young women make up the majority of people with AN, with an average illness duration of about 6 years (Schmidt et al., 2016).

Anorexia nervosa is diagnostically defined by abnormal eating behavior and distorted attitudes toward body weight and shape (DSM-5). It has a high impact on patients' quality of life, affecting their physical and psychological health as well as having important consequences for their academic and social functioning (Treasure et al., 2015).

Data suggest that AN is associated with atypical social and emotional functioning (Harrison et al., 2010; Patel et al., 2016). In this sense, negative social experiences (such as derogatory comments, negative feedback, and pressure) can be stressors that trigger the disease (Hutchinson and Rapee, 2007; Quiles et al., 2013), and during its most acute phase, patients can experience isolation and loneliness (Levine, 2012). It is also known that socio-communicative difficulties are maintaining factors for these patients (Patel et al., 2016; Schmidt and Treasure, 2006). Recently, Cardi et al. (2018) identified three specific factors that might be involved in the onset and maintenance of AN: fear of negative evaluation, perceived lack of social competence and early experiences of submissiveness.

Academic performance is another important trigger in AN patients. Although reported premorbid characteristics for these patients include high levels of academic performance and extreme perfectionism, when the illness becomes entrenched, cognitive decline and impaired concentration can accompany starvation and depression (Maxwell et al., 2011). This impaired neurocognitive functioning present in AN patients (Weider et al., 2015; Kucharska et al., 2019) leads to difficulties in different neuropsychological capacities, such as attention, working memory, long-term learning, autobiographical memory, processing speed, problem solving, or information processing (Oltra et al., 2012). Data suggests that this could be a consequence of the illness per se or could arise from intensified underlying traits for AN (Lang et al., 2016). On the one hand, the personal self-demand that characterizes these patients is associated with high pressure to obtain excellent academic results; and on the other hand, if patients identify themselves as "AN patients" their performance also worsens. However, academic performance can be affected by school stress too (Espíndola and Blay, 2009).

Cognitive difficulties are not the only factor that could influence academic performance (Yanover and Thompson, 2008), discrepancies between actual and ideal self-perceptions, what the patient would really like to be and how they really feel, are also a core symptom. These differences are related to poor school grades, low self-esteem and depressive symptoms (Ferguson et al., 2010). In fact, individuals with AN report that the social and psychological consequences of the disorder are more important than physical ones (Dovydaitiene and Maslauskiene, 2013). Thus, during the recovery process, it is important to consider the extent to which patients consider that the disease hinders their daily functioning (Tchanturia et al., 2012).

There is scarce research on illness perception with respect to AN (Jansen, 2016). It is perceived as a chronic illness with strong negative consequences (Holliday et al., 2005), and AN patients typically have a high number of symptoms that are difficult to control, cure, and understand. These perceptions are very important because patients with a strong belief in treatment control are more likely to report a better

psychological adjustment and appear to have better academic performance, family relationships, and global adjustment (Quiles et al., 2007a). It is therefore apparent that illness perception is related to treatment outcomes, which can interfere with recovery. Moreover, AN is often seen as linked to an individual's identity and difficult to give up (Higbed and Fox, 2010), and patients tend to perceive their illness as chronic and difficult to be treated. This perception of chronicity and severity is related to the impression that the eating disorder is untreatable (Stockford et al., 2007). Apart from this, illness perception also affects family and social relationships.

The aim of this study was to describe illness perception in adolescent AN patients and assess its relationship with socio-emotional and academic adjustment following Leventhal's Self-Regulation Model (Leventhal et al., 1984, 1997, 2003). This is a very useful model to understand the way that AN patients understand and cope to the illness. It hypothesizes that individuals create mental representations of illness based on five dimensions (illness identity, timeline, consequences, causes, and controllability/curability).

MATERIALS AND METHODS

Participants

A total of 34 female AN nervosa outpatients attending a specialized unit for eating disorders were recruited. Patients have a primary DSM-IV diagnosis of AN (restrictive type = 30; purging type = 4). Participants' age ranged from 12 to 19 (Mean = 15.76 years, SD = 2.00). The patients had a mean illness duration of 25.82 months (SD = 18.62), and they were receiving psychological and nutritional treatment.

Variables and Instruments
Sociodemographic and Clinical Characteristics
Patients' sociodemographic data and clinical characteristics were collected through the completion of an *ad hoc* questionnaire. This sought information concerning ages and relevant clinical data for the study (diagnosis and history of the problem).

Illness Perception
Patients' perceptions of eating disorder were assessed using the specific eating disorders dimension from the Spanish version (Quiles et al., 2007b) of the Revised Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002). This questionnaire measures participants' illness beliefs in eight dimensions: identity, timeline (individual's beliefs about the course of the illness), consequences, cause, cyclical timeline, control, cure, and emotional representations. It is divided into three sections: the identity and causal dimensions are presented in two separate sections, while the remaining dimensions are presented together in one section. The cause subscale consists of four components: *psychological cause*, *ED specified cause*, *risk cause,* and *external cause*. The internal consistency for the subscales in the Spanish version of this questionnaire range from $\alpha = 0.55$ to $\alpha = 0.85$. For this study, McDonald's omega for the

subscales ranged from ω = 0.62 (cyclical timeline subscale) to ω = 0.86 (identity subscale).

Psychosocial Adaptation

The PAIS (Psychosocial Adjustment to Illness Scale, Derogatis, 1986) was used to assess adjustment to illness. The PAIS comprises 45 items, each of which contains four statements scored on a 4-point scale ranging from 0 (no problem) to 3 (many difficulties). Higher scores indicate more difficulties. The scale is designed to provide information on global adjustment as well as adjustment in specific areas. In this study, we have assessed these areas: educational and social adjustment, family relationships and psychological distress. The Spanish version of this questionnaire has adequate psychometric properties (from α = 0.70 to α = 0.90) (Neipp, 2005; Portillo et al., 2019). For this study, McDonald's omega ranged from ω = 0.74 (educational adjustment) to ω = 0.91 (social adjustment).

Anxiety and Depression

The HAD (Hospital Anxiety and Depression Scale; Zigmond and Snaith, 1983) is a 14-item scale that assesses anxiety and depression, requiring answers on a 4-point scale. In this questionnaire, patients rate the degree to which they have experienced these symptoms over the previous week. The internal consistency, calculated with the Cronbach's alpha coefficient for the Spanish version was 0.80 in the anxiety subscale and 0.76 in the depression subscale (Terol et al., 2007). For this study, McDonald's omega for the subscales was ω = 0.73 and ω = 0.86, respectively.

Procedure

Patients were recruited from the Eating Disorder Unit of a public Hospital in the province of Alicante (Spain). Patients were included in the study if they were outpatients. Exclusion criteria were: borderline personality disorder, psychosis, current alcohol, substance dependence, or serious medical condition. This information was provided by the Eating Disorder Unit. These patients were handed information about the study during their treatment sessions. All patients and their relatives gave written informed consent for participation. Patients were interviewed in the Eating Disorder Unit by a qualified health psychologist after one of their treatment sessions.

Data Analysis

A cross-sectional design was used for this study. Data were analyzed using IBM SPSS v.25. to obtain frequencies and data descriptions for mean and minimum and maximum standard deviation. A one-way ANOVA was carried out to determine the differences in illness perception scores according to illness duration. For relation analysis, we used the Pearson correlation coefficient, and a stepwise multiple regression procedure was conducted to examine the relation between illness perception and socio-emotional and academic adjustment. Prior to the analysis, the assumptions of normality, homoscedasticity and independence were tested. The three assumptions were met.

RESULTS

Illness Perception

Identity Subscale

Illness identity refers to statements regarding beliefs about the illness label and the link with symptoms. The mean for symptoms experienced by the patients was 6.85 (SD = 2.94). The two most frequently experienced symptoms were "weight loss" (94.1%) and "irregularities in menstruation" (88.2%). The two least frequently experienced symptoms were "wheeziness," "sore eyes" and "stiff joints." Results for this subscale are given in **Table 1**.

Consequences, Control, Cure, Timeline, Emotional Representation and Cyclical Timeline Subscales

Illness perception of the sample is described in **Table 2**. The mean scores for these dimensions would suggest that these patients' perception of their illness is that it was highly distressing, they had control over it, it was going to last a long time, and it had serious consequences. A one-way ANOVA comparing illness perception according to illness duration revealed that AN patients with a shorter average illness duration (≤ 1 year), perceived their illness with less serious consequences ($M = 10$; SD = 3.36) than patients with a longer illness duration (≥ 2 years) ($M = 12.5$; SD = 1.67) ($F = 4.06$, $p < 0.05$).

Causal Subscale

These patients showed higher scores in "specified ED factor" ($M = 23.52$; SD = 6.35) and "psychological factor" ($M = 20.26$; SD = 6.19). By contrast, the lowest scores were in "external cause

TABLE 1 | Identity subscale: frequency of experienced symptoms.

	N	%
1. Pain	19	55.9
2. Sore throat	11	32.4
3. Nausea	12	35.3
4. Breathlessness	9	26.5
5. Dry and rough skin	26	76.5
6. Irregularities in menstruation	30	88.2
7. Weight loss	32	94.1
8. Fatigue	20	58.8
9. Stiff joints	7	20.6
10. Sore eyes	7	20.6
11. Wheeziness	3	8.8
12. Headache	17	50
13. Upset stomach	27	79.4
14. Sleep difficulties	15	44.1
15. Dizziness	18	52.9
16. Loss of strength	23	67.6

TABLE 2 | Means and standard deviations of illness perception dimensions.

Dimension	Range/mean point	*M*	SD
Timeline	3–15 (9)	16.58	6
Control	5–25 (15)	24.85	3.08
Cure	5–25 (15)	19.94	3.08
Consequences	3–15 (9)	10.88	2.66
Cyclical timeline	3–15 (9)	9	2.94
Emotional representation	5–25 (15)	22.7	5.44

factor" ($M = 6$; SD = 2.65) and in "risk factor" ($M = 12.61$; SD = 4). The factors that were most frequently identified as the cause of anorexia were low self-esteem and own behavior, followed by the need to be perfect, while the least frequently identified factors were alcohol, germen or virus and smoking. A one-way ANOVA comparing the type of causes to which they attributed their illness according to illness duration revealed that AN patients with the shortest average illness duration (≤ 6 months), attributed their disease to causes of the specific ED factor to a lesser extent ($M = 18.00$; SD = 6.00) than the group with the longest evolution time (≥ 4 years) ($M = 28.8$; SD = 5.8) ($F = 3.85$, $p < 0.05$).

Relationships Between Illness Perception and Socio-Emotional and Academic Adjustment

The Pearson correlation analyses showed that "identity" was associated with psychological distress ($r = 0.48$, $p < 0.01$), academic adjustment ($r = 0.51$, $p < 0.01$), family relationships ($r = 0.45$, $p < 0.01$), anxiety ($r = 0.40$, $p < 0.05$), and depression ($r = 0.36$, $p < 0.05$). Emotional representation was associated with psychological distress ($r = 0.68$, $p < 0.001$), anxiety ($r = 0.50$, $p < 0.01$), depression ($r = 0.54$, $p < 0.01$), family relationships ($r = 0.43$, $p < 0.05$), and with social ($r = 0.36$, $p < 0.05$) and academic ($r = 0.38$, $p < 0.05$) adjustment.

The timeline dimension was associated with psychological distress ($r = 0.42$, $p < 0.01$) and anxiety ($r = 0.36$, $p < 0.05$). ED specified causes were associated with family relationships ($r = 0.38$, $p < 0.05$) and with anxiety ($r = 0.39$, $p < 0.05$).

The results of the regression analyses are shown in **Table 3**.

"Emotional representation" was the most significant illness perception dimension related to emotional adjustment. It contributed to 25% of the variance in anxiety, 29% in depression, and 47% in psychological distress.

With respect to academic adjustment, "identity" contributed to 24% of the variance, while "emotional representation"

TABLE 3 | Stepwise multiple regression analyses: the relation between illness perception and socio-emotional and academic adjustment.

Dependent variables /predictors	R^2/r	Change R^2	F	β
Emotional adjustment				
Anxiety/emotional representation	0.25/0.5	0.25	10.96*	0.50*
Depression/emotional representation	0.29/0.53	0.29	13.17**	0.54**
Psychological distress/emotional representation	0.50/0.70	0.47	18.06***	0.68***
Personal control		0.06		−0.25*
Academic and social adjustment				
Academic adjustment/identity	0.24/0.48	0.26	11.42*	0.51*
Family relationships/identity	0.18/0.42	0.20	8.38*	0.45**
Social adjustment/emotional representation	0.10/0.31	0.12	4.70*	0.36*

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

explained 10% of the variance, which was the same as in social adjustment.

DISCUSSION

Illness perception in adolescent AN patients may not coincide with the clinical conception of this disorder, and their understanding of this illness and its causes, consequences, duration, and treatment effectiveness may significantly influence their recovery process. The results of this study showed that adolescent AN patients reported experiencing a moderate number of physical symptoms and believed that they had control over their disease and that the treatment was effective for their recovery. However, they also believed that their illness was going to last a long time and that it had serious consequences. The most commonly reported causes were attributed to the "specified ED factor" (refers to items that have been identified in research as core causes related to the onset of EDs) and "psychological factor," such as low self-esteem and the need to be perfect. AN patients with longer duration of the illness perceived more physical and psychological complications.

This research has shown that AN patients' illness perceptions are related to socio-emotional and academic adjustment. One area of concern is the extent to which negative emotional responses to AN negatively influence patients' socio-emotional adjustment. These results are in line with Leventhal's Self-Regulation Model, which asserts that emotional representation is a determining factor in an individual's emotional response to their disease (Leventhal et al., 1980). In this context, high levels of illness-related distress (emotional representation) are associated with anxiety, depression, psychological distress and worse social functioning. Thus, these unpleasant emotions will affect patients' social adjustment and therefore deteriorate their social relations. If an individual is afraid and insecure or perceives any situation as a threat or danger, it is difficult for them to relate to others, and consequently, these feelings can lead to social isolation, which is a key maintaining factor of the disorder (Kan and Treasure, 2019; Meneguzzo et al., 2020).

Illness identity or the tendency to attribute symptoms to AN was associated with academic adjustment, since these symptoms can become a signal to patients that their AN is active or progressing, leading to anxiety (Leventhal et al., 2003). Literature has shown that high levels of anxiety reduce learning efficiency by decreasing attention, concentration and retention, with the consequent deterioration in school performance (Van Ameringen et al., 2003; Visu-Petra et al., 2014; Respondek et al., 2017). For this reason, it is very important to treat anxiety that comes from identifying symptoms because decreased school performance negatively affects marks as well as adolescent students' self-esteem (Nguyen et al., 2019).

This study highlights that illness perception is a key factor to be considered and one that should be included in the treatment of anorexia. In this sense, interventions designed to address illness perception can improve adjustment in these patients. Despite the importance of patients' beliefs as well as their views of their symptoms and illness, they are not fully discussed in consultations. The results of the psychological treatment of AN

may improve if the therapist addresses patients' perceptions of identity and the emotional state of these patients.

Clinicians supporting adolescent AN patients' adjustment should consider that some illness beliefs are associated with their academic and socio-emotional adjustment. It would be interesting for these patients to become aware of how these beliefs influence the strategies they use to cope with their disease as well as their adjustment to it.

This research has produced clear findings, but a number of limitations need to be considered, as sample size and the low reliability of some subscales, as cyclical timeline subscale of the IPQ-R. The results of the study might be influenced by the fact that at the time of the study all patients were in outpatient treatment. Therefore, it is likely that the results cannot be generalized to other patient samples. This was a cross-sectional study, so it would be important to carry out a longitudinal study to find out how illness perception changes in response to experience with one's illness.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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A Meta-Analysis of the Relationship Between Emotional Intelligence and Academic Performance in Secondary Education: A Multi-Stream Comparison

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This study was a quantitative meta-analysis of empirical research on the relationship between emotional intelligence (EI) and academic performance (AP) that included the three main theoretical models of EI. We conducted a computerized literature search in the main electronic databases. Forty-four of an initial 3,210 articles met the inclusion criteria. With 49 effect sizes and a cumulative sample size of 19,861 participants, we found significant heterogeneity indices indicating a variety of results. In general, the results of this study indicated a significant effect of EI on AP ($\overline{Z} = 0.26$). Average association between EI and AP was higher in studies measured EI as ability ($\overline{Z} = 0.31$), than studies measured EI as self-report ($\overline{Z} = 0.24$), and self-report mixed EI ($\overline{Z} = 0.26$). In the educational field, this meta-analysis provides information on the specific role of EI as a function of used measures. Some practical implications are discussed.

Keywords: emotional intelligence, academic performance, secondary education, meta-analysis, instruments

INTRODUCTION

In the educational field, academic performance (AP) is the construct that has been studied most. Teaching, learning, and all the cognitive factors related to AP have been widely examined (Pellitteri and Smith, 2007). Recently, one of the most analyzed research lines concerns the influence of personality factors and personal skills on achievement of AP (Poropat, 2009; MacCann et al., 2019). In the last 20 years, a large portion of research has been guided by a recent theoretical focus on emotional abilities, specifically emotional intelligence (EI), which has been viewed as a key component of the factors that influence well-being as well as adaptive processes in specific contexts (Zeidner et al., 2012). Several reviews showed the relevance of EI as a personal resource associated with health outcomes (Martins et al., 2010), well-being (Sánchez-Álvarez et al., 2016), and even task performance (Miao et al., 2017). Likewise, literature reviews focused on analyzing the role of EI in AP have been published (Perera and DiGiacomo, 2013; MacCann et al., 2019). These studies showed significant effects of EI in predicting AP after controlling the effects of

intelligence and personality traits. In addition, EI has emerged as a strong predictor in secondary education.

Academic Performance

Academic success or performance by students in educational centers is a key goal in the development of all educational programs. AP has been commonly measured through continuous exams or evaluations, with a general consensus about the most important aspects to evaluate, such as skills, and declarative and procedural knowledge (Ward et al., 1996). Although there is no common agreement for the evaluation of AP, measures of cognitive skills or declarative knowledge are the main factors evaluated (Perera and DiGiacomo, 2013), and the most commonly used indicators to measure AP are usually: Grade Performance Academic (GPA), Achievement Test (AT), Grade Average (GA), Academic Achievement (AA), Standard Assessment Test (SAT), and Teacher Ratings Academic (TRA) (Perera and DiGiacomo, 2013).

Recent empirical research in education regarding predictors of AP has focussed on intelligence, IQ, or personal cognitive abilities. This research movement has accumulated an extensive research literature on the measurement of cognitive intelligence (Ritchie and Tucker-Drob, 2018). Moreover, there are other personal skills that differ from traditional cognitive intelligence that could affect academic success (Furnham et al., 2009). Currently, there are several lines of research that analyse individual non-cognitive factors that increase the prediction of AP, which requires broader educational models that integrate personal and contextual factors (Gutman and Schoon, 2013). Other non-cognitive skills include attitude, motivation, personality traits, self-regulation, resilience, and social and emotional skills, which are beyond the academic skills that determine successful performance (Bowles and Gintis, 2007). Likewise, personal factors such as motivation and emotional self-regulation in the classroom are associated with school performance, that is, students who are more motivated and have greater skill to manage emotions to obtain higher academic qualifications (Pintrich and de Groot, 1990). Currently, an increasing number of studies have examined the role of emotional skills such as EI in AP.

Emotional Intelligence

Since the EI concept was first introduced in the scientific literature by Salovey and Mayer (1990), different EI models have been developed. Based on the measurement methods used, the different theoretical conceptions of EI can be grouped into three main streams: (stream 1) Mayer and Salovey (1997) four branch ability model of EI, which defines ability EI as having four components, including the capacity to perceive, value, and express emotions accurately; the ability to access and generate feelings that facilitate thinking; the ability to understand emotions and emotional awareness; and the ability to regulate emotions and promote emotional and intellectual growth; (stream 2) cognitive emotional abilities three-branch self-perception model of Salovey and Mayer (1990), self-report EI proposes the existence of a continuous reflexive process associated with one's mood; (stream 3) cognitive emotional

competences and other non-cognitive features like personal skills, motivation, and social aspects is conceived how EI mixed model (Goleman, 1995; Mayer and Salovey, 1997; Petrides et al., 2004a; Bar-On, 2006).

The ability EI stream (stream 1), also defined as EI-performance, is the conception of EI that seems to have the most similarity to AP, because EI is measured by exercises and problems to assess emotional ability, just as exams are used to measure AP in schools. On the other hand, because ability EI is assessed in a similar way to AP, students with higher levels of EI-performance could better manage stress related to exams, resulting in better AP (Brackett and Salovey, 2006). At the same time, students with inadequate or poor emotional skills will have school maladjustment, interpersonal problems that affect their anxiety (Rivers et al., 2012), and/or a lack of social support from their peers that affects their AP (Mestre et al., 2006). The instruments developed to assess ability EI, the Mayer, Salovey, and Caruso Emotional Intelligence Test (MSCEIT) (Mayer et al., 2002) and the Multifactor Emotional Intelligence Scale (MEIS) (Mayer et al., 1999), have objective criteria for correct and wrong answers.

The self-report EI stream (stream 2), based on self-perception of one's emotional skills, assesses a person's subjective emotional abilities. This means that each individual indicates their level of EI according to their previous experiences and their level of self-esteem, including the mood in which they find themselves when completing the EI self-report scale (Davies et al., 1998). This type of measure is usually related to well-established personality factors such as neuroticism, extraversion, agreeableness, openness, and psychoticism, and this connection can yield false correlations with performance and academic achievement (Gannon and Ranzijn, 2005). Representative self-report EI instruments include the Wong and Law Emotional Intelligence Scale (WLEIS) (Wong and Law, 2002), Trait Meta-Mood Scale (TMMS) (Salovey and Mayer, 1990), Schutte Emotional Intelligence Scale (SEIS) (Schutte et al., 1998; Saklofske and Zeidner, 2006), and Swinburne University Emotional Intelligence Test (SUEIT) (Palmer and Stough, 2001).

In the mixed EI stream (stream 3), the integration of different personal and social skills leads to overlapping effects with other factors that may influence AP. When evaluating personality variables, cognitive skills, and social-emotional traits together, one obtains a profile that may be more associated with the different skills that are implemented in an academic context. Therefore, students with better social-emotional traits, with high cognitive abilities (Shen and Comrey, 1997), and adaptive personality trait variables achieve better test scores (Pulford and Sohal, 2006; Poropat, 2009). Therefore, students with better adaptation to the school context will obtain better scores in AP than students with profiles less oriented toward academic adaptation. Representative measures of mixed EI include the Emotional Quotient Inventory (EQi) (Bar-On, 1997), Trait Emotional Intelligence Questionnaire (TEIQ) (Petrides, 2009), and Emotion Identification Skills (EIS) (Ciarrochi et al., 2008).

Each of the three main streams has contributed to research linking EI and AP, with heterogenous results, despite being evaluated with instruments developed under the same theoretical

conceptions of EI. It is not surprising that EI is conceived from several theoretical approaches. A possible cause of the lack of consensus on the results may be the multitude of instruments to evaluate EI from the different theoretical approaches.

Theoretical Linkages Between Emotional Intelligence and Academic Performance

The EI literature has shown that individuals with a higher capacity to process information typically perform better on cognitive tasks (Saklofske et al., 2012). Interpersonal and intrapersonal skills are of great importance in secondary education, since it is a period that involves many social, contextual, and personal changes and stresses. During adolescence, the peer group is of great relevance to adolescents' emotional development and identity formation (Duncan et al., 2006; Eccles and Roeser, 2009), with immediate contexts such as the school environment being one of the most relevant (Monreal and Guitart, 2012). In this sense, the events and early experiences lived in the different contexts, the reactions and responses of adolescents to the different situations of risk and stress throughout their development, as well as the existence of resource vulnerability protection, are relevant and important to understanding individual differences between young people (Monreal and Guitart, 2012). Greater emotional regulation and a better process of adaptability are useful to cope with academic stress and achieve academic success (Saklofske et al., 2012). Interestingly, emotional perceptive people appear to be more strongly impacted by stress than their less perceptive counterparts, expressing higher levels of psychological distress (Ciarrochi et al., 2002). It is hypothesized that low perceptive people might ignore thoughts of daily hassles and therefore might be more likely to be confused about the experienced negative feelings showing less coherence between their levels of perceived stress and psychological maladjustment. Thus, people with high EI are more resilient, adapting more easily to changes, reacting better under stress conditions, and coping with difficulties in the form of challenges (Schneider et al., 2013). Finally, students with a better management of their emotions are happier and have better social relationships (Eryilmaz, 2011). In turn, having better interpersonal management is generally associated with higher social networks, as well as better friendships quality (Brackett et al., 2005). Similarly, having a greater social network in a classroom might stimulate an adequate social environment for better cooperative work, better group learning, greater support from classmates (Hogan et al., 2010), and better relationships with teachers (Di Fabio and Kenny, 2015). Together, both the academic climate involving classmates and professors, as well as a better predisposition of learning-oriented abilities might be associated with a greater AP (Brackett et al., 2011; Johnson, 2016). In summary, there are several plausible theoretical mechanisms that might explain the relationship between EI as a set of skills and optimal academic functioning in secondary education.

Current Meta-Analysis

Previous work has excluded studies conducted with instruments developed under other theoretical approaches of EI (Perera and DiGiacomo, 2013), or has contemplated the role of EI in AP in a more global way and by levels (MacCann et al., 2019), making it difficult to compare the results between different instruments. The present study examined the association between EI and AP, considering instruments developed from all the theoretical approaches to EI in studies conducted in secondary school students, as an educational level of greater relevance according to previous literature (Perera and DiGiacomo, 2013; MacCann et al., 2019). Our meta-analysis aimed to examine previous review studies, comparing the results by the main streams and EI instruments used in secondary education including native English and Spanish speakers. The current meta-analysis study was carried out to (1) asses the associations of AP and EI, hypothesizing that there will be a significant correlation between EI; (2) show the associations of different instruments used to asses EI based on three main streams and levels of AP; in line with previous studies, it was hypothesized that EI ability instruments would have a greater association with AP.

METHODS

Literature Search

We searched relevants studies of EI y AP on electronic database: PsychoINFO, MEDLINE, SCOPUS, PubMed, ISI Web of Science, Google Scholar, and ProQuest Dissertations and Theses. The search term (emotional intelligence) AND (academic performance OR academic achievement OR grades performance OR academic OR education OR school) AND (secondary level). We also reviewed specialized database journals of relevant papers. This review was conducted from June 2017 to January 2020.

Inclusion Criteria

Studies eligible were scanned titles and abstracts, and included in the review all those that referred to the above terms. To be included in the review, papers had to meet the following inclusion criteria for eligibility of studies (Lipsey and Wilson, 2000): (1) empirical study that provides data on the association between EI and AP; (2) minimum sample size at least 20 participants; (3) studies had to have been performed between 1999 and 2020 (January); published article and unpublished doctoral thesis without published and conference paper, (4) studies written in Spanish and English.

Coding

Following a Lipsey and Wilson (2000) : (a) country, (b) publication type, (c) design features, (d) measure used to asses EI, (e) AP index, (f) study sample size, (g) size of the association between key variables, (h) level of significance. Finally, extrinsic characteristics coded were results reporting the year and publication source (see **Table A1**).

Statistical Analysis

All data were conducted in R (Team, 2012), using the "stats" and "metaphor" packages (Viechtbauer, 2010). For the meta-analysis the technique by DerSimonian and Laird (1986) was used. The Q-value indicated heterogeneity among studies ($p < 0.10$), thus

applied random effect models was used in the meta-analysis. Additionally, we quantified the effect of heterogeneity using I^2 (Higgins and Thompson, 2002). The I^2 value indicate proportion of inconsistency due to heterogeneity rather than chance. The effect size index was converted by Fisher r – Z following the procedures recommended by Hedges and Olkin (1985). The categorical model between-class results were obtained through

a goodness-of-fit statistic Q_b, and the within-class goodness-of-fit statistic Q_w. The statistic Q_{wj} within-category heterogeneity is under the null hypothesis of within-category homogeneity.

Publication Bias

Publication bias was evaluated by rank correlation with Kendall's tau method, in which a significant correlation indicates

FIGURE 1 | PRISMA flowchart for the identification, screening, and inclusion of publications in the meta-analyses.
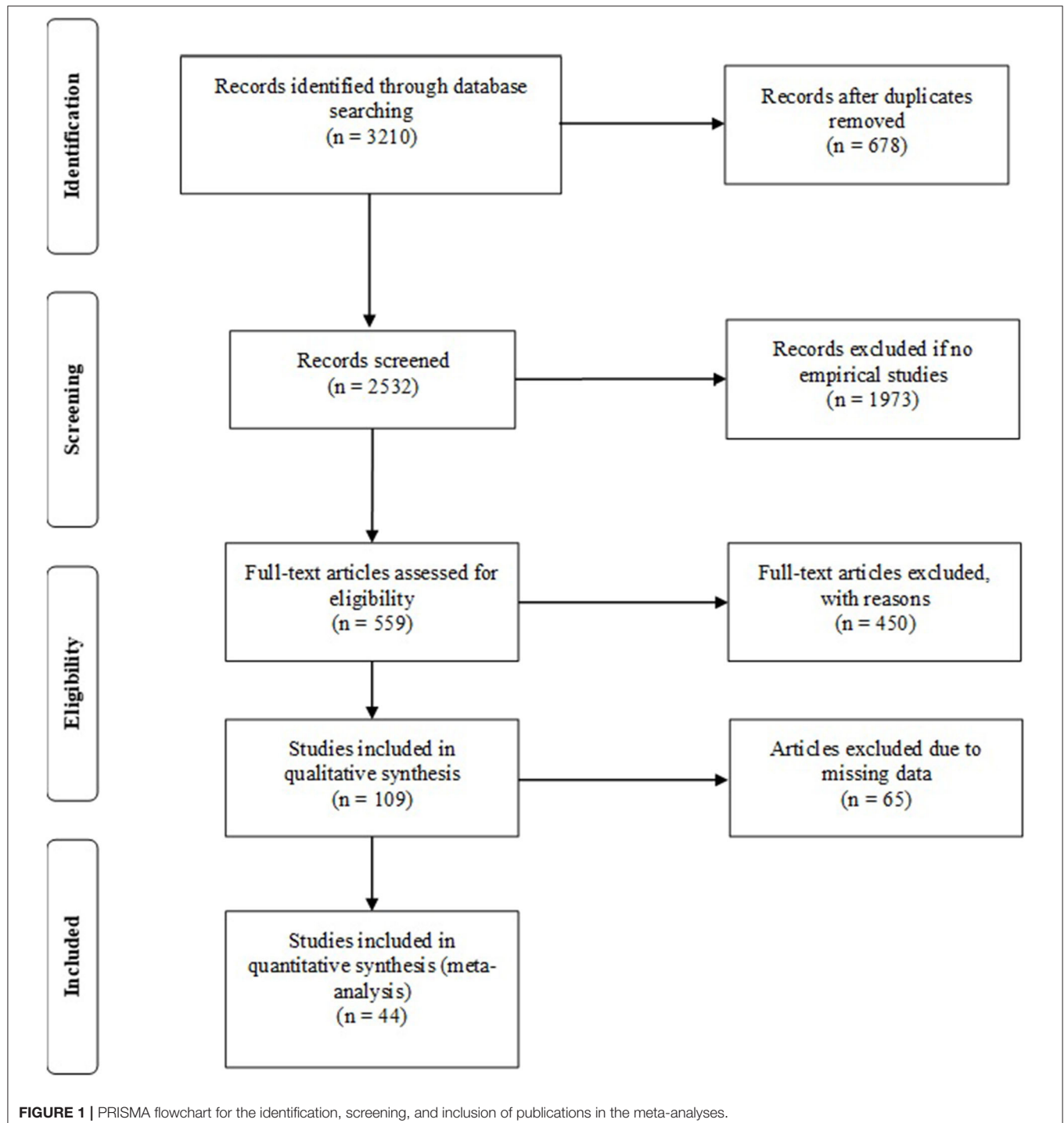
publication bias, and Egger's regression test asymmetry, in which significant asymmetry indicates publication bias (Fernández-Castilla et al., 2019). The Egger regression test should not differ significantly ($z = −1.189$, $p = 0.234$), and the rank correlation yielded non-significant results ($T = 0.03$, $p = 0.243$). Non-significant results showed symmetry and absence of publication bias. Regression tests and the funnel plot indicated a non-significant asymmetry, so the results showed no evidence of publication bias between EI and AP.

RESULTS

Selected Studies

The sample consisted of 3,210 studies, 678 were duplicate studies. Eventually, 1,973 did not correspond to association between EI and AP. They associated lack of personal distress and absence of mental disorder to higher levels of well-being. The full text of the remaining 559 articles were reviewed, obtaining 44 items that were selected and evaluated more deeply (see **Figure 1**).

Study Characteristics

The articles included in the meta-analysis showed a closed association between target variables. The overall sample consisted of 19,714 participants, and the mean age was of 15.82 years. Several studies included some scales for assessing EI, obtaining 49 effect sizes. The studies included were conducted in 16 countries, with the largest number conducted in the US (14 studies).

Association of EI and AP

The main results of this study indicated that the association between EI and AP had a significant low to moderate cumulative effect ($\overline{Z} = 0.26$; CI from 0.14 to 0.38). A DerSimonian test and Laird's random effect showed statistical evidence of heterogeneity ($Q = 1,206.16$, $p < 0,001$), indicating a greater variance of effect sizes between studies than anticipated by chance. In addition, the I^2 estimated of 96% suggests a high proportion of variation between samples.

Main EI Streams

The categorical model test that examined the subgroup model results intra-group showed statistical evidence of heterogeneity ($Q_b = 0.39$, $p = 0.540$). The Q_w statistics revealed that the model was misspecified ($Q_w = 1,205.77$, $p < 0.001$). Therefore, significant differences were found between the effect sizes, indicating heterogeneity within each category (see **Table 1**). The ability stream showed lower levels of heterogeneity ($Q_{wj} = 24.16$, $p < 0.012$), with smaller variation between scores ($I^2 = 54\%$) obtained between the different studies that used ability stream instruments. When examining the effect size results by grouping the EI instruments by main streams, we found larger effect sizes for those studies that used instruments based on the ability EI stream ($\overline{Z} = 0.31$). At the same time, the degree of inconsistency between studies that used instruments based on the ability EI stream was lower ($I^2 = 54\%$) than in the other groups of studies (self-report EI stream $I^2 = 99\%$; mixed EI stream $I^2 = 92\%$).

TABLE 1 | Olkin and Pratt weighted average ($\overline{Z}$), effect size number (K), homogeneity test (Q_{wj}), and the degree of inconsistency (I^2) between EI main stream.

EI stream	N	$\overline{Z}$	K	Q_{wj}	P	I^2 %
Ability (stream 1)	2,644	0.31	12	24.16	0.012	54
Self-report (stream 2)	9,529	0.26	7	869.24	0.001	99
Mixed (stream 3)	7,628	0.24	25	312.37	0.001	92

$Q_w = 1205.77$, $p < 0.001$.
$Q_b = 0.39$, $p < 0.100$.

TABLE 2 | Olkin and Pratt weighted average ($\overline{Z}$), effect size number (K), homogeneity test (Q_{wj}), and the degree of inconsistency (I^2) between EI measure.

EI measure	N	$\overline{Z}$	K	Q_{wj}	P	I^2 %
MSCEIT	138	0.35	8	3.05	0.880	78
EQ-i	3,017	0.21	15	80.58	0.001	82
TEIQue	2,675	0.18	8	92.30	0.001	92
SUEIT	452	0.22	2	0.63	0.426	58
AMEIS	205	0.14	1	–	–	–
EIS	1,936	0.40	5	62.89	0.001	93
EQBI	1,563	0.94	1	–	–	–
MEIS	39	0.50	1	–	–	–
ESCQ	380	0.17	1	–	–	–
SSREI	127	0.15	1	–	–	–
TMMS	5,268	0.17	2	12.17	0.001	91
STEM-Y	525	0.26	2	0.51	0.476	97
PSM	486	0.14	1	–	–	–
EM	1,799	0.02	1	–	–	–

$Q_w = 252.13$, $p < 0.001$.
$Q_b = 954.04$, $p < 0.001$.

Type of EI Measure

As shown in **Table 2**, the different instruments used to assess EI had differing levels of association with AP. Moreover, there was much variability in the scores obtained in studies using the same EI instrument. Only the MSCEIT ($Q_{wj} = 3.05$, $p = 0.880$), SUEIT ($Q_{wj} = 0.63$, $p = 0.426$), and Situational Test of Emotion Management for Youths (STEM-Y) ($Q_{wj} = 0.51$, $p = 0.476$) measures did not show significant levels of heterogeneity between the effect sizes of the different studies. On the other hand, the largest effect sizes were observed in studies that used the Behavior Emotional Quotient Inventory (EQBI) ($\overline{Z} = 0.94$, $K = 1$), followed by the studies carried out with the MEIS ($\overline{Z} = 0.50$, $K = 1$), EIS ($\overline{Z} = 0.40$, $K = 5$), and MSCEIT ($\overline{Z} = 0.35$, $K = 8$) instruments. At the same time, the lowest degree of inconsistency between studies that used the same instruments was found for the SUEIT ($I^2 = 58\%$, $K = 2$), followed by the MSCEIT ($I^2 = 78\%$, $K = 8$), and Emotional Quotient Inventory (EQ-i) ($I^2 = 82\%$, $K = 15$), with the EQ-i being the most widely used instrument.

Type of AP Measure

Subgroup analysis was conducted to examine the variability in the scores obtained in studies using the same AP instrument (see **Table 3**). The highest degree of variability in the scores between

TABLE 3 | Olkin and Pratt weighted average ($\overline{Z}$), effect size number (K), homogeneity test (Q_{wj}), and the degree of inconsistency (I^2) between AP measure.

AP measure	N	$\overline{Z}$	K	Q_{wj}	P	I^2 %
GPA	11,623	0.28	30,00	246.68	0.001	88
ACS	205	0.14	1,00	–	–	–
AA	1,337	0.24	5,00	16.35	0.003	76
ABE	161	0.20	1,00	–	–	–
AT	165	0.12	1,00	–	–	–
MA	169	−0.24	1,00	–	–	–
GA	2,168	−0.01	2,00	0.49	0.485	99
TRA	254	0.23	2,00	1.90	0.168	47
VSLECRA	142	0.38	1,00	–	–	–
WAEC	1,563	0.74	1,00	–	–	–
SAT	139	0.07	1,00	–	–	–
GCSE	1,935	0.14	3,00	35.07	0.001	94

$Q_w = 300.48$, $p < 0.001$.
$Q_b = 955.71$, $p < 0.001$.

studies using the same instruments was found for the GPA ($Q_{wj} = 246.68$, $p < 0.001$), AA ($Q_{wj} = 16.35$, $p = 0.003$), and GCSE ($Q_{wj} = 35.07$, $p < 0.001$). Furthermore, the largest effect sizes were observed in studies using the WAEC ($\overline{Z} = 0.74$, $K = 1$), followed by the studies using the VSLECRA ($\overline{Z} = 0.38$, $K = 1$), and GPA ($\overline{Z} = 0.28$, $K = 30$) instruments. Simultaneously, the lowest degree of inconsistency between studies using the same instruments was found for the TRA ($I^2 = 47\%$, $K = 2$), followed by the AA ($I^2 = 76\%$, $K = 5$) and GPA ($I^2 = 88\%$, $K = 30$), with the GPA being the most widely used instrument.

DISCUSSION

The current study was designed to examine the relationship between EI and AP through meta-analyses comparing diverse main EI streams and instruments used in secondary education. Filling the gaps in previous meta-analytic research, our study provides new data, and expands past findings. After a literature review, 44 studies with 49 independent effect sizes based on 19,714 secondary school students were included in cumulative quantitative research on the link between EI and AP. Publication bias analysis showed that these findings are robust and reliable.

Regarding hypothesis 1, we found a moderate significant cumulative effect between EI and AP, including measures of the three main EI streams, and diverse indicators of AP. These findings support previous research (Perera and DiGiacomo, 2013; MacCann et al., 2019) suggesting that EI levels are moderately associated with academic success, which suggests that knowledge of one's own and others' feelings, as well as the ability to solve adaptive problems, provides an essential basis for academic learning (Zeidner and Matthews, 2016). Additionally, these results show that EI is a personal resource with an important influence in the academic field, as a process of adaptation to the environment (Zeidner et al., 2012). EI has a dual role; on the one hand, it has intrapersonal affective influences on aspects related to AP, such as motivation and self-regulation.

On the other hand, interpersonal skills increase social networks in the academic environment, improving teamwork, which is so important in secondary education level. Teaching staff, through workshops can develop emotional skills to help improve mental health and interpersonal aspects, which is supported by previous literature. Current programs aim to reduce aggressive behavior and substance use; future programs should also target school performance. To deepen these interactions between emotional skills and relevant factors in AP, it would be interesting for future meta-analytical studies to focus on revealing and quantifying each of these links, especially those that are relevant at the secondary level, as it is a period full of changes, is very sensitive to risks, and involves searching for immediate well-being.

With respect to hypothesis 2, we found differences in the levels of association of EI and AP as a function of the EI measures category. The results showed non-significant differences, with ability EI measures (Mayer and Salovey, 1997) showing a greater association with AP, followed by self-report EI (Salovey and Mayer, 1990), and finally the mixed EI stream (Bar-On, 2006). This higher index of association between EI measured with ability instruments and AP may be due to similarities with the tests used to obtain AP, as both of them use performance-based tests. In this sense it is possible this collinearity effect occurred because students who have good abilities to respond to performance tests will obtain high scores in both EI tests and tests that evaluate AP (Ogundokun and Adeyemo, 2010). At the same time, and contrary to other meta-analytical studies on EI (Martins et al., 2010; Sánchez-Álvarez et al., 2016), the most commonly used instruments in academic contexts are instruments developed from the mixed EI approach. Future studies should analyse in detail these effects of overlap and collinearity with personality and other aspects to obtain non-biased findings. Previous review studies (Perera and DiGiacomo, 2013; MacCann et al., 2019) did not assess the impact of different measures of EI on the association with AP, so these findings provide relevant information for future studies. The results showed great heterogeneity within each instrument category, presenting large differences between different studies that used the same instrument to measure EI (Sánchez-Álvarez et al., 2016). This variability could be caused by moderating variables such as sex, IQ, and personality traits, that moderate the EI–AP association when the same instruments are used (Petrides et al., 2004b; Furnham et al., 2005). Furthermore, they may be due to variations in adaptations to different languages or variations due to cultural differences (Fernández-Berrocal et al., 2005; Ang and van Dyne, 2015). These results go beyond differences between the various instruments to evaluate EI, since they show differences despite using the same instrument. Although it is logical for each theoretical approach to develop and use its own instruments to analyse emotional skills, the results of this type of meta-analysis show the difficulties encountered when comparing the results of studies investigating this area of interest. This is certainly one of the sources of heterogeneity, and the consequent controversy about the results. To clarify this issue, it would be necessary for future studies to select instruments to evaluate emotional skills that have a robust trajectory and well-confirmed psychometric replicative properties in cross-cultural studies. Few studies have

been conducted with Spanish-speaking samples. Therefore, more research is needed in Spanish and Latin American population.

The findings of this review should be considered with caution because there were several limitations. The current study was done without controlling for IQ, personality, and other variables that could influence the results. Other studies have been published in languages other than English and Spanish. On the other hand, EI integrates several dimensions, and this study did not take into account the individual associations that each of the dimensions of EI have with AP. It is possible that the associative effect of some dimensions of EI are greater than others, which implies that unifying all the dimensions of EI and analyzing the overall effect they have with AP could produce bias. Future studies should analyze each of the dimensions and their relationship with AP individually, and then compare them to analyze the differences.

These findings have several implications for research and application contexts. The school setting is one of the most important contexts for learning emotional skills and competencies (Zeidner and Matthews, 2016). EI training improves other associated issues, as well as improving performance. Developing emotional skills in early stages of adolescence (Herrera et al., 2020), will allow them to become consolidated personal resources to face risks and promote motivation oriented toward academic success and well-being. For this reason, this review study provides relevant information for the development of programs focused on increasing emotional skills in students, as well as providing tools for teachers and counselors, providing an empirical basis for the development of theoretical educational models oriented to AP. These findings cover the ages at which socio-emotional skills are most important, as well as relevant information for educators and teaching staff on the use of appropriate tools to assess EI in secondary education. We recommend that practitioners be cautious in choosing EI measurement instruments because of differences in their use. In the field of research, this meta-analysis

provides information on which future studies should be conducted, helping to clarify the different EI concepts and evaluation measures. Future studies would need to replicate these findings with a larger sample and more of the different EI measures, including variables that may influence AP.

In conclusion, the results of this study found great heterogeneity in the outcomes assessed, so the findings should be considered with caution. The results of this meta-analysis show a moderate association between EI and AP. Future research should explore how other variables influence this relationship, improving our understanding of EI and how it influences our lives. This meta-analytic study presents a quantitative review of the association between EI and AP globally and categorically, shedding light on the gaps in previous studies on the topic on adolescents. This study also shows the inadequacies in the review of studies in this field and provides guidelines to be followed in future empirical studies on AP. These discoveries are of great relevance in the explanatory models intended to predict academic success in secondary education.

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.

AUTHOR CONTRIBUTIONS

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

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APPENDIX

TABLE A1 | Studies included in the meta-analysis of the relationships between EI and AP.

Study	Country	Publication type	Research design	EI measure	AP index	N	Z	p
Abdo (2012)	EEUU	Dissertation	Cross-sectional	EQ-i	GPA	266	0.12	0.025
Abel (2014)	EEUU	Dissertation	Cross-sectional	TEIQue	GPA	78	0.15	0.185
Abdullah et al. (2004)	Malaysia	Article	Cross-sectional	AMEIS	ACS	205	0.14	0.024
Aremu et al. (2006)	Nigeria	Article	Cross-sectional	EIS	AA	500	0.32	0.001
Chamundeswari (2013)	India	Article	Cross-sectional	EIS	GPA	321	0.26	0.010
Clark (2004)	EEUU	Dissertation	Cross-sectional	EQ-i	ABE	161	0.20	0.005
Costa and Faria (2015)	Portugal	Article	Longitudinal	ESCQ	GPA	380	0.17	0.001
Di Fabio and Palazzeschi (2009)[1]	Italy	Article	Cross-sectional	MSCEIT	GPA	124	0.32	0.001
Di Fabio and Palazzeschi (2009)[2]	Italy	Article	Cross-sectional	EQ-i	GPA	124	0.22	0.007
Di Fabio and Palazzeschi (2015)[1]	Italy	Article	Cross-sectional	EQ-i	GPA	133	0.48	0.001
Di Fabio and Palazzeschi (2015)[2]	Italy	Article	Cross-sectional	TEIQue	GPA	133	0.59	0.001
Downey et al. (2008)	Australia	Article	Cross-sectional	SUEIT	GPA	209	0.18	0.031
Downey et al. (2014)	Australia	Article	Cross-sectional	SUEIT	GPA	243	0.26	0.001
Drati (2010)	EEUU	Dissertation	Cross-sectional	EQ-i	AT	165	0.12	0.199
Gil-Olarte Márquez et al. (2006)	Spain	Article	Cross-sectional	MSCEIT	GPA	77	0.50	0.010
Glickman-Rogers (2010)	EEUU	Dissertation	Cross-sectional	MSCEIT	GPA	412	0.33	0.001
Hogan et al. (2010)	Canada	Article	Cross-sectional	EQ-i	GPA	192	0.37	0.008
Jones (2013)	EEUU	Dissertation	Cross-sectional	MSCEIT	GPA	38	0.23	0.082
Jordan et al. (2010)	Ireland	Article	Cross-sectional	EQ-i	AA	86	0.18	0.050
Kaliská (2015)	Eslovaquia	Article	Cross-sectional	TEIQue	MA	169	−0.24	0.001
Khajehpour (2011)	Iran	Article	Cross-sectional	EIS	AA	300	0.45	0.001
Killen (2016)	EEUU	Dissertation	Cross-sectional	EQ-i	GPA	93	0.69	0.001
Kumar et al. (2013)	India	Article	Cross-sectional	EIS	GPA	200	0.27	0.010
Kvapil (2007)	EEUU	Dissertation	Cross-sectional	MSCEIT	GPA	237	0.31	0.001
Lawrence and Deepa (2013)	India	Article	Cross-sectional	TEIQue	AA	400	0.17	0.098
Lui (2009)	India	Dissertation	Cross-sectional	EQ-i	GPA	108	0.03	0.764
MacCann and Fogarty (2011)	EEUU	Article	Cross-sectional	STEM-Y	GPA	293	0.29	0.001
Mateši (2015)	Croatia	Article	Cross-sectional	EQ-i	GA	369	0.01	0.420
Mavroveli et al. (2008)	UK	Article	Cross-sectional	TEIQue	SAT	139	0.07	0.200
Menzie (2005)	EEUU	Dissertation	Cross-sectional	EQ-i	GPA	55	0.21	0.061
Mestre et al. (2006)	Spain	Article	Cross-sectional	MSCEIT	TRA	127	0.33	0.010
Mestre et al. (2006)	Spain	Article	Cross-sectional	SSREI	TRA	127	0.15	0.180
Mitrofan and Cioricaru (2014)	Romania	Conference paper	Cross-sectional	EQ-i	GPA	136	−0.06	0.458
Nelson (2010)	EEUU	Dissertation	Cross-sectional	MSCEIT	VSLECRA	142	0.40	0.001
Ogundokun and Adeyemo (2010)	Nigeria	Article	Cross-sectional	EQBI	WAEC	1563	0.94	0.010
Parker et al. (2004)	Canada	Article	Cross-sectional	EQ-i	GPA	667	0.34	0.010
Petersen (2010)	EEUU	Dissertation	Cross-sectional	EQ-i	AA	51	0.12	0.200
Petrides et al. (2004a)	UK	Article	Cross-sectional	TEIQue	GCSE	650	0.08	0.043
Qualter et al. (2012)	UK	Article	Longitudinal	EQ-i	GCSE	411	0.15	0.080
Rice (2007)	EEUU	Dissertation	Cross-sectional	PSM	GPA	486	0.14	0.001
Vidal Rodeiro et al. (2012)	UK	Article	Cross-sectional	TEIQue	GCSE	874	0.37	0.001
Rodrigo-Ruiz (2017)[1]	Spain	Dissertation	Cross-sectional	STEM-Y	GPA	232	0.22	0.001
Rodrigo-Ruiz (2017)[2]	Spain	Dissertation	Cross-sectional	MSCEIT	GPA	232	0.35	0.001
Rodrigo-Ruiz (2017)[3]	Spain	Dissertation	Cross-sectional	TEIQue	GPA	232	0.29	0.001
Trigueros et al. (2019)	Spain	Article	Cross-sectional	EIS	GPA	615	0.69	0.001
Usán Supervía and Salavera Bordás (2018)	Spain	Article	Cross-sectional	TMMS	GPA	3512	0.22	0.001
Usán and Salavera (2019)	Spain	Article	Cross-sectional	TMMS	GPA	1756	0.12	0.001
Woitaszewski and Aalsma (2004)	EEUU	Article	Cross-sectional	MEIS	GPA	39	0.50	0.090
Xu (2018)	China	Article	Cross-sectional	EM	GA	1799	−0.03	0.101

[1]First instrument used, [2]second instrument used, [3]third instrument useds.

Math Performance and Sex: The Predictive Capacity of Self-Efficacy, Interest and Motivation for Learning Mathematics

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Differences between the sexes in education is something of particular interest in much research. This study sought to investigate the possible differences between the sexes in math performance, and to deeply examine the causal factors for those differences. Beginning from the administration of the BECOMA-On (Online Evaluation Battery of Mathematics Skills) to 3,795 5th year primary students aged 10–11, in 16 Spanish autonomous communities and the 2 autonomous cities of Ceuta and Melilla. The results for each sex were compared to their perceptions of self-efficacy about completing the test items, and with their interest in and motivation for mathematics. Statistically significant differences were seen in the variables examined. The boys were generally more engaged with science and technical subjects. Generalizing from studies such as this aims to more thoroughly explore, and improve this situation.

Keywords: math performance, sex, self-efficacy, interest and motivation for math, primary education

INTRODUCTION

Inequality between the sexes in education is an enormously important issue for society as a whole, not only for those working in the field. Its importance goes beyond the educational arena and is manifested in power dynamics and decision-making in various contexts. The origins of these inequalities may be multidimensional, such as traits, behaviors, and identities determined by socialization processes (Hadjar et al., 2014; García-Perales, 2016; Ministerio de Educación y Formación Profesional, 2019b) causing internal dissonance, on occasion led by undervaluing talent and potential (Pomar et al., 2009).

In this study, we focus on science and technical disciplines, women are underrepresented in these fields (Lehman et al., 2017; Botella et al., 2019; McCullough, 2020), more specifically on math. We aim to thoroughly examine the reasons for differences between the sexes in this area, looking into possible causal factors. Various studies have concluded that boys get better results in tests of math performance (Bennett, 1997; Furnham et al., 1999; Pasarín et al., 2004; Chan, 2006; Sánchez et al., 2008; Llor et al., 2012; Instituto Nacional de Evaluación Educativa, 2013; Ministerio de Educación y Formación Profesional, 2019b), and that there are differences in scientific and mathematical reasoning that favor boys and men (Fox and Denham, 1974; Beltrán and Pérez, 1994; Pasarín et al., 2004; Barbero et al., 2007; Suberviola, 2012). This leads to the necessary interpretation beyond the

educational arena that, as stated in PISA 2018, "there is a deficit of representation of girls among students with the highest levels of performance in science and mathematics may explain, at least in part, the persistent gender gap in science, technology, engineering, and mathematics (STEM) courses, fields which are among the best paid occupations" (Ministerio de Educación y Formación Profesional, 2019b, p. 85).

From early ages, boys and girls receive the same math instruction, allowing them to assimilate fundamental algorithms to structure their math reasoning in order to be able to apply it to everyday problems. Modifying the teaching and learning processes to their potentials, interests, and motivations helps to prevent the frustration, boredom, and even rejection that the subject sometimes causes in students (González, 2019). Teacher training for the prevention of these attitudes is essential (Nortes and Nortes, 2020). The differences between the sexes in this area cannot be explained by the existence of innate differences of ability (Ministerio de Educación y Formación Profesional, 2019b).

A favorable disposition toward learning math is fundamental, and many national and international organizations have stressed the importance of working on these attitudes in the classroom (Unión Europea, 2004; Ministerio de Educación, Cultura y Deporte, 2014; Ministerio de Educación y Formación Profesional, 2019b). This has also been reinforced by various studies (Cueli et al., 2013; Mato et al., 2014), with the teacher having a prominent role as one who understands these internal processes (Muñoz and Mato, 2008; Tourón et al., 2012). According to this variable, PISA 2012, the last version to focus on the specific evaluation of mathematics, concluded that pupils' interest in learning math was low, they did not enjoy their learning very much. Girls' progress in this area was hindered by anxiety and a lack of confidence (Instituto Nacional de Evaluación Educativa, 2013), and by the different types of education they received depending on their models of socialization both in and outside the family environment (Ministerio de Educación y Formación Profesional, 2019b). Nonetheless, the gap between boys and girls has narrowed in each edition of PISA in Spain (Ministerio de Educación y Formación Profesional, 2019b). Logically, attention must be paid to the *math affective domain* (Palacios et al., 2014). The analysis of these attitudes is fundamental in more capable students because "weaknesses in attitudes toward the study of math not only affect lower performing students or schools, many students who are relatively high achieving are slowed down by their negative attitudes toward math" (Muñoz and Mato, 2008, p. 224).

Students with greater potential for math show, even from the beginning of their learning, intense activity and commitment to tasks, rapid understanding of concepts and algorithms, high capacity for abstraction, high flexibility of thought, and elevated interest and motivation (Kruteskii, 1976; Benavides, 2008; Reyes-Santander and Karg, 2009). The numbers of detected cases of highly intellectually capable female students is lower than for their male peers. By way of illustration, this situation is clear from the national data for Spanish schoolchildren in school year 2017/8, the most recent year for which official data is available (Ministerio de Educación y Formación Profesional, 2020): **Table 1**.

TABLE 1 | Prevalence of highly intellectually capable students in Spain by sex.

Region	Total high capacity	Boys girls			
		n	*%*	*n*	*%*
Andalucía	14420	8819	61.16	5601	38.84
Aragón	478	368	76.99	110	23.01
Asturias	1087	756	69.55	331	30.45
Baleares	1132	762	67.31	370	32.69
Canarias	2235	1425	63.76	810	36.24
Cantabria	138	104	75.36	34	24.64
Castilla and León	742	564	76.01	178	23.99
Castilla La Mancha	510	370	72.55	140	27.45
Cataluña	2108	1392	66.03	716	33.97
Comunidad Valenciana	1637	1142	69.76	495	30.24
Extremadura	331	248	74.92	83	25.08
Galicia	1833	1223	66.72	610	33.28
Madrid	2371	1621	68.37	750	31.63
Murcia	3755	2341	62.34	1414	37.66
Navarra	410	287	70.00	123	30.00
País Vasco	564	407	72.16	157	27.84
La Rioja	350	245	70.00	105	30.00
Ceuta	9	7	77.78	2	22.22
Melilla	3	3	100.00	0	0.00
Spain	34113	22084	64.74	12029	35.26

Authors creation using statistics from Ministerio de Educación y Formación Profesional (2020).

As **Table 1** makes clear, of the 34,113 students identified as highly intellectually capable in Spain, 22,084 (64.74%) were boys compared to 12,029 (35.26%) girls. In the autonomous communities, Andalucía was the most equal region with 8,819 (61.6%) boys and 5,601 (38.84%) girls, whereas Aragón exhibited the greatest differences with 368 (76.99%) boys and 110 (23.01%) girls. Despite these differences in numbers between the sexes, there are studies that have shown that there are no differences in high abilities between boys and girls (Organización para la Cooperación y el Desarrollo Económico, 2009; Jiménez et al., 2010; Jiménez and Baeza, 2012). In this regard, Pérez and Díaz (1994, p. 110) noted that "studies that pose the hypothesis of a sex-linked hereditary factor for mathematical or spatial aptitude, or a different lateral specialization in the brain for men and women are not very substantial." In addition, there are studies which noted that girls suffered from more prejudice in the diagnostic process for giftedness (Kerr, 2000; Landau, 2003; Jiménez, 2014), existing stereotypes that influence their academic and professional choices in education (Bian et al., 2017) and showing higher levels of emotional problems with respect to gifted boys (Huang et al., 2020). Therefore, there is a need to give a high profile to giftedness, regardless of sex (Mandelman et al., 2010; Hernández and Gutiérrez, 2014; Jaime and Gutiérrez, 2017; García-Perales and Almeida, 2019).

In summary, in this study we aimed to show the results achieved by students participating in the BECOMA-On according to sex, relating the scores to students own perceptions of self-efficacy in completing the test battery, and their interest in and motivation for math. This study uses a contextual framework

in order to provide guidance for setting the most egalitarian educational policies possible.

MATERIALS AND METHODS

This was a ex post facto study which attempted to analyze the relationships between a series of quantitative data.

Participants

According to the statistics from MEFP for the 2018/19 school year, the time of the study, 51.7% of schoolchildren were boys, and 48.3% were girls. The data for primary schoolchildren was 51.6% boys, and 48.4% girls (Ministerio de Educación y Formación Profesional, 2020).

The main sample for the study was selected from 147 infant and primary schools from 16 autonomous communities, and 2 autonomous cities. The participating schools were both publicly funded and private or independent, and in both urban and rural areas. The sample selection method was not random, each autonomous community selected the participating schools in their areas. The distribution of the study sample according to their sex was as follows: male 2002 or 52.75% and female 1793 or 47.25%.

Variables

The main variable in the study was math performance via the BECOMA-On test. This construct has its educational basis in the elements or thinking that allow a subject to deal with day-to-day situations, and assessing how that contributes to social and cultural progress. It is also based on subjects' understanding of how mathematical algorithms work, modifying them to each individual situation.

Two additional variables were considered:

- Self-efficacy in completing the test battery: this was systematized from 0, the lowest value, to 10, the highest value. It is a relative belief in the subjects' ability to complete the test battery, based on feelings, actions, and thoughts. The following question has been collected from schoolchildren once the battery has been completed: "How did the test go? Mark an option from 0 to 10, with 0 being the lowest score and 10 being the highest. It indicates only one option."
- Interest and motivation toward mathematics as a subject: categorized from 0 (lowest value) to 10 (highest value). This variable has an impact on the students' intrinsic motivation for the subject, affecting their effort and involvement, and thus their academic performance. After completing the instrument, students have been asked the following questions: "What is your interest and motivation toward the Mathematics area? Mark an option from 0 to 10, with 0 being the lowest score and 10 being the highest. It indicates only one option."

Instrument

BECOMA-On is an instrument own creation for the online evaluation of math performance in 5th-year primary students,

aged about 10–11. It has 30 items spread over 7 Evaluation Tests (ET): Mathematical interpretation (ET1, items 1–5), Mental arithmetic (ET2, items 6–11), Geometric properties (ET3, items 12 and 13), Logical numerical series (ET4, items 14–19), Discovering algorithms (ET5, items 20 and 21), Conventional units (ET6, items 22–27), and Logical series of figures (ET7, items 28–30). Each item is scored as 0, 1, or 2, where 0 means incorrect, 1 means partially correct, and 2 means correct. The test scores range from 0 to 60. The reliability index for the original battery was 0.83 and the validity indices were between 0.78 and 0.86.

This instrument seeks to produce both a qualitative and quantitative evaluation of the students' math performance. Using the results, students are placed in one of 7 hierarchical performance levels with different qualitative characteristics, from poorer to better mastery of the subject. The instrument is applied to class groups online, and takes about 45 min to complete.

Procedure

The study was carried out during February 2019. The schools selected were charged with administering the instrument, and in particular with explaining each test, demonstrating examples, and monitoring the time. Prior to the application, participating teachers were given specific training in the administration and content of the instrument. All of the variables used in the study were collected at the same time as the application of the test battery. In the analysis of the results, descriptive statistics and the mean comparison t-test were mainly used. For the treatment of the results, the SPSS V24 program has been used.

RESULTS

The results are given below in three sections: the relationship between the BECOMA-On results and sex, the relationship between the BECOMA-On results, sex, and self-efficacy regarding the test battery and the relationship between the BECOMA-On results, sex, and interest and motivation for math.

Relationship Between the BECOMA-On Results and Sex

The item responses are given below for each item by students' sex: **Table 2**.

Table 2 demonstrated differences between the sexes which made it necessary to continue with the analysis to determine statistical significance. For example, item 29 was answered correctly by more girls than boys, despite the participating sample of girls being smaller. We performed a t test to examine the results in more depth: **Table 3**.

As **Table 3** shows, the mean score for the overall test battery was 35.18 (SD = 10.08) for boys. and 34.44 (SD = 9.22) for girls. Comparison testing showed that there were statistically significant differences between the sexes. Boys scored higher than girls in items 9, 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, and the Total score. While girls scored higher in items 7, 8, 12, 13, 23, and 30. It was notable that boys scored higher than girls in 5 of

TABLE 2 | Frequencies for each item response by sex.

Items	Boys			Girls		
	0	1	2	0	1	2
IT 1	498	356	1148	397	334	1062
IT 2	710	753	539	634	685	474
IT 3	640	492	870	524	462	807
IT 4	301	421	1280	283	346	1164
IT 5	273	415	1314	220	360	1213
IT 6	211	660	1131	196	552	1045
IT 7	223	468	1311	170	335	1288
IT 8	432	520	1050	334	447	1012
IT 9	553	582	867	543	542	708
IT 10	701	720	581	658	634	501
IT 11	1021	465	516	936	394	463
IT 12	527	152	1323	428	101	1264
IT 13	290	254	1458	235	182	1376
IT 14	196	374	1432	160	332	1301
IT 15	514	719	769	567	807	419
IT 16	720	765	517	827	642	324
IT 17	769	740	493	766	738	289
IT 18	442	864	696	513	783	497
IT 19	455	870	677	490	853	450
IT 20	629	409	964	642	334	817
IT 21	977	355	670	930	300	563
IT 22	399	149	1454	463	103	1227
IT 23	695	385	922	548	331	914
IT 24	700	488	814	640	486	667
IT 25	422	550	1030	437	492	864
IT 26	547	905	550	570	750	473
IT 27	746	135	1121	798	119	876
IT 28	1072	756	174	924	718	151
IT 29	588	906	508	515	751	527
IT 30	494	578	930	389	442	962
Total	16745	16206	27109	15737	14355	23698

TABLE 3 | t test for independent samples by sex.

Items	Boys		Girls		t	df	p	d
	M	SD	M	SD				
IT 1	1.32	0.85	1.37	0.82	1.70	3793	0.089	0.06
IT 2	0.91	0.78	0.91	0.79	−0.15	3793	0.881	0.00
IT 3	1.11	0.86	1.16	0.85	1.55	3793	0.122	0.06
IT 4	1.49	0.74	1.49	0.75	1.00	3793	0.923	0.00
IT 5	1.52	0.72	1.55	0.70	1.46	3793	0.145	0.04
IT 6	1.46	0.68	1.47	0.68	0.63	3793	0.528	0.01
IT 7	1.54	0.69	1.62	0.65	3.68	3793	0.000***	0.12
IT 8	1.31	0.80	1.38	0.78	2.70	3793	0.007**	0.09
IT 9	1.16	0.83	1.09	0.83	−2.41	3793	0.016*	0.08
IT 10	0.94	0.80	0.91	0.80	−1.06	3793	0.288	0.04
IT 11	0.75	0.84	0.74	0.84	−0.42	3793	0.673	0.01
IT 12	1.40	0.88	1.47	0.85	2.44	3793	0.015*	0.08
IT 13	1.58	0.73	1.64	0.70	2.27	3793	0.023*	0.08
IT 14	1.62	0.66	1.64	0.64	0.90	3793	0.369	0.03
IT 15	1.13	0.79	0.92	0.74	−8.43	3793	0.000***	0.27
IT 16	0.90	0.78	0.72	0.75	−7.19	3793	0.000***	0.23
IT 17	0.86	0.78	0.73	0.72	−5.23	3793	0.000***	0.17
IT 18	1.13	0.74	0.99	0.75	−5.59	3793	0.000***	0.19
IT 19	1.11	0.74	0.98	0.72	−5.58	3793	0.000***	0.18
IT 20	1.17	0.88	1.10	0.90	−2.42	3793	0.016*	0.08
IT 21	0.85	0.89	0.80	0.89	−1.77	3793	0.077	0.06
IT 22	1.53	0.81	1.43	0.87	−3.70	3793	0.000***	0.12
IT 23	1.11	0.89	1.20	0.88	3.15	3793	0.002**	0.10
IT 24	1.06	0.87	1.02	0.85	−1.50	3793	0.135	0.05
IT 25	1.30	0.80	1.24	0.82	−2.50	3793	0.012*	0.07
IT 26	1.00	0.74	0.95	0.76	−2.28	3793	0.023*	0.07
IT 27	1.19	0.95	1.04	0.97	−4.63	3793	0.000***	0.16
IT 28	0.55	0.65	0.57	0.64	0.83	3793	0.407	0.03
IT 29	0.96	0.74	1.01	0.76	1.91	3793	0.056	0.07
IT 30	1.22	0.82	1.32	0.81	3.86	3793	0.000***	0.12
Total	35.18	10.08	34.44	9.22	−2.34	3793	0.019*	0.08

*Significant at 5% ($p < 0.05$). **Significant at 1% ($p < 0.01$). ***Significant at 0.01% ($p < 0.001$).

the 6 items in the Logical numerical series tests (items 14–19) and in 4 of the 6 items in the Conventional units test (items 22–27). Whereas girls scored statistically significantly higher in the Geometric properties test (items 12 and 13).

To corroborate these differences between sexes for each of the Evaluation Tests (ET) in which each item is integrated, a t-test was carried out with the following results: **Table 4**.

In **Table 4**, statistically significant differences have been observed in several of the evaluation tests. In favor of men, in tests 4 or Logical numerical series, $p < 0.001$, 5 or Discovering algorithms, $p < 0.01$, and 6 or Conventional units, $p < 0.001$. In favor of women, in tests 3 or Geometric properties, $p < 0.01$, and 7 or Logical series of figures, $p < 0.01$.

Relationship Between the BECOMA-On Results, Sex and Self-Efficacy Regarding Completing the Test Battery

The first step in the analysis of this relationship was to examine the frequencies and corresponding percentages: **Table 5**.

Table 5 shows two notable tendencies. Firstly, girls chose self-efficacy scores of 4, 5, and 6 more than the boys. Secondly, more boys than girls rated themselves with self-efficacy scores of 7, 8, 9, and 10. This is shown graphically below: **Figure 1**.

These results required deeper analysis to examine possible statistically significant differences. The boys' mean score was 7.39 (SD = 1.96). and the girls' was 6.92 (SD = 1.99). The t test gave a value of −7.39. $p < 0.001$ and $d = 0.24$. It confirm the existence of statistically significant differences. After continuing to study these differences by means of a regression analysis with a view to establishing the predictive capacity of self-efficacy depending on the sex of schoolchildren, the following results have appeared: **Table 6**.

It has been observed that the contrast made by analysis of variance has given a value of 54.67 (the value of t squared has been 54.61), obtaining a significance of $p < 0.001$. The estimating function of the regression model has been: $\dot{Y} = 6.92 + 0.47X$. The predicted score for self-efficacy men will be $\dot{Y} = 7.39$, for women $\dot{Y} = 6.92$.

TABLE 4 | t test for independent samples by sex for each evaluation tests.

Evaluation Tests	Boys		Girls		t	df	p	d
	M	SD	M	SD				
ET1 (IT 1-5)	6.36	2.20	6.48	2.17	1.71	3793	0.087	0.05
ET2 (IT 6-11)	7.16	3.27	7.22	3.22	0.56	3793	0.573	0.02
ET3 (IT 12–13)	2.98	1.25	3.10	1.19	3.06	3793	0.002**	0.10
ET4 (IT 14–19)	6.74	3.08	5.98	2.67	−8.16	3793	0.000***	0.26
ET5 (IT 20–21)	2.01	1.41	1.89	1.41	−2.64	3793	0.008**	0.09
ET6 (IT 22–27)	7.19	2.73	6.87	2.64	−3.63	3793	0.000***	0.12
ET7 (IT 28–30)	2.73	1.54	2.90	1.55	3.31	3793	0.001**	0.11

*Significant at 5% ($p < 0.05$). **Significant at 1% ($p < 0.01$). ***Significant at 0.01% ($p < 0.001$).*

TABLE 5 | Self-efficacy in completing the test battery by sex.

Self-efficacy	Boys		Girls		Total	
	f	%	f	%	f	%
0	24	0.63	28	0.74	52	1.37
1	14	0.37	12	0.32	26	0.69
2	16	0.42	28	0.74	44	1.16
3	30	0.79	39	1.03	69	1.82
4	55	1.45	67	1.77	122	3.21
5	150	3.95	190	5.01	340	8.96
6	218	5.74	237	6.25	455	11.99
7	421	11.09	413	10.88	834	21.98
8	477	12.57	430	11.33	907	23.90
9	345	9.09	240	6.32	585	15.42
10	252	6.64	109	2.87	361	9.51
Total	2002	52.75	1793	47.25	3795	100.00

FIGURE 1 | Graphical representation of sex-differences in self-efficacy.

TABLE 6 | Regression analysis between sex and self-efficacy variables.

Model summary

Model	R	R square	Adjusted R squared	Std. error of the estimate
1	0.12	0.01	0.01	1.97

ANOVA

	Model	Sum of squares	df	Mean square	F	p
1	Regression	212.94	1	212.94	54.67	0.000***
	Residual	14775.11	3793	3.89		
	Total	14988.05	3794			

Coefficients

	Model	Unstandardized coefficients		Standardized coefficients	t	p
		B	Std. Error	Beta		
1	(Constant)	6.92	0.05		148.45	0.000***
	Sex	0.47	0.06	0.12	7.39	0.000***

*Significant at 5% ($p < 0.05$). **Significant at 1% ($p < 0.01$). ***Significant at 0.01% ($p < 0.001$).*

Relationship Between the BECOMA-On Results, Sex, and Interest and Motivation for Math

Table 7 gives the frequencies and percentages for this variable: **Table 7**.

Table 7 shows that the results were similar for the options chosen. with the exception of the highest scores. More girls gave themselves a score of 8 than boys, and more boys gave themselves scores of 10. **Figure 2** shows this difference graphically: **Figure 2**.

It was necessary to analyze these results more deeply. The boys' mean score was 7.94 (SD = 2.38), and the girls' mean score was 7.47 (SD = 2.37). The t test produced an index of −6.09, $p < 0.001$ and $d = 0.20$. It confirm the existence of statistically significant differences. With the aim of deepening these differences, a regression analysis has been carried out to observe the predictive capacity of interest and motivation toward

Mathematics according to the sex of schoolchildren, these results have been achieved: **Table 8**.

This table has reflected the contrast made through analysis of variance with a value of 37.14 (the value of t squared has been 37.10), reaching a significance of $p < 0.001$. The estimating function of the regression model has been: $\dot{Y} = 7.47 + 0.47X$. The expected score for men in interest and motivation will be $\dot{Y} = 7.94$, for women $\dot{Y} = 7.47$.

DISCUSSION

One of the basic premises of educational systems is the empowerment of human capital. The integrated development of each person encourages a country's social, economic and cultural progress. Compulsory schooling is a key time to make the school population participants in learning. Co-education is key work in

TABLE 7 | Interest and motivation for math by sex.

Interest and motivation	Boys		Girls		Total	
	f	%	f	%	f	%
0	53	1.40	33	0.87	86	2.27
1	13	0.34	26	0.69	39	1.03
2	17	0.45	35	0.92	52	1.37
3	46	1.21	36	0.95	82	2.16
4	45	1.19	73	1.92	118	3.11
5	110	2.90	129	3.40	239	6.30
6	137	3.61	160	4.22	297	7.83
7	220	5.80	211	5.56	431	11.36
8	306	8.06	361	9.51	667	17.58
9	380	10.01	364	9.59	744	19.60
10	675	17.79	365	9.62	1.040	27.40
Total	2002	52.75	1793	47.25	3795	100.00

FIGURE 2 | Graphical representation of sex-differences in interest and motivation for math.

TABLE 8 | Regression analysis between sex and interest and motivation toward Mathematics.

Model summary

Model	R	R square	Adjusted R squared	Std. error of the estimate
1	0.10	0.01	0.01	2.37

ANOVA

	Model	Sum of squares	df	Mean square	F	p
1	Regression	209.40	1	209.40	37.14	0.000***
	Residual	21386.22	3793	5.64		
	Total	21595.62	3794			

Coefficients

	Model	Unstandardized coefficients		Standardized coefficients	t	p
		B	Std. Error	Beta		
1	(Constant)	7.47	0.06		133.19	0.000***
	Sex	0.47	0.08	0.10	6.09	0.000***

*Significant at 5% ($p < 0.05$). **Significant at 1% ($p < 0.01$). ***Significant at 0.01% ($p < 0.001$).
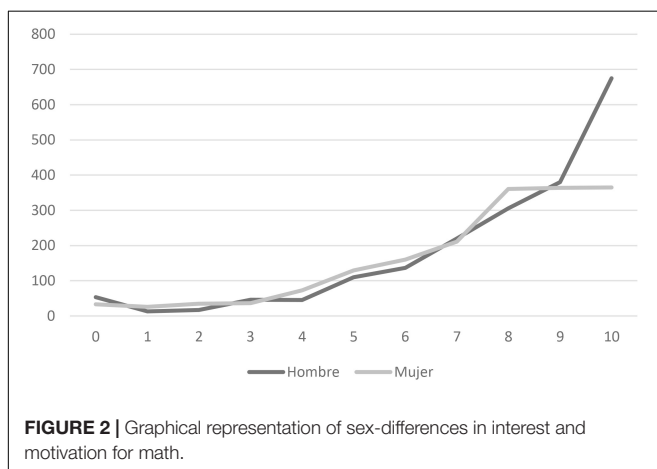
in various studies, may be more linked to results in specific sub-areas of math.

In addition, when comparing the results from boys and girls regarding self-efficacy about completing the test battery, there were statistically significant ($p < 0.001$) differences. Girls selected options 4–6 in the self-efficacy scale more than boys, and boys selected the higher score, 7–10, more than girls. The estimating function of the regression model has been: $\dot{Y} = 6.92 + 0.47X$. This is despite there being items in which each sex scored higher than the other. In education, beliefs of self-efficacy affect motivation, persistence, and school success (Zalazar et al., 2011; Rosário et al., 2012; Huéscar-Hernández et al., 2020), and there are also social factors (Ruiz, 2005).

The last variable analyzed was students' interest and motivation for math according to sex. The results were similar between the two sexes, except for the fact that more girls gave themselves scores of 8 than boys, and more boys gave themselves scores of 10 than girls, both statistically significant differences ($p < 0.001$). This was despite some girls outperforming boys, and some boys outperforming girls. The estimating function of the regression model has been: $\dot{Y} = 7.47 + 0.47X$. These results are in line with findings from other studies (Bazán and Aparicio, 2006; Molera, 2012; Instituto Nacional de Evaluación Educativa, 2013; Mato et al., 2014; Ministerio de Educación y Formación Profesional, 2019b). In addition, this issue may be affected by changes in educational stages, with the transition between primary and secondary school, when attitudes toward math increasingly decline (Mato et al., 2014) and there is the appearance of a lack of interest, motivation, value and faith in ones' own abilities (Mato, 2010).

Learning math makes educational sense when the knowledge learned in this area is used in the schoolchild's normal

schools, all students must have the same teaching and learning processes in equal conditions and with equal opportunities, avoiding the discrimination that occasionally coexists with the attempt to offer quality education (Gallardo-López et al., 2020). Differences between sexes may be avoided if suitable measures are put in place (Ministerio de Educación y Formación Profesional, 2019b). In this regard, educational tasks in the curriculum based on scientific-technical skills, such as STEAM (Science, Technology, Engineering, Art and Mathematics). May be an interesting option for encouraging equality between the sexes in the classroom (Crespo-García, 2019).

This is justified by the results from our study. There were statistically significant differences between the sexes in the participating sample. In almost all of the items of the Logical numerical series, and Conventional units sub-testes the boys exhibited higher scores. In contrast, girls scored higher in the items making up the Geometric properties test. In the analysis of the results according to each evaluation test, there are also differences between the sexes, with better results being observed for men in tests with arithmetic content and management of units of measurement, and for women in tests with geometric content. These effects may indicate that sex differences, noted

surroundings. In this regard, the value placed on math by the individual, and attitudinal factors are central in learning math. Pleasure in learning math leads to enjoyment for the learner, they perform well, and they find the content interesting (Tourón et al., 2012), as well as exhibiting better attitudes toward homework (Pan et al., 2013). In this way, educational practice must insist on the importance of these considerations or attitudes toward math, and be aware that occasionally the difference between the sexes can come from a discrepancy between what one does and what one could do, from the predisposition to learning rather than problems of attitude. It is unreasonable for the sex of schoolchildren to be a barrier to academic success in this subject. For the development of future research on sex using evaluation tests such as the one presented in this study, other variables could be included for a more exhaustive analysis such as, for example, academic performance, interest and motivation of the scholar toward Mathematics from the point of teaching view and / or academic self-concept. The number of questions for the collection of data related to the variables self-efficacy and interest and motivation in Mathematics will also be increased, with the aim of calculating internal consistency indices of the measurements made. We highlight some data to consider; 75.0% of undergraduates and 71.8% of graduates in Engineering and Architecture are men (Ministerio de Ciencia, Innovación y Universidades, 2019). In 2030 it is expected that 32% of women will reach tertiary education, and 27% of men. Currently the number of women aged 25–64 who have higher education qualifications is 15% higher than the number of men who have those qualifications in Spain (Ministerio de Educación y Formación Profesional, 2019a). Logically, the achievement of personal, social and school wellbeing is essential in educational processes.

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 National Institute of Educational Technologies and Teacher Training (INTEF), the National University of Distance Education (UNED), and the University of Castilla-La Mancha (UCLM). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

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The School Climate and Academic Mindset Inventory (SCAMI): Confirmatory Factor Analysis and Invariance Across Demographic Groups

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School climate is a multidimensional construct of the quality of a student's academic environment, often subsuming dimensions such as safety, instructional practices, social relationships, school facilities, and school connectedness. Positive school climate has beneficial effects on a wide range of adjustment variables in youth, including academic achievement, mental health, school attendance and graduation, and school-based behavior. Studies regarding school climate assessment have burgeoned in recent years but remain marked by limited sample sizes, narrow developmental levels, restricted items, unclear psychometric strength across multiple demographic groups, and lack of integration with key student education contextual factors such as academic mindset and social emotional learning. The present study evaluated a comprehensive measure of aspects of school climate, academic mindset, and social emotional learning in a sample of 105,379 diverse students (M_{age} = 13.47 years; SD = 2.47). The 9-factor structure of the School Climate and Academic Mindset Inventory was supported via confirmatory factor analysis. A trimmed model displayed adequate goodness-of-fit for males and females, younger age groups, and European American, biracial/multiracial, Hispanic, Native American, and Native Hawaiian/Pacific Islander students. The trimmed model was slightly less strong for older age groups as well as for African American and Asian American students. The scale may be useful for assessing school climate interventions, longitudinal climate patterns, and school-based algorithms of future performance, though additional validation of the scale remains necessary.

Keywords: school climate, school climate and academic mindset inventory, confirmatory factor analysis, academic mindset, social emotional learning

INTRODUCTION

School climate is a multidimensional construct of the "quality and character of school life" that reflects "norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures" in a youth-based academic environment (Cohen et al., 2009; Thapa and Cohen, 2017, pp. 303–304). Key dimensions of school climate include safety, instructional practices,

social relationships, school facilities, and school connectedness (Zullig et al., 2010). Other, related dimensions of school climate include community, equity, institutional or academic environment, leadership, and shared beliefs (Uline et al., 2010; Wang and Degol, 2016).

Dimensions of school climate have been further explicated in the literature. Safety refers to actual and perceived degree of relational aggression as well as respect for others, supportive environments, and clear rules and norms (Goldstein et al., 2008; Capp et al., 2020). Teaching and learning practices refer to quality of instruction, social emotional learning, and support for academic achievement (Gage et al., 2016). Social relationships refer to parent involvement, supportive relationships with important others such as peers and teachers at school, and respect for diversity (Bradshaw et al., 2014b; Gage et al., 2014). School facilities refer to the condition of the physical environment of an academic setting as well as availability of resources and supplies (Gislason, 2010). School connectedness refers to student affective attachment to the academic community, commitment to social and academic goals, and involvement in social and academic activities (García-Moya et al., 2019). Several of these dimensions overlap in definition and scope, most notably degree of support from the academic environment (Thapa et al., 2013; McMillan et al., 2017).

School climate has been linked to improved child and adolescent socioemotional and academic adjustment in many ways. Positive school climate has been associated with enhanced academic achievement, particularly among students from lower socioeconomic backgrounds (Berkowitz et al., 2017; Maxwell et al., 2017). In addition, positive or authoritative school climate is associated with various mental health benefits that include increased self-esteem, psychosocial wellbeing, and perceived quality of life as well as less depression, suicidal thoughts and behavior, substance use, and psychiatric problems (Thapa et al., 2013; Cornell and Huang, 2016; Aldridge and McChesney, 2018; Zullig et al., 2018). Positive school climate is also linked to academic behavioral outcomes such as less absenteeism, school dropout, suspensions, disciplinary referrals, and bullying and other violent school-based incidents (Kutsyuruba et al., 2015; Hendron and Kearney, 2016; Jia et al., 2016; Reaves et al., 2018). More broadly, positive school climate relates to enhanced teacher satisfaction, retention, efficacy, and productivity as well as less burnout (Berkowitz et al., 2017).

School climate enhancement has thus become a central aspect of broad-based school improvement strategies. Such efforts prominently include, for example, Positive Behavioral Interventions and Supports (PBIS), a systemic intervention to promote a positive school environment that includes appropriate student and teacher behavior (Sugai and Horner, 2002). Key aspects of PBIS include clearly articulated behavioral expectations, student incentives, positive student-teacher interactions, effective classroom management, and empirically based decision making (Bradshaw et al., 2014a). Efforts to improve school climate are typically integrated into multi-tiered systems of support models that focus in part on primary prevention practices to promote adaptive behavior and to deter maladaptive behavior (Lewis et al., 2017). PBIS implemented with fidelity relates to improvements

in academic performance, bullying, office discipline referrals, social emotional competencies, and student suspensions and expulsions (Bradshaw et al., 2010; Horner and Sugai, 2015; Freeman et al., 2016).

The importance of school climate to child and adolescent adjustment as well as to overall academic and behavioral outcomes mandates the need for comprehensive and psychometrically strong assessment measures for this construct, particularly for schools (Lindstrom Johnson et al., 2019). A full review of school climate assessments is beyond the scope of this article (for reviews, see Ramelow et al., 2015; Olsen et al., 2018). These measures focus primarily on various dimensions of school climate described earlier in addition to ancillary variables such as substance use, school-community relations, and school identification (e.g., Lee et al., 2017). Substantial variability exists across the measures with respect to school climate domains and how these domains are labeled (Shukla et al., 2019).

Despite the availability of instruments to measure school climate, researchers have noted shortcomings with respect to many of these measures and their associated psychometric properties (Ramelow et al., 2015; Olsen et al., 2018). First, many measures in this area are not particularly comprehensive, instead focusing on limited numbers of constructs and items related only to safety, student-teacher relationships, and connectedness (Berkowitz et al., 2017). Second, psychometric support for most school climate assessments is limited and is often based on restricted sample sizes and developmental levels (Wang and Degol, 2016). Third, important student-based contextual variables related to school climate are often neglected in these measurements (Konold, 2018). Examples include key academic mindset and social emotional learning competencies utilized by students in their academic endeavors (Rattan et al., 2015; Lawson et al., 2019). Theories of optimal school performance in children often integrate student-based contextual factors with school climate (Lee and Shute, 2010; Rudasill et al., 2018).

Academic mindsets refer to "beliefs, attitudes, or ways of perceiving oneself in relation to learning and intellectual work that support academic performance" (Farrington et al., 2012, p. 28). Such intrinsic motivational or non-cognitive factors, including academic tenacity or self-efficacy, relate closely to improved academic achievement across many demographic groups (Yeager and Dweck, 2012; Dweck et al., 2014). Organizational learning variables that can include a positive school climate correlate significantly with a growth mindset culture among students (Hanson et al., 2016). Mechanisms for this relationship may include enhanced student sense of contextual fairness as well as solidarity or belongingness at school, incentives for academic performance, trust in authorities, and transmission of mindset beliefs by teachers (Thomas et al., 2019).

Social emotional learning competencies, sometimes integrated with the teaching and learning practices domain of school climate, refer broadly to skills regarding self-awareness, self-management, social awareness, relationships, and responsible decision-making (Durlak et al., 2015). Social emotional learning practices can help produce adaptive academic mindsets via (1) explicit instruction in interpersonal, emotional, and cognitive

skills, (2) ample school-based opportunities to use these skills, and (3) effective classroom management and discipline approaches (Darling-Hammond and Cook-Harvey, 2018). Efforts to enhance school climate often include social-emotional learning practices to promote safe contexts to develop these skills and to boost student engagement (Corcoran et al., 2018).

The aim of the present study was to evaluate a comprehensive measure of aspects of school climate, academic mindset, and social emotional learning in a very large sample of diverse students. The study was designed in part to help address drawbacks associated with extant measures in this area such as restricted comprehensiveness and sample size, limited psychometric strength across multiple demographic groups, and lack of integration with key contextual factors related to student learning. Specifically, the present study examined the adjustment and reliability of a districtwide 9-factor, 66-item measure of school climate and academic mindset (School Climate and Academic Mindset Inventory; SCAMI) among tens of thousands of elementary, middle, and high school students. The primary hypothesis was that the original 9-factor model representing these constructs (i.e., parent involvement and support, academic mindset, social emotional learning, safety, physical safety, bullying, physical environment and resources, respect for diversity, and perceptions of school performance) would be supported via confirmatory factor analysis. In addition, factorial invariance across multiple demographic groups was expected. Model trimming was implemented as needed.

MATERIALS AND METHODS

Participants

Participants included 4th–12th grade students ($n = 105,379$) in a large urban school district in the United States. Participants were slightly more female (50.1%), aged 9–21 years ($M = 13.47$; $SD = 2.47$), and Hispanic/Latino (45.5%), European American (27.7%), African American (10.3%), Asian (8.2%), biracial/multiracial (6.3%), Native Hawaiian/Pacific Islander (1.6%), and American Indian/Alaska Native (0.4%). Distribution by age group follows: 9–11 years (39,860), 12–14 years (27,116), 15–16 years (21,590), 17–18 years (16,228), and >18 years (585). Participants voluntarily completed an online survey of the measure described next during the spring semester of the 2016–2017 academic year. The survey was posted publicly by the school district and via social media, but the largest contingent of students completed the measure at their school. Each school was encouraged to survey 75% of their population, but the overall response rate is unknown.

Measure and Data Analyses

Original subscales and associated items are in **Table 1**. Subscales ($n = 9$) included Parent Involvement and Support, Academic Mindset, Social Emotional Learning, Safety, Physical Safety, Bullying, Physical Environment and Resources, Respect for Diversity, and Perceptions of School Performance. Items were

derived by the school district via original development, a state department of education, and the University of Chicago Consortium on School Research (academic mindset questions). Items are scored in variable fashion (**Table 1**).

The subscales had different Likert-type scales, so raw data were lineally transformed to obtain scores on a 0–100 scale (see Vilagut et al., 2005). Items were reversed-scored as needed. Confirmatory factor analyses (CFA) were then performed to analyze models that could be adjusted to the data: 0-factor model, 1-factor model, original 9-factor model (with correlated and uncorrelated factors), a trimmed 9-factor model (with correlated and uncorrelated factors), and a trimmed 9-factor model with a second-order factor (with correlated and uncorrelated factors). A trimmed 9-factor model was obtained by analyzing item saturation in each of the factors, keeping the theoretical meaning of the items inside the respective factors and the modification indices (Leung et al., 2013; Gonzálvez et al., 2016; Gómez-Núñez et al., 2020). Mardia's coefficient of the total sample was above the 5 points established as multivariate normality in the data (1,122.76), so the Robust Maximum Likelihood (RML) and Satorra-Bentler χ^2 scaled (S-Bχ^2) were applied (Bentler, 2005). To identify extreme cases with respect to multivariate kurtosis, the method that was employed was the analysis of the five cases automatically provided by EQS that contribute most to the normalized multivariate kurtosis estimate. The criterion used was the comparison between the estimate presented for one case relative to the estimate of the other four cases. This method was implemented until the five estimates of the final sample were included in the same range of values and none was distinctively different from the others (Byrne, 2008).

Four goodness-of-fit indices were examined for the models: robust root mean square error of approximation (R-RMSEA), standardized root mean square residual (SRMR), robust comparative fit index (R-CFI), and Tucker Lewis index (TLI). Acceptable goodness-of-fit in this study was defined as rounded SRMR and R-RMSEA values of <0.08 and R-CFI and TLI values of 0.90+ (Hu and Bentler, 1999; Brown, 2006). In addition, the upper end of the R-RMSEA 90% confidence interval should be <0.10 (Kline, 2005). Subscale reliability of the best-fitting model was evaluated via Cronbach's alpha and Omega coefficients (McDonald, 1999).

Multigroup confirmatory factor analyses were performed to test factorial invariance of the chosen model (configural, measurement, and structural invariance) across gender, age group (9–11, 12–14, 15–16, 17–18, 18+ years) and ethnic group (Hispanic/Latino, European American, African American, Asian, Biracial/Multiracial, Native Hawaiian/Pacific Islander, and American Indian/Alaska Native). Mardia's coefficients were elevated, so the S-Bχ^2 and the robust indices mentioned above were used to include certain groups in the invariance analyses and determine the adequacy of the nested models that are part of the invariance analyses. An invariance criterion (ΔR-CFI > -0.01) was also utilized to accept nested models (Byrne, 2008). Statistical analyses were calculated using SPSS, Amos 23, and EQS 6.1.

TABLE 1 | School Climate and Academic Mindset Inventory items (original model).

Item	Key	Subscale
My parents feel welcome to come to my school	1 = strongly disagree	Parent Involvement and Support
This school involves parents in most school events or activities	2 = disagree	
My parents know what goes on inside my school	3 = agree	
	4 = strongly agree	
My intelligence is something that I can't change very much	1 = not at all true	Academic Mindset
Challenging myself won't make me any smarter	2 = a little true	
There are some things I am not capable of learning	3 = somewhat true	
If I am not naturally smart in a subject, I will never do well in it	4 = mostly true	
I don't participate in discussions because I am afraid people might think I am foolish	5 = completely true	
I would rather do easy work that I can do well than challenging work where I might learn more*		
I don't ask questions in class because people might think my questions are not smart		
I stop doing work if I feel like I can't do it well*		
I only volunteer to answer a question if I am sure my answer is right		
Do the readings or other assigned work to prepare for class?	1 = never	
Turn in assignments on the due date?	2 = once in a while	
Actively participate in class?	3 = about half the timey	
Have all of your class materials with you?	4 = most of the time	
Do more than what is expected of you?	5 = always	
Knowing what my strengths are*	1 = very difficult	Social Emotional Learning
Knowing ways I calm myself down*	2 = difficult	
Knowing the emotions I feel*	3 = easy	
Knowing when my feelings are making it hard for me to focus*	4 = very easy	
Knowing what people may be feeling by the look on their face*		
Learning from people with different opinions than me*		
Knowing when someone needs help*		
Getting through something even when I feel frustrated		
Being patient even when I am really excited		
Finishing tasks even if they are hard for me		
Setting goals for myself		
Doing my schoolwork even when I do not feel like it		
Being prepared for tests		
Getting along with my classmates*		
Respecting a classmate's opinions during a disagreement*		
Thinking about what might happen before making a decision*		
Knowing what is right or wrong*		
This school is safe	1 = strongly disagree	Safety
Students feel safe in this school	2 = disagree	
This school has safety procedures that work	3 = agree	
Students know what to do if there is an emergency during school	4 = strongly agree	
This school encourages me to have healthy habits (ex., physical activity or nutrition)		
I sometimes stay home because I don't feel safe at this school	1 = strongly disagree	Physical Safety
Students at this school threaten to hurt other students	2 = disagree	
Students at this school damage or destroy other students' property	3 = agree	
	4 = strongly agree	
This school does a good job to prevent bullying	1 = strongly disagree	Bullying
Students in this school are teased about their clothing or physical appearance	2 = disagree	
Bullying is a problem at this school	3 = agree	
Cyberbullying is a problem at this school	4 = strongly agree	
Students in this school are teased or put down because of their race or ethnicity		
In my experience, at this school everything works or gets fixed quickly	1 = strongly disagree	Physical Environment and Resources
This school is clean	2 = disagree	

(Continued)

TABLE 1 | Continued

Item	Key	Subscale
The heating and air conditioning work well at this school	3 = *agree*	
The technology (computers, iPads, mobile devices, etc.) works well at this school	4 = *strongly agree*	
The equipment and facilities at this school work well		
School staff treat students with respect, regardless of differences like race, ethnicity, gender, or disability	1 = *strongly disagree*	Respect for Diversity
	2 = *disagree*	
This school encourages an appreciation of student diversity and respect for each other	3 = *agree*	
School staff encourages all students to take challenging courses no matter their race, ethnicity, gender, or disability	4 = *strongly agree*	
Student treat other students with respect, regardless of differences like race, ethnicity, gender, or disability		
My school encourages me to be courteous and respectful toward others		
At my school, my teachers tell me how I am doing in my classes	1 = *strongly disagree*	Perceptions of School Performance
This school promotes academic success for all students	2 = *disagree*	
I am learning with technology such as computers, mobile devices and the Internet at this school	3 = *agree*	
I like my school*	4 = *strongly agree*	
I am getting a good education at this school		
Help is available at this school if I have trouble with my schoolwork		
Teachers understand my problems		
My teachers care about me*		
If I am absent, there is a teacher or some other adult at school that will notice my absence		

Removed items in trimmed model.

RESULTS

Confirmatory Factor Analyses and Reliability

Results from the CFAs are in **Table 3**. The 0-factor, 1-factor, and original 9-factor model with and without correlated factors did not meet criteria for adequate goodness-of-fit. Model trimming then consisted of removing 15 items whose factor loadings were <0.40 (noted in **Table 1**). These items included 2 from academic mindset, 11 from social emotional learning, and 2 from perceptions of school environment. Errors were correlated to improve model fit. No items were removed from the other subscales, and no items were moved from one subscale to another (**Table 2**). Removal of these 15 items produced a trimmed 9-factor 51-item model for the SCAMI with and without correlated factors that was not supported by all goodness-of-fit indices. A new trimmed 9-factor model dividing factor 2 (academic mindset) into a second-order factor was proposed (**Table 3**). The trimmed 9-factor model with a second-order factor with correlated factors met criteria for adequate goodness-of-fit (R-RMSEA = 0.034, 90% confidence interval: 0.34–0.34; SRMR = 0.047; R-CFI = 0.908; TLI = 0.901).

Factor loadings of the trimmed 9-factor model with one second-order factor with correlated factors ranged from 0.43–0.83. Internal consistency coefficients (Cronbach's alpha/Omega/Composite reliability/Average Variance Extracted) were calculated for each subscale: Parent involvement and Support (0.61/0.61/0.61/0.35), Academic Mindset (0.75/0.87/0.87/0.37), Social Emotional Learning (0.75/0.76/0.76/0.35), Safety (0.84/0.83/0.83/0.50), Physical Safety (0.72/0.74/0.74/0.50), Bullying (0.81/0.80/0.80/0.45),

Physical Environment and Resources (0.78/0.78/0.78/0.41), Respect for Diversity (0.79/0.80/0.80/0.45), and Perceptions of School Performance (0.83/0.84/0.84/0.42).

Factorial Invariance Across Demographic Groups

Factorial invariance of the trimmed 9-factor model with one second-order factor was examined across several demographic groups. A baseline model (Model 0) without constraints was initially established; factor loadings of first order (Model 1) and second order (Model 2) models were then imposed to obtain metric invariance. In addition, intercept constraints were added to Model 2 and the strong or scalar invariance (Model 3) was obtained. Factor loadings (first and second order), intercepts, and variances and covariances of errors were constrained to test strict invariance (Model 4). Finally, covariances of the factors were constrained in Model 2 to test structural invariance (Model 5).

Regarding invariance across gender, the trimmed model displayed adequate goodness-of-fit criteria for males and females (TLI and R-CFI > 0.90; R-RMSEA < 0.05; SRMR < 0.08; ΔR-CFI values > −0.01) (**Table 4**). Measurement and structural invariance were thus confirmed (adequate goodness-of-fit indexes values and ΔR-CFI > −0.01 for all tested models). Regarding invariance across age, the trimmed model displayed adequate goodness-of-fit criteria for younger age groups: 9–11 years and 12–14 years (TLI and R-CFI > 0.90; R-RMSEA < 0.05; SRMR < 0.08) (**Table 3**) but less so for older age groups: 15–16 years (R-RMSEA = 0.037, 90% confidence interval: 0.37–0.37; SRMR = 0.049; R-CFI = 0.894; TLI = 0.886); 17–18 years (R-RMSEA = 0.040, 90% confidence interval: 0.39–0.40; SRMR = 0.054; R-CFI = 0.884; TLI = 0.875);

TABLE 2 | School Climate and Academic Mindset Inventory items (trimmed model).

Item	Key	Subscale
My parents feel welcome to come to my school	1 = *strongly disagree*	Parent Involvement and Support
This school involves parents in most school events or activities	2 = *disagree*	
My parents know what goes on inside my school	3 = *agree*	
	4 = *strongly agree*	
My intelligence is something that I can't change very much	1 = *not at all true*	Academic Mindset
Challenging myself won't make me any smarter	2 = *a little true*	
There are some things I am not capable of learning	3 = *somewhat true*	
If I am not naturally smart in a subject, I will never do well in it	4 = *mostly true*	
I don't participate in discussions because I am afraid people might think I am foolish	5 = *completely true*	
I don't ask questions in class because people might think my questions are not smart		
I only volunteer to answer a question if I am sure my answer is right		
Do the readings or other assigned work to prepare for class?	1 = *never*	
Turn in assignments on the due date?	2 = *once in a while*	
Actively participate in class?	3 = *about half the time*	
Have all of your class materials with you?	4 = *most of the time*	
Do more than what is expected of you?	5 = *always*	
Getting through something even when I feel frustrated	1 = *very difficult*	Social Emotional Learning
Being patient even when I am really excited	2 = *difficult*	
Finishing tasks even if they are hard for me	3 = *easy*	
Setting goals for myself	4 = *very easy*	
Doing my schoolwork even when I do not feel like it		
Being prepared for tests		
This school is safe	1 = *strongly disagree*	Safety
Students feel safe in this school	2 = *disagree*	
This school has safety procedures that work	3 = *agree*	
Students know what to do if there is an emergency during school	4 = *strongly agree*	
This school encourages me to have healthy habits (ex., physical activity or nutrition)		
I sometimes stay home because I don't feel safe at this school	1 = *strongly disagree*	Physical Safety
Students at this school threaten to hurt other students	2 = *disagree*	
Students at this school damage or destroy other students' property	3 = *agree*	
	4 = *strongly agree*	
This school does a good job to prevent bullying	1 = *strongly disagree*	Bullying
Students in this school are teased about their clothing or physical appearance	2 = *disagree*	
Bullying is a problem at this school	3 = *agree*	
Cyberbullying is a problem at this school	4 = *strongly agree*	
Students in this school are teased or put down because of their race or ethnicity		
In my experience, at this school everything works or gets fixed quickly	1 = *strongly disagree*	Physical Environment and Resources
This school is clean	2 = *disagree*	
The heating and air conditioning work well at this school	3 = *agree*	
The technology (computers, iPads, mobile devices, etc.) works well at this school	4 = *strongly agree*	
The equipment and facilities at this school work well		
School staff treat students with respect, regardless of differences like race, ethnicity, gender, or disability	1 = *strongly disagree*	Respect for Diversity
This school encourages an appreciation of student diversity and respect for each other	2 = *disagree*	
School staff encourages all students to take challenging courses no matter their race, ethnicity, gender, or disability	3 = *agree*	
Student treat other students with respect, regardless of differences like race, ethnicity, gender, or disability	4 = *strongly agree*	
My school encourages me to be courteous and respectful toward others		
At my school, my teachers tell me how I am doing in my classes	1 = *strongly disagree*	Perceptions of School Performance
This school promotes academic success for all students	2 = *disagree*	
I am learning with technology such as computers, mobile devices and the Internet at this school	3 = *agree*	

(Continued)

TABLE 2 | Continued

Item	Key	Subscale
I am getting a good education at this school	4 = strongly agree	
Help is available at this school if I have trouble with my schoolwork		
Teachers understand my problems		
If I am absent, there is a teacher or some other adult at school that will notice my absence		

TABLE 3 | Goodness-of-fit indices for proposed models.

	S-Bχ^2	df	R-RMSEA 90% CI	SRMR	R-CFI	TLI
0-factor model	2051321.19	2145	0.095 [0.095,0.095]	0.225	0.000	0.000
1-factor model	841569.57	2079	0.062 [0.062,0.062]	0.079	0.590	0.577
Original 9-factor model with non-correlated factors	706350.10	2079	0.057 [0.057,0.057]	0.193	0.656	0.645
Original 9-factor model with correlated factors	339922.74	2043	0.040 [0.040,0.040]	0.056	0.835	0.827
Trimmed 9-factor model with non-correlated factors	585501.18	1221	0.067 [0.067,0.068]	0.214	0.634	0.617
Trimmed 9-factor model with correlated factors	221087.08	1185	0.042 [0.042,0.042]	0.058	0.862	0.852
Trimmed 9-factor model with one second-order factor with non-correlated factors	515599.04	1218	0.063 [0.063,0.063]	0.212	0.678	0.662
Trimmed 9-factor model with one second-order factor with correlated factors	148025.13	1182	0.034 [0.034,0.034]	0.047	0.908	0.901

p < 0.001 for S-Bχ^2 in all cases. S-Bχ^2 = Satorra-Bentler scaled χ^2; df = degrees of freedom; R-RMSEA = robust root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean square residual; R-CFI = robust comparative fit index; TLI = Tucker Lewis Index.

TABLE 4 | Goodness-of-fit indices for invariance of the trimmed model across gender.

	χ^2	S-Bχ^2	df	TLI	R-CFI	R-RMSEA	SRMR	ΔR-CFI
Male	91026.93	72675.50	1182	0.900	0.904	0.034 [0.034, 0.034]	0.049	
Female	97394.50	78792.53	1182	0.903	0.910	0.035 [0.035, 0.035]	0.046	
Model 0	188421.42	151427.68	2364	0.900	0.907	0.024 [0.024, 0.025]	0.048	
Model 1	189471.73	152657.94	2412	0.901	0.906	0.024 [0.024, 0.024]	0.049	−0.001
Model 2	189641.89	152816.94	2415	0.901	0.906	0.024 [0.024, 0.024]	0.049	0.000
Model 3	199691.90	162146.73	2466	0.900	0.907	0.025 [0.025, 0.025]	0.049	0.001
Model 4	211280.97	170001.21	2523	0.900	0.902	0.025 [0.025, 0.025]	0.051	−0.005
Model 5	200555.12	162554.53	2502	0.901	0.906	0.025 [0.025, 0.025]	0.049	−0.001

Model 0 = free model; Model 1 = Model 0 with factor loadings of first-order; Model 2 = Model 1 with factor loadings of second order; Model 3 = Model 2 with intercepts; Model 4 = Model 3 with error variances and covariances; Model 5 = Model 3 with factor covariances; S-Bχ^2 = Satorra-Bentler χ^2 scaled; df = degrees of freedom; TLI = the Tucker-Lewis Index; R-CFI = robust comparative fit index; R-RMSEA = robust root mean square error of approximation; SRMR = standardized root mean square residual; ΔR-CFI = robust comparative fit index difference test.

18+ years (R-RMSEA = 0.039, 90% confidence interval: 0.37–0.42; SRMR = 0.073; R-CFI = 0.891; TLI = 0.883). Factorial invariance was thus tested for the younger age groups; adequate goodness-of-fit criteria were met and all ΔR-CFI > −0.01 (**Table 5**). Measurement and structural invariance were thus confirmed.

Regarding invariance across ethnic group, the trimmed model displayed adequate goodness-of-fit criteria for European American, Biracial/Multiracial, Native Hawaiian/Pacific Islander, Hispanic, and American Indian/Alaska Native students (TLI and R-CFI > 0.90; R-RMSEA < 0.05; SRMR < 0.08) (**Table 6**). Goodness-of-fit was less strong for African-American (R-RMSEA = 0.034, 90% confidence interval: 0.34–0.35; SRMR = 0.052; R-CFI = 0.902; TLI = 0.894) and Asian American (R-RMSEA = 0.036, 90% confidence interval: 0.35–0.36; SRMR = 0.047; R-CFI = 0.900; TLI = 0.888) students. Metric invariance was not confirmed (TLI < 0.90 and SRMR > 0.08 for Model 2; factorial invariance analyses were thus halted).

DISCUSSION

The present study examined the adjustment and reliability values of a 9-factor, 66-item measure of school climate and academic mindset among a very large sample of elementary, middle, and high school students. Confirmatory factor analysis supported the proposed factor structure of the School Climate and Academic Mindset Inventory (SCAMI) (i.e., Parent Involvement and Support, Academic Mindset, Social Emotional Learning, Safety, Physical Safety, Bullying, Physical Environment and Resources, Respect for Diversity, and Perceptions of School Performance). Coefficient values were adequate for all subscales (Taber, 2018). Model trimming to arrive at satisfactory goodness-of-fit indices included the removal of items from academic mindset (2 items), social emotional learning (11 items), and perceptions of school environment (2 items). Six other subscales retained their full item integrity and no items shifted from one factor to another. Removed items may constitute supplementary items to be used

TABLE 5 | Goodness-of-fit indices for invariance of the trimmed model across age.

	χ^2	S-Bχ^2	df	TLI	R-CFI	R-RMSEA	SRMR	∆R-CFI
9–11 years	52629.06	42181.28	1182	0.910	0.917	0.030 [0.029, 0.030]	0.040	
12–14 years	49769.53	40101.60	1182	0.900	0.904	0.035 [0.035, 0.035]	0.046	
Model 0	102398.60	82288.41	2364	0.904	0.911	0.022 [0.022, 0.023]	0.044	
Model 1	103865.77	83586.59	2412	0.905	0.910	0.022 [0.022, 0.023]	0.051	−0.001
Model 2	104034.29	83732.25	2415	0.905	0.910	0.022 [0.022, 0.023]	0.051	0.000
Model 3	120179.21	97916.29	2466	0.900	0.902	0.024 [0.024, 0.024]	0.053	−0.008
Model 4	128118.79	1009211.70	2523	0.904	0.910	0.025 [0.025, 0.025]	0.053	0.008
Model 5	121071.88	98409.56	2502	0.900	0.902	0.024 [0.024, 0.024]	0.051	0.000

Model 0 = free model; Model 1 = Model 0 with factor loadings of first-order; Model 2 = Model 1 with factor loadings of second order; Model 3 = Model 2 with intercepts; Model 4 = Model 3 with error variances and covariances; Model 5 = Model 3 with factor covariances; S-Bχ^2 = Satorra-Bentler χ^2 scaled; df = degrees of freedom; TLI = the Tucker-Lewis Index; R-CFI = robust comparative fit index; R-RMSEA = robust root mean square error of approximation; SRMR = standardized root mean square residual; ∆R-CFI = robust comparative fit index difference test.

TABLE 6 | Goodness-of-fit indices for invariance of the trimmed model across ethnic group.

	χ^2	S-Bχ^2	df	TLI	R-CFI	R-RMSEA	SRMR	∆R-CFI
European American	56198.61	45105.27	1182	0.902	0.909	0.036 [0.035, 0.036]	0.045	
Biracial/Multiracial	13515.08	10854.09	1182	0.900	0.908	0.035 [0.035, 0.036]	0.047	
Native Hawaiian/Pacific Islander	4401.75	3517.27	1182	0.900	0.907	0.034 [0.033, 0.035]	0.054	
Hispanic	80159.60	64407.09	1182	0.902	0.909	0.033 [0.033, 0.034]	0.048	
American Indian/Alaska Native	2182.76	1769.76	1182	0.911	0.917	0.034 [0.030, 0.037]	0.065	
Model 0	156457.79	125759.75	5910	0.903	0.910	0.015 [0.015, 0.0015]	0.052	
Model 1	157851.85	127360.183	6102	0.905	0.909	0.015 [0.015, 0.0015]	0.057	−0.001
Model 2	175979.56	142085.91	6114	0.894	0.900	0.016 [0.016, 0.0016]	0.082	−0.009

Model 0 = free model; Model 1 = Model 0 with factor loadings of first-order; Model 2 = Model 1 with factor loadings of second order; S-Bχ^2 = Satorra-Bentler χ^2 scaled; df = degrees of freedom; TLI = the Tucker-Lewis Index; R-CFI = robust comparative fit index; R-RMSEA = robust root mean square error of approximation; SRMR = standardized root mean square residual; ∆R-CFI = robust comparative fit index difference test.

with caution. The subscale of Parent Involvement and Support demonstrated lower internal consistency and should also be used with caution.

In addition, the trimmed model displayed adequate goodness-of-fit for males and females, younger age groups, and European American, biracial/multiracial, Hispanic, Native American, and Native Hawaiian/Pacific Islander students. The trimmed model was slightly less strong for older age groups as well as for African American and Asian American students. School climate may be impacted by less social trust in later adolescence as well as differential discrimination among racial groups and percentage of minority students at a given school, which may have affected the results (Flanagan and Stout, 2010; Wang et al., 2014; Wang and Atwal, 2015). Factorial invariance analyses revealed that the SCAMI had an equivalent factor structure by gender and younger age groups. The constructs that the SCAMI is assessing can thus be viewed as comparable between males and females and individuals aged 9–11 and 12–14 years.

The assessment of school climate continues to evolve, and one advantage of the SCAMI is the inclusion of contextual variables utilized by students in their school-based endeavors, most notably academic mindset and social emotional learning factors. The scale allows researchers and school officials to more compactly study the relationship between various aspects of school climate and these associated variables, which is a burgeoning focus of the climate literature (Allbright et al., 2019).

Researchers, for example, can use the scale in conjunction with grades and standardized test scores to better understand the specific mechanisms by which school climate leads to improved academic achievement (Cornell et al., 2016). In addition, educators and school-based mental health professionals could use the scale to identify schools, classrooms, and even individual students that may require additional support or services to enhance climate and, by extension, academic performance and well-being (Cleveland and Sink, 2017). The scale could be used to identify non-instructional targets of change in an academic environment (Zullig et al., 2010). The SCAMI could also be utilized as part of school climate improvement efforts within the context of multi-tiered systems of support models (James et al., 2018). In these models, Tier 1 system-wide strategies focus heavily on universal or primary prevention practices to promote adaptive behavior and deter maladaptive behavior, often via enhancement of positive school climate, adaptive mindsets, social-emotional competencies, well-managed and engaged classroom behavior, and successful academic performance (Voight and Nation, 2016). The SCAMI can be a practical tool for evaluating many aspects of Tier 1 intervention. In addition, the scale could help districts leverage limited resources by serving as a needs assessment to identify schools most in need of Tier 1 intervention to enhance school climate (Wang and Degol, 2016). This process could occur longitudinally as well to examine patterns of change over time or across grade and developmental levels (László et al., 2019).

Other tiers in a multi-tiered systems of support model include escalating interventions to address emerging (Tier 2) and later chronic and severe (Tier 3) academic, behavioral, social, and emotional problems (McIntosh and Goodman, 2016). The SCAMI may be utilized to help identify demarcations between these tiers so that schools have better benchmarks for shifting and intensifying the use of resources (Berkowitz, 2019). In addition, the scale may be helpful as part of an algorithm with other known benchmarks such as absenteeism, office discipline referrals, and course grades to help predict long-term outcomes such as school dropout (Kotok et al., 2016; Kearney et al., 2019).

Results from the present study also help confirm the substance of domains commonly ascribed to school climate. Dimensions of school climate are generally considered to be malleable in nature, with little agreement on specific labels among researchers except for wide-ranging relational and safety components (Grazia and Molinari, 2020). Several of the SCAMI school climate subscales can be broadly grouped into relational (parent involvement and support, respect for diversity, perceptions of school performance) and safety (physical safety, bullying) domains. Condition of school facilities, another common element of school climate assessment, is represented as well (Berman et al., 2018). A key advantage of the SCAMI is the presence of multiple items for each of these specific domains.

Limitations of the present study should be noted. First, the measure evaluated here (SCAMI) was derived from a prefabricated survey utilized by the school district involved in the present study. As such, the evaluation of the measure is more data-based than theory-based, and one primary geographical location was involved. In addition, less control was exercised over its distribution, with an unknown number completing the measure at home or school, which may have affected the internal consistency of some of the subscales. Second, the scale was based on student report despite the fact that school climate can affect youth, parents, and teachers, each of whom may evaluate climate differently (Ramsey et al., 2016). Student-based reports and inventories do have advantages, however, including practicality, compliance, and assessment of internalizing variables such as mindset (Yeager et al., 2016). Third, deeper student groupings, such as those with disabilities or mental health problems, were not feasible. Perceptions of school climate may differ among these student groups (La Salle et al., 2018). Finally, the scale was administered only in English; measuring school climate among Spanish-speaking and other-language students should be a future priority (Rocha et al., 2019).

CONCLUSION

Despite these limitations, the evaluation of the SCAMI represents one of the largest and most diverse sample sizes with respect to school climate assessment. The results illustrated the adjustment and reliability values of the measure as well as factorial invariance across multiple demographic groups. Future work should focus on expansion of psychometric testing in other geographical regions, further validation, and multilevel modeling to explore individual and collective perceptions of school climate. In addition, the scale's utility for assessing school climate interventions and longitudinal patterns, as well as its value within a multi-tiered systems of support model, should be fully evaluated. Finally, linking findings from the scale to other key school variables such as absenteeism, academic performance, social-emotional competency development, and relational aggression may be instructive.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by UNLV IRB. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors revised and approved the submitted version. CK collected the data, wrote the manuscript, and supervised the study. RS and CG performed the analyses and assisted in writing of the manuscript.

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Training Inhibition and Social Cognition in the Classrooms

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Executive functions and social cognition competences are associated with many important areas of life, such as school readiness, academic success or sociability. Numerous intervention programs aiming to improve these capacities have emerged and have been shown to be effective. As inhibition in particular, is closely related with social cognition competences, we developed a training program that targets both abilities and implemented it in kindergarten and lower primary school classes for 6 months. We evaluated its effectiveness at improving inhibition and social cognition as well as its possible impact on academic performance. The results showed that tackling inhibition and social cognition in the classroom at an early age improved inhibition, visual attention and flexibility as well as Theory of Mind and social information processing skills. However, the impact on academic learning was weak; a slight effect on a mathematical task was observed.

Keywords: executive functions, inhibition, social cognition, Theory of Mind, social information processing, training

INTRODUCTION

In children, executive functions (EF) allow them to control their behavior and their attention (Espy, 2004; Burgess and Simons, 2005; Riggs et al., 2006b). For example, thinking before acting rather than acting impulsively, delaying the arrival of a reward (being able to wait longer for a bigger reward instead of getting a smaller reward directly) and/or resist temptations (being able to wait for the parents' authorization during the aperitif to start eating). EFs also allows children to focus and maintain their attention on a task while resisting distractions during school lessons. This allows them to stay focused on what the teacher says or on the task at hand, but also remember and follow instructions correctly. That way they are able to take turns, not reacting impulsively in the playground, etc. EFs play a role not only at the level of ability to concentrate, but also at the behavioral level: they act as a true regulator of behavior (Anderson, 2002). Typically, three main components of EFs are distinguished: working memory, inhibitory control, and cognitive flexibility (Miyake et al., 2000; Diamond, 2013). Yet, according to Diamond (2013) the two basic EF are inhibition and WM while flexibility would build on these two EF and develop much later (Davidson et al., 2006).

These abilities are associated with many areas of life, e.g., school readiness (Blair, 2002) academic success (Miyake et al., 2000; Duckworth and Seligman, 2005; Duncan et al., 2007; Loosli et al., 2012) achievement, health, wealth (Moffitt et al., 2011) sociability (Hughes and Dunn, 1998), and behavior (Anderson, 2002; Pauli-Pott and Becker, 2011). As it seems important for children to be equipped with strong EF, several programs have been developed to improve it, each of them being centered

on some specific EF, such as working memory (Klingberg et al., 2005; Thorell et al., 2009) attention (Rueda et al., 2005; Tamm et al., 2013) or inhibition/control capacities (Diamond et al., 2007; Tominey and McClelland, 2011; Röthlisberger et al., 2012; Volckaert and Noël, 2015, 2016). These experimental studies have shown that EF can be improved Diamond and Ling (2016) through training. In this study, we decided to focus our intervention mainly on inhibition. Indeed, although working memory plays an important role in learning and many programs have been developed to enhance these capacities, results of these interventions are quite disappointing. For instance, Melby-Lervåg and Hulme (2013) concluded their meta-analytic review of this topic by saying that memory training programs have only short-term and specific effects that do not generalize. Otherwise, Honoré and Noël tested both the well-known Cogmed program (Honoré and Noël, 2017) and another program of their own (Honoré and Noël, 2017) to enhance preschoolers working memory capacities. They found some small signs of memory improvements and barely any impact on arithmetic skills. More importantly, inhibition is a key dimension that underlies the other executive functions. In particular, inhibition is in the service of WM both by controlling goal-irrelevant information and preventing them to enter in WM and by suppressing any information in memory that is no more relevant (Halperin et al., 1999). Inhibition is also in service of flexibility as for switching from one task or one dimension to another this requires to inhibit the tendency to stay on the former task or process the former dimension.

Moreover, learning would involve both the acquisition of new knowledge of increasing complexity and the ability to resist to the interference created by the previous knowledge. For instance, in the numerical domain, the pupil first learn natural numbers and the fact that 5 is smaller than 7. Later on, the student learns rational numbers. Then, when comparing fractions for instance, such as 1/5 and 1/7, he/she has to inhibit the previous knowledge on natural numbers to correctly judge that 1/5 is larger than 1/7 (Stafylidou and Vosniadou, 2004).

This is been evidenced for instance, in reading (Ahr et al., 2016) or in number conservation or class-inclusion tasks (Borst et al., 2012). More globally, young children's inhibitory control capacities are significantly related to their academic skills, as shown in the meta-analysis of Allan et al. (2014). Finally, in previous research, we have developed a program to enhance inhibition in young children and have observed significant improvement both on inhibition capacities but also on WM and attention (Volckaert and Noël, 2015) as well as children' behavior.

Diamond et al. (2007) have revealed that stimulating EF within the school, and more specifically inhibition, leads children to greater academic success. Indeed, on the one hand at preschool, EFs are malleable which favors their stimulation (Sasser et al., 2017). On the other hand integrate EF program at school allows for much more intensive stimulation than when it is a program including only a few sessions.

Several researches have shown that inhibition is not independent from socio-emotional competences (SEC) (Carlson et al., 2004; Henning et al., 2010). SEC include emotional regulation, social adaptation and social cognition skills. Social

cognition refers to two major models, Theory of Mind (Premack and Woodruff, 1978; Flavell, 1999) and Social Information Processing (Crick and Dodge, 1994). The first of these focuses on the child's knowledge about mental states such as desires, beliefs, perceptions, knowledge, thoughts, intentions and emotions, and on his/her capacity to attribute mental states to others and to link them to their behaviors. The second describes the mental process involved when a child faces critical social situations and distinguishes five successive steps (Yeates et al., 2007): encoding process (encoding of relevant information), representation process (interpretation of the information), response search process (choice of desired goal), response decision process (choice of a response in line with the goal) and enactment process (behavioral response). Having good ToM (Crick and Dodge, 1994; Deneault et al., 2011; Deneault and Ricard, 2013) and SIP (Yeates et al., 2007; Nader-Grosbois, 2011) skills contributes to good social adaptation. Social cognition training programs have also been developed and proved to be effective at enhancing ToM and SIP competences. For example, after a ToM training, children's level of socio-emotional competences increased (Izard et al., 2008; Webster-Stratton et al., 2011). An improvement in social problem solving was also found after a training program in which children discussed stories about peer interactions and performed related activities or after children had been involved in role playing (Bhavnagri and Samuels, 1996; Webster-Stratton et al., 2011). Recently, Houssa and Nader-Grosbois (2016) developed a training combining a ToM training with a SIP training and showed that receiving this combined training let to better ToM abilities, more appropriate emotion regulation, and improved social adjustment and competences in children (Houssa and Nader-Grosbois, 2016).

The intervention studies mentioned here above considered either the EF (in general or not) or social cognition. However, several researches have shown that these cognitive dimensions are not independent from one another. Significant correlations between measures of these two dimensions have been reported (Carlson et al., 2004; Benson et al., 2013; Van Nieuwenhuijzen et al., 2015). For instance, children's executive functioning correlates with their ability to control disruptive behavior (Cole et al., 1993) and having weak EF is associated with lower emotional regulation abilities (Cole et al., 1993). Indeed, taking another person's perspective for instance requires inhibitory control (Aïte et al., 2016). Moreover, SEC and EF processes activate the same brain region, the frontal lobe (Welsh et al., 1991). It has also been shown that the executive capacities of young children (5–7 years old) predict behavior and social competences 2 years later (Nigg et al., 1999). In the same way that an EF training would benefit from including an aspect of SEC, a training program tackling SEC would benefit from including EF (Riggs et al., 2006a). These authors suggest that EF could act as a moderator (pre-existing EF impact the relationship between intervention and social cognition outcomes), a mediator (EF interfere with the way the intervention influences the outcomes) or an outcome (social cognition intervention impacts EF) in SEC intervention studies. Therefore, it seems important to address social and emotional issues in an EF training program.

Furthermore, Kloo and Perner (2003) investigated the transfer of training between ToM and EF and found a reciprocal effect after a short training (one session). These authors explained this interdependence between the two processes by the fact that understanding the mind presupposes a certain level of executive control, and inversely executive control presupposes a certain level of insight into the mind. For instance, develop ToM competencies requires the inhibition of his/her own perspective in order to be able to take the other's perspective. Moreover, manage his impulsivity could help in social problem solving. Houssa et al. (2017) compared one program targeting inhibition (Volckaert and Noël, 2015) and one focusing on social cognition (Houssa and Nader-Grosbois, 2016). They showed that while the social cognition program increased social cognition skills, the inhibition intervention not only improved executive abilities such as inhibition, attention or working memory but also led to enhanced emotional regulation and social adaptation. As pointed out by Diamond and Ling (2016) to be effective, an intervention program aiming at improving EF should not only train EF abilities but also promote factors supporting them. For instance, stress (Arnsten, 1998) negative mood (Gable and Harmon-Jones, 2008; Desseilles et al., 2009) and lack of social support (Cacioppo and Patrick, 2008) negatively affect executive abilities.

Both EF and ToM seem to predict academic success: they are related to mathematics and literacy (Bull and Scerif, 2001; Gumora and Arsenio, 2002; St Clair-Thompson and Gathercole, 2006; Blair and Razza, 2007; Protopapas et al., 2007; Blair and Diamond, 2008; Monette et al., 2011; Shaul and Schwartz, 2014). To take the example of SEC, anxiety impacts performance in academic tests (McDonald, 2001) and the association of negative affect with academic tasks (e.g., class participation, quizzes or tests) interferes with performance in language and mathematics (Gumora and Arsenio, 2002). Researchers have shown that emotion regulation skills are related to academic success because they impact the relationship between teachers and pupils (Graziano et al., 2007), cognitive processes (such as attention, working memory, inhibition) (Graziano et al., 2007; Denervaud et al., 2017) and engagement with learning (Graziano et al., 2007; Pekrun and Linnenbrink-Garcia, 2014) all of which are necessary for school learning. Although emotions can sometimes interfere with learning, experimental results also suggest that they often facilitate cognitive processes, such as attention and memory, which are essential for learning (Denervaud et al., 2017).

The aforementioned training studies (Röthlisberger et al., 2012; Healey, 2013; Houssa and Nader-Grosbois, 2015, 2016; Volckaert and Noël, 2015, 2016) have examined the impact of EF or ToM and/or SIP training implemented in small groups outside the classroom. However, implementing an intervention program at school leads to more stimulation and, more importantly, to a greater possibility of transfer to academic learning. Some authors have developed school curriculum programs that aim to improve EF or SEC and observed a positive impact on these trained competences (EF: Diamond et al., 2007; Barnett et al., 2008 and social problem solving: Domitrovich et al., 2007; Merrell et al., 2008; Webster-Stratton et al., 2008; Theurel and Gentaz, 2015).

Moreover, Riggs et al. (2006b) showed that stimulating children's SEC in class enhances inhibition abilities.

Finally, in their review, Diamond and Ling (2016) have highlighted the importance of the amount of practice time required for an EF training program to be effective; the longest training programs lead to better EF outcomes. The training program developed for this study was therefore implemented once a week in the classroom for 6 months, for a total of 18 sessions.

The aim of the present study was to assess the effectiveness of an intervention program combining the stimulation of inhibition and social cognition (ToM and SIP). As inhibition (Dowsett and Livesey, 2000; Carlson, 2005) and social cognition (Wellman, 1991; Lemerise and Arsenio, 2000; Baron-Cohen, 2001) show significant growth during the preschool period, and are hence malleable, the present intervention took place with young children (5 and 6 years old). Literature has shown how difficult it is to highlight significant results on working memory in young children (Melby-Lervåg and Hulme, 2013). We then choose to focus on inhibition because many research have found that targeting the inhibition dimension of the EF is very promising (Diamond et al., 2007; Volckaert and Noël, 2015) and also because this study combines the content of the studies of Volckaert and Noël (2015) and Houssa and Nader-Grosbois (2016) which specifically targeted inhibition for the EF part. We also know the importance of developing good inhibition capacities to have good social adaptation abilities. Flexibility was, however, tested because when certain training games became more complex, the rules then implied flexibility. In terms of attention, we have chosen to look at the impact of training on these skills because research has shown that stimulating inhibition has a significant impact on attention capacities (Noël et al., 2007).

In Volckaert and Noël (2015) and Houssa and Nader-Grosbois (2016) 5- and 6-year-old children were then assigned either to an experimental condition in which they received the intervention program once a week for 6 months, or to a control condition in which they engaged in normal activities in class. Just before and after the intervention, the children in the experimental and control groups were tested for their performance in EF and social cognition. Then, as EF and social cognition both have important implications for school success (Gumora and Arsenio, 2002; Blair and Diamond, 2008) participants were also tested for their academic performance (literacy and mathematics). Positive effects of the program were expected in the trained competences, as it has been shown that EF and social cognition skills can be trained (Röthlisberger et al., 2012; Houssa et al., 2013; Tamm et al., 2013; Houssa and Nader-Grosbois, 2015; Volckaert and Noël, 2015, 2016). A transfer effect was also predicted in tasks assessing literacy and mathematics, as previous researchers have shown that EF and social cognition are related to academic performance (Bull and Scerif, 2001; Gumora and Arsenio, 2002; St Clair-Thompson and Gathercole, 2006; Blair and Razza, 2007; Graziano et al., 2007; Protopapas et al., 2007; Monette et al., 2011; Shaul and Schwartz, 2014; Denervaud et al., 2017).

MATERIALS AND METHODS

Participants

As the study took place in classrooms, the participants were recruited through their school. Schools were contacted by email or by phone. They were presented with the project and to take part in it. There were four inclusion criteria for schools: they must be part of the French speaking part of Belgium, they must provide both kindergarten and the first year of elementary schooling, there must be at least two classes in each grade, and they must use conventional teaching (no alternative pedagogy). Furthermore, we paid attention to vary socio-economic status of schools and regions. If the school's director was interested in the project, the intervention was presented to concerned teachers.

Exclusion criterion by children was language disorders or intellectual disabilities. Children were excluded if they have not elementary comprehension and production of spoken French.

Among the schools meeting these criteria, nine were randomly selected. All parents of children in the last (third) year of kindergarten (K3) and in the first year of primary school (P1) were given an information letter presenting the research as well as a consent form. Among the children whose parents gave their written informed consent, a maximum of eight children per class were randomly selected to participate in the study. Data were collected from 241 preschoolers (51% boys) aged between 4 years and 9 months and 7 years and 6 months old (M age = 69.08 months, SD = 7.32 months). Hundred and twenty children were in K3 and 121 children in P1. Parents' level of education was evaluated on a scale (from elementary school not completed to university degree). In average, mothers indicated 4.74 (SD = 1.24) (5 corresponded to "3 years of Graduate school") and fathers indicated 4.70 (SD = 1.28). Concerning the family's monthly income, parents had to specify it on a scale from "0 – 999€" to "6000€ or more," with a mean on 4.11 (SD = 1.64) (4 corresponding to 3000 – 3999€ a month), which is a little bit above the average of the country. Children were all Caucasians.

The study was approved by the ethics committee of the Psychological Sciences Research Institute of UCLouvain.

Procedure

The study took place in the schools. In each grade of each school, one class was assigned to the experimental group (121 children), which received the intervention program, and one class to the control group (120 children), which engaged in usual classroom activities.

The research consisted of three phases: pre-test, intervention and post-test. For the pre-test session, different tests were initially administered individually across two sessions for each participant (lasting approximately 30–40 min according to the participant's attention and availability).

The children were pre-tested during the first 5 weeks (September – October), the intervention program took place during the next 6 months for the experimental group (November – April), and the children were then post-tested during the last 4 weeks (May). The program consisted of eighteen 50-min sessions implemented in the classroom in the presence of the teacher.

Within each class, sessions were administered by the same experimenter (three Ph.D. in Psychology). Pre- and post-test were performed blind.

Pre- and Post-testing
Instruments for the inclusion criterion

The validated scales of the Wechsler Intelligence Scales – third edition (Weschler, 2004) were used in a pre-test session to exclude possible mental retardation. We used two subscales which were "Information" from the verbal scale and "Block design" from the performance scale. Standard scores for these subtests have a mean of 10 ± 3. A global score was calculated as the mean of the two standard scores. To take part in the study, children had to be in the normal range (±1.5 SD), i.e., to have a global score lying between 5.5 and 14.5. In terms of validation, the intercorrelations calculated between raw scores on all scales were high.

Executive Functions
Attention

Executive attention is often considered among the EF (see for instance Diamond, 2013) as it requires the inhibition of external distractors to filter the information to be processed; this is typically called selective attention. Visual attentional capacities were then assessed with the Face Cancelation Task (Brooks et al., 2009). In this task, participants were presented with an A3 sheet displaying 96 similar faces organized into 8 lines of 12 faces. Two target faces were presented at the top of the sheet and participants were asked to cancel, any of the 96 faces which were identical to either of the target ones, in a maximum of 180 s. They were asked to do this as quickly and accurately as possible. Accuracy [= correct responses (maximum 20) – errors] and the time taken to perform the task were calculated and an efficiency score (ES = accuracy/time) was used as the dependent variable. The Face Cancelation Task is one of the 32 subtests of the NEPSY-II, validated by 1200 children between 3 and 16 years old. The test–retest reliability and internal validity were high.

Inhibition

Three tasks were used. First, a Stroop Task developed by Catale et al. (2014) was chosen as it did not require the participants to read. The validation was performed with TD children and ADHD children (Catale et al., 2014). The task was composed of three parts. In the color denomination part, participants had to name the color of 45 colored rectangles (red, yellow, and green). In the black fruit part, they had to name the real color of 45 fruits colored black (strawberry, banana, and pear). In the interference part, they had to name the real color of 45 fruits displayed in an incorrect color (yellow strawberries, green bananas, and red pears). In each part, participants were asked to perform as quickly and accurately as possible. Time as well as accuracy [45 – corrected (0.5) and uncorrected errors (1)] were scored. An ES was computed (accuracy/time) for the interference part and used as the dependent variable. Second, in the Tongue Task (Willoughby et al., 2011) participants were told "we are

going to play a game together in which we will have to keep a piece of candy on our tongue as long as possible, without chewing it, sucking it or swallowing it." In a first 10-s trial, both the experimenter and the child placed a sweet on their tongue, keeping their mouth open. If the child closed his/her mouth for more than 3 s, the experimenter reminded him/her to open it. If the child kept the sweet on his/her tongue for 10 s, the experimenter told him/her that he/she had won and could eat it. Then, a 40-s test was administered and the child was reminded of the rules: *"You have to hold with the sweet on your tongue, with your mouth open, for as long as you can until I tell you can stop, without closing your mouth, and without sucking, chewing or swallowing the sweet."* The time in seconds during which the child followed the instructions was used as the dependent variable. As performance were at ceiling at pre-test (more than half of the participants held the sweet for 40 s), the duration of the task was lengthened to 60 s at post-test. These analyses therefore were applied only on performances displayed by the participants who did not reach 40 s at pre-test. Tongue Task was validated by 926 3–6 years old children through factorial analysis and convergent validity. Third, the Teddy Delay Task (Sonuga-Barke et al., 2003) was a computerized task assessing delay of gratification by asking participants to make a choice between a small immediate reward (one reward after 1 s) and large delayed rewards (2 rewards after 17 s). This choice was represented by two teddy bears, one holding one balloon in the foreground of the left side of a screen (small immediate reward) and one holding two balloons in the background of the right side of a screen (large delayed reward). When the participant made his/her choice, the experimenter clicked on the chosen bear, which started walking and released its balloon(s). The participant received one token for each balloon released and was told that he/she could exchange these tokens for stickers at the end of the game. Two practice trials were first presented; in the first, the child was invited to choose between the two bears, while in the second, he/she had to choose the one not previously chosen in order to experience both waiting times. There were 20 test trials and the percentage of choices of the large delayed reward was computed. The test–retest reliability is satisfactory ($r = 0.67$) (Dalen, 2004).

Flexibility
Two tasks were used. First, in the Dimensional Change Card Sort (Zelazo, 2006) participants were presented with two target cards, one with a blue rabbit and one with a red boat, and two sorting trays. In the first part, the color game, the child had to sort eight testing cards (four red rabbits and four blue boats) according to their color: if the card was blue, the child had to put it in the sorting tray below the blue rabbit and if it was red, he/she had to put it in the sorting tray below the red boat. The first two cards (one blue and one red) were used as practice trials. In a second part, the shape game, the child had to sort six cards according to their shape: if the card depicted a rabbit, he/she had to put it in the sorting tray below the blue rabbit and if it showed a boat, he/she had to put it in the sorting tray below the red boat. Then, a third part was presented to the child if he/she had successfully completed the second one (at least 5 correct responses out of 6). In this part, 12 cards were successively presented; half of them had

a border and the other half did not. When the card had a border, the child had to play the color game and when it did not have a border, he/she had to play the shape game (Zelazo, 2006 for more details). The score of the third part (maximum = 12) was recorded to assess flexibility. Doebel and Zelazo (2015) validated the DCCS and revealed a perfect inter-rater reliability.

Second, the Traffic Lights Task (Volckaert and Noël, 2015) was a computerized task inspired by the Dots Task (Davidson et al., 2006) composed of three conditions. In the congruent condition, a green traffic light appeared either on the right or left side of the screen and the child had to press a button on the side of the traffic light as fast as possible. In the incongruent condition, the traffic light was red and the child has to press a button situated on the opposite side from the traffic light as fast as possible. In the mixed condition, there were both green and red traffic lights and the child had to press a button on the side of the traffic light when it was green and on the opposite side from the traffic light when it was red. Reaction times and number of correct responses were recorded and an ES was computed (correct responses/median reaction time) and used as the dependent variable.

Social Cognition
Theory of mind
We used the translated version (Nader-Grosbois and Houssa, 2016) of the ToM Task Battery (Hutchins et al., 2008) as a direct measure of the children's understanding of Theory of Mind. This consisted of 15 questions addressing different mental states and with increasing difficulty, from facial emotion recognition to inference of second-rate false beliefs. The total score (maximum = 15) was used as the dependent variable. This test was validated through test-retest reliability, internal consistency and external correlation.

Social information processing
The Social Problem Resolution Task (Barisnikov et al., unpublished) assesses the ability to judge the appropriateness of the social behavior of others and determines the extent to which the judgment is based on knowledge of conventional and/or moral rules. It consists of 14 illustrations of everyday social situations in which the character displays a behavior which is either appropriate (5 situations, for example of sharing or of help between two protagonists) or inappropriate (9 situations, for example, frustration, conflict or non-respect of social rules). For each fictious situation, the children were asked three questions. First: *"Can you see what is happening in this image? Is he/she behaving well or not?"* This question aimed to explain what happens in a given situation. A correct response was scored 2 and an incorrect response was scored 0 (for all situations, identification score maximum = 28). Second: *"Can you show me what is appropriate/inappropriate?"* This question measured the capacity to qualify the target behavior in one protagonist, as socially appropriate or inappropriate behavior, toward the other protagonist. It was scored 1 (correct response) or 0 (incorrect response) (for all situations, judgment score maximum = 14). Third: *"Why is it appropriate/inappropriate?"* This third question assessed the level of complexity of the child's judgment and in which measure he or she was able to refer to social/moral

rules in his or her justification about the protagonist' behavior. This question was scored 2, 5, or 7, according to the level revealed by the child's answer (for all situations, justification score maximum = 98). The descriptive level (maximum 2 points) corresponded to a description by the child about what he/she saw in the illustrated situation. At the intersubjective level (maximum 5 points), the child gave an explanation showing his or her attention on relational and social aspects between the protagonists, and his or her to social consciousness. At the conceptual level (maximum 7 points), both social consciousness and reference to social or moral rules underlay the child's explanation. If the child could not answer or if his/her answer revealed a misunderstanding of the situation, no point was given. A total score (maximum = 10) was calculated for each situation and the mean score, computed for appropriate behaviors and for inappropriate behaviors, was used as the dependent variable. The validation was performed with TD children and people with intellectual disability. The inter-judge agreement was 98% congruent (Hippolyte et al., 2010).

Academic Learning

Language

For participants in K3, we used the Image Designation Task from the ELO (Khomsi, 2001) in which words were verbally presented to children and they had to point to one of four images that corresponded to the given word. The task consisted of 20 items; 1 point was given for every correct answer, and the percentage of correct responses (%CR) was computed. In P1, children were presented with the Reading Task from the BELO (Pech-Georgel and George, 2006) divided into two parts: letter (26 items) and word (12 items) reading. Each correct response corresponded to 1 point (maximum = 38) and the % CR was calculated. The BELO was validated through a good external validity and a good internal consistency (Pech-Georgel and George, 2006).

Mathematics

K3 participants were evaluated for their performance in a number conservation task and a simple addition task. We used the Number Conservation Task from the TEDI-MATH (Van Nieuwenhoven et al., 2001). The validation was performed on a large sample of TD children and showed good internal consistency (Van Nieuwenhoven et al., 2001). In the initial setting, two parallel rows of 6 tokens each (equally spaced) were arranged between the child and the experimenter and the child was asked whether the two rows were numerically equivalent or whether one was larger or smaller than the other. Then, in a first condition, the experimenter spaced the tokens of one of the rows and asked again the child if they were numerically equivalent or if one was larger than the other. Then, tokens were rearranged as in the initial setting and the same question was again asked to the child. Finally, in the second condition, one of the rows was put into a pile and the child was again asked the same question. For the two conditions, 0 points were given if the child said the collections were not equivalent in number; 1 point was given if the child said they were numerically equivalent but needed to count them first and 2 points were given if the child said they were numerically equivalent and gave a logical justification (e.g., *"you*

did not add or remove any token"); the total score was computed (max = 4). In the Simple Addition Task, developed by Noël (2009) children were presented with 10 additions (4 ties: 2 + 2, 3 + 3, 4 + 4, and 5 + 5, and six non-ties: 2 + 3, 2 + 4, 2 + 5, 3 + 4, 3 + 5, 4 + 5). For each addition, the child was presented with a drawing of apples corresponding to the first operand; the experimenter said: *"Here are* [number of apples] *apples; if I give you* [second operand] *more apples, how many apples will you have in total?"* The child's answers and strategies used to solve the problem [(1) counting all, e.g., for 2 + 3 "1,2,3,4,5"; (2) counting on = counts from the first addend, e.g., "2,3,4,5"; (3) counting min = counts from the larger addend, e.g., "3,4,5"; (4) mental strategy] were recorded. A score combining the accuracy of the answer and the strategy used to solve the problem (0 = wrong answer; 1 = correct answer using strategy 1; 2 = correct answer using strategy 2; 3 = correct answer using strategy 3; 4 = correct answer using strategy 4) was computed and used as the dependent variable.

Participants in P1 were presented with an Arithmetic Problems Task divided into two parts: additions and subtractions. The addition task consists of 15 problems presented in order of increasing difficulty; the first group involved operands less than 5 (2 + 2, 3 + 3, 4 + 4, 2 + 3, 2 + 4, 3 + 4); in the second group, one operand was less and the other one was greater than 5 but the sum was less than 10 (2 + 5, 3 + 5, 4 + 5); and in the third group both operands were greater than 5 (6 + 6, 7 + 7, 8 + 8, 6 + 8, 7 + 8, 8 + 9). For the first and third groups of items, problems using both ties and non-ties used, the former being presented first as they are easier. Subtractions correspond to the counterpart of the additions (e.g., 8-3 as the counterpart of 3 + 5). A stop criterion was applied after three consecutive failures. The total number of correct responses was calculated (max = 30).

Intervention

The intervention program consisted of eighteen 45-min sessions implemented in the classroom in the presence of the teacher. Once a week during 6 months, a trained psychologist presented each session with fun activities aiming at improving inhibition and social cognition skills. In each session, both inhibition and social cognition were trained; the inhibition aspect of the program was inspired by Volckaert and Noël (2015, 2016) training program and the social cognition aspect by Houssa et al. (2013) and Houssa and Nader-Grosbois (2015). As difficulty should progressively increase and correspond to the zone of proximal development (Vygotsky, 1986) activities were presented in order of increasing difficulty, according to the theory underlying each concept. We choose to target inhibition in the activities, as this is described as one of the core EF (Diamond, 2013) and is particularly related to SEC (Riggs et al., 2006a). The four components of inhibition were trained: inhibition of a predominant response, interruption of an ongoing response, inhibition of external distractors and impulsivity control. The executive functions drill was accompanied by metacognition, with the children being encouraged to analyze the mental processes happening when carrying out an activity. Flavell (1979) already reported that young children have limited knowledge of their own functioning, therefore weak metacognitive capacities. However, metacognitive skills are essential from an early age,

both at home and school, in non-routine executive tasks or even during new learning. Understanding his own functioning allows not only the child to manage a task but also to promote the transfer of acquisitions when the child understands that it could possibly be applied to other tasks. The transferability could help the child to better self-regulate in problem solving, in new learnings and perhaps, his or her emotions in new situations. Metacognitive abilities and transferability could contribute to academic success in middle and long-term. For example, the use of metacognition in training has already shown its benefits on mathematical reasoning for example (Kramarski and Mevarech, 2003; Teong, 2003). The use of metacognition as we used it in our intervention makes it possible both to bring the child to understand the mechanisms involved in each proposed exercise but also to keep each child in the "active" mode as you will see. Three characters, inspired by Reflecto (Gagné and Longpré, 2004) symbolizing different aspects of inhibition were used. First, Mr. Stop represented the ability to inhibit a predominant response; he invited the children to take time before acting: "Stop: first I think and then I do." The Detective referred to the capacity to inhibit interference and distractors in order to focus attention on elements relevant to the ongoing task and encouraged the children to check his work. Finally, the Statue corresponded to motor control; it invited the children not to move excessively during calm activities, and to observe which parts of their body were in movement.

Before each activity focusing on the EF or the social cognition abilities, children were reminded to activate and use the characters useful for the task.

The social cognition program was developed with reference to a theoretical background for both ToM and SIP competences. The activities involving ToM competences were based on Howlin et al. (2017) program which suggests a progression in terms of theory of mind on emotions and their links with other mental states: (1) recognition of emotions expressed by faces on photos, (2) recognition of emotions expressed by "schematic" faces, (3) understanding of causes and consequences of emotions in social situations, (4) understanding of a desire based on emotions and (5) understanding of a belief based on emotions and beliefs (1) simple perspective taking, (2) complex perspective taking, (3) seeing leads to knowing, (4) true belief/action prediction, and (5) false belief (Hadwin et al., 1996). The exercises targeting the SIP competences were built according to the six steps of the SIP model (Crick and Dodge, 1994): (1) encoding other people's social cues, (2) interpretation of social cues, (3) clarification of goals, (4) response access, (5) response decision, (6) behavioral execution. Finally, the proposed activities were presented in order of increasing difficulty, in accordance with the hierarchical levels of justification distinguished by Barisnikov et al. (unpublished) in the RES: (1) descriptive level, (2) intersubjective level, and (3) conceptual level. The activities tackling ToM and SIP competences included pictures, sequences of play, video extracts, handling of objects, story reading and other activities.

The program was used in the classroom; working in groups allowed socio-cognitive conflicts to emerge which might help children to become aware of the diversity of points of view in a given situation. Socio-cognitive conflicts is interesting because this generally conducts to a positive influence of social interactions on learning. Moreover, authors of a recent meta-analysis on training in understanding emotions explain that the effect sizes are larger when children are trained in groups (Sprung et al., 2015) rather than individually.

Teachers were invited to use the concepts and materials used in the session as often as possible during the rest of the week to promote a transfer of knowledge to other situations. To help teachers ensure this continuity, activities were suggested every week (e.g., story reading followed by a discussion, use of metacognition characters in different situations; finishing an activity started in the session).

Teachers were asked to keep a record book each week. They were invited to describe their general feeling about the activities and children's receptiveness, to write down any comments or questions and to specify what concept/material was used in the classroom during the week (by ticking a box corresponding to the given concept/material). Indeed, the teacher was expected to continue the activities during the week, targeting the concepts learned during the session. This should then be reported in the logbook.

Finally, the level of involvement in the project of teachers in the experimental classes was assessed. The measure, ranging from 1 to 5 (**Table 1**), considered the teachers' involvement during the sessions (Is s/he present? Does s/he take an interest in the session? Does s/he participate?) and outside the sessions (use of the tools and concepts during the week). The assessment on this scale was based on the observation of the teacher during the session and on the contents of the record book for involvement outside the sessions.

Finally, the attendance of the participants of the study was recorded at each session.

RESULTS

First, we were interested in the implementation of the intervention program. We checked whether the participants in the experimental group received a sufficient number of sessions by exploring the variable "attendance" and whether the teachers were involved in the project through the variable "level of involvement of the teachers."

TABLE 1 | Measure of the involvement of the teachers in the project.

Level	Description
1	Minimum involvement during the sessions, no (or little) use of the materials and concepts outside the sessions.
2	Weak involvement during the sessions, little use of the materials and concepts outside the sessions.
3	Average involvement during the sessions, little or occasional use of the materials and concepts outside the sessions.
4	Intense involvement during the sessions, little or occasional use of the materials and concepts outside the sessions.
5	Intense involvement during the sessions, intense use of the materials and concepts outside the sessions.

Second, a first series of *t*-tests and Chi squares were calculated to compare the characteristics of the experimental and control groups in terms of demographic data (age, sex, and school year) and pre-test performance. The effect of the parents' level of education and family incomes were evaluated but there was no significant influence of those variables (**Table 10**).

Third, to assess the effect of training, we conducted repeated-measures ANOVAs with testing time (pre-test and post-test) as within-subject factors and group (experimental and control) as between-subject factor on each of the baseline task scores; partial Eta-squared was calculated as a measure of effect size. For the RES, two within-subject factors were introduced: testing time and appropriateness of behavior (appropriate and not appropriate).

Finally, to better understand which children benefited the most from the intervention, we evaluated the potential impact of characteristics concerning the teachers (involvement of the teacher in the project and number of years of service) and the children (initial level of EF and of social cognition competences, age, school year, attendance at sessions) on the progression in EF and social cognition skills.

The normality assumption was controlled for each variable.

Implementation of the Program
Attendance
Most of the children in the experimental group attended most of the program. As shown in **Table 2**, 85% of participants attended 16 or more of the 18 sessions.

Level of Involvement of the Teachers
The mean level of involvement (3.31 ± 1.40) corresponds to "average involvement of the teacher during the sessions and occasional use of materials and concepts outside the sessions." As shown in **Table 3**, 77% of children had teachers with at least this level of involvement.

TABLE 2 | Number of sessions that children from the experimental group attended.

Number of sessions	Number of children
12	2
14	7
15	9
16	14
17	40
18	48

TABLE 3 | Level of involvement in the project of teachers of children in the experimental group.

Level of involvement	Number of teachers	Number of children
1	3	22
2	1	8
3	5	33
4	4	29
5	4	30

TABLE 4 | Demographic data at pre-test (means ± standard deviation) and comparison of the two groups (*t*-test or Chi^2 and *p*-value).

Demographic data	Experimental group	Control group	*t*/Chi^2	*p*
Age (in months)	69.02 ± 7.20	69.08 ± 7.48	−0.06	0.951
Sex	63 girls – 58 boys	55 girls – 65 boys	0.94	0.368
School year	63 M3 – 58 P1	59 M3 – 61 P1	0.04	0.898
WPPSI verbal	9.02 ± 2.37	9.17 ± 2.58	−0.47	0.679
WPPSI visuo-spatial	8.98 ± 2.55	9.13 ± 2.75	−0.41	0.638

Control and Experimental Groups Comparisons at Pre-test
The two groups were statistically equivalent in terms of demographic data, verbal and non-verbal intelligence (see **Table 4**) and pre-test performance (**Table 5**) on the executive, socioemotional and academic tasks.

Effects of the Intervention
Table 6 presents the results of the repeated measure ANOVAs comparing the pre- and post-tests for the control and experimental groups. As can be seen, a significant effect of time was observed in all the test tasks except the Teddy Task. For the Teddy Task, participants chose the large delayed reward significantly less at post-test compared to pre-test.

Significant effects of group were observed in the RES [with higher performance in the experimental group (5.34 ± 0.76) than in the control group (5.04 ± 0.87)] and in the Number Conservation Task [K3, with higher performance in the experimental group (0.48 ± 0.49) than in the control group 0.30 ± 0.44], and a marginal group effect was found in the Traffic Lights Task [with a slightly higher ES in the experimental group (0.028 ± 0.008) than in the control group (0.026 ± 0.007)].

More importantly, significant interactions between time and group were observed in several tasks. For the EF measures, significant interactions were found in the Face Cancelation Task, the Tongue Task and the DCCS task (**Table 6**). For the Face Cancelation Task (**Figure 1**), the improvement in ES was greater in the experimental group (0.038 ± 0.046) than in the control group (0.026 ± 0.048). In the Tongue Task (**Figure 2**), the duration spent with the candy in the subject's open mouth increased more in the experimental group (38.37 ± 10.80) than in the control group (24.27 ± 19.62). Finally, in the DCCS task, we observed a greater increase of performance in the experimental (1.48 ± 2.87) than in the control (0.70 ± 2.86) group (**Figure 3**). These three results suggest that the intervention program was effective at improving children's EF capacities, and in particular at improving their performance in selective attention, inhibition and flexibility.

For social cognition, the interaction effect was significant for the ToM task battery and marginal for the RES (**Table 6**). These results reveal a significantly greater improvement in the experimental group (2.09 ± 2.24) than in the control group (1.52 ± 2.25) for the ToM task battery (**Figure 4**) and, more moderately, for the RES (**Figure 5**) (an improvement of 0.77 ± 0.99 for the experimental group and of 0.55 ± 1.09 for the control group).

TABLE 5 | Means ± standard deviations for each task at pre-test and post-test in the two groups and comparison of groups at pre-test (*t*-test and *p*-value).

Measures and tasks	Experimental Group			Control Group			Comparison at pre-test	
	N	**Pre-test**	**Post-test**	**N**	**Pre-test**	**Post-test**	**t**	**p**
EF								
Face cancelation task	121	0.033 ± 0.048	0.072 ± 0.045	119	0.039 ± 0.041	0.065 ± 0.046	−1.07	0.284
Fruits Stroop	117	0.45 ± 0.13	0.56 ± 0.14	114	0.45 ± 0.14	0.56 ± 0.16	−0.01	0.999
Tongue task	30	23.13 ± 11.69	59.83 ± 0.91	17	26.18 ± 12.64	50.18 ± 15.86	−0.83	0.409
Teddy	121	45.12 ± 15.67	40.12 ± 16.30	120	45.33 ± 13.78	39.71 ± 18.72	−0.11	0.912
DCCS	108	6.29 ± 1.66	7.77 ± 2.44	100	6.50 ± 2.11	7.20 ± 2.15	−0.81	0.422
Traffic lights	120	0.025 ± 0.008	0.030 ± 0.009	118	0.024 ± 0.007	0.028 ± 0.009	1.46	0.236
Social cognition								
ToM Battery	121	8.98 ± 2.43	11.07 ± 2.27	120	9.14 ± 2.46	10.66 ± 2.14	−0.50	0.616
RES	121	4.95 ± 0.86	5.72 ± 0.86	119	4.76 ± 1.05	5.27 ± 1.02	1.55	0.124
Academic learning								
Language K3	61	73.20 ± 10.49	78.85 ± 9.72	58	74.66 ± 10.25	79.48 ± 8.36	−0.77	0.554
Language P1	60	33.07 ± 19.07	78.11 ± 15.71	59	32.43 ± 19.81	75.29 ± 16.10	0.18	0.857
Number conservation K3	61	0.62 ± 1.10	1.31 ± 1.71	58	0.40 ± 0.88	0.79 ± 1.33	1.25	0.215
Additions K3	61	0.56 ± 0.65	1.43 ± 1.08	58	0.65 ± 0.77	1.37 ± 1.11	−0.71	0.480
Arithmetic P1	60	8.25 ± 7.31	19.35 ± 5.71	60	9.32 ± 6.62	20.45 ± 5.50	−0.84	0.404

TABLE 6 | Repeated-measures analyses for each task.

Measures and tasks	Effect of time			Effect of group			Effect of interaction group*time		
	F	**p**	**η²**	**F**	**p**	**η²**	**F**	**p**	**η²**
EF									
Face cancelation task	113.30	<0.001	0.429	0.01	0.980	0	4.01	0.046	0.017
Fruits Stroop	171.89	<0.001	0.429	0.01	0.920	0	0.05	0.829	0
Tongue task	195.85	<0.001	0.813	1.79	0.188	0.038	8.57	0.005	0.160
Teddy	15.32	<0.001	0.060	0.01	0.948	0	0.05	0.818	0
DCCS	75.39	<0.001	0.242	3.17	0.076	0.013	0.30	0.583	0.001
Traffic lights	28.12	<0.001	0.128	0.69	0.409	0.003	3.87	0.051	0.018
Social cognition									
ToM Battery	155.91	<0.001	0.395	0.24	0.624	0.001	3.95	0.048	0.016
RES	92.17	<0.001	0.279	10.92	0.001	0.044	3.34	0.069	0.014
Academic learning									
Language K3	26.79	<0.001	0.186	0.50	0.480	0.004	0.17	0.683	0.001
Language P1	709.47	<0.001	0.858	0.38	0.538	0.003	0.44	0.510	0.004
Number conservation K3	10.92	0.001	0.085	4.70	0.032	0.039	0.79	0.376	0.007
Additions K3	83.42	<0.001	0.416	0.02	0.885	0	0.68	0.412	0.006
Arithmetic P1	319.19	<0.001	0.730	1.24	0.286	0.010	0.01	0.979	0

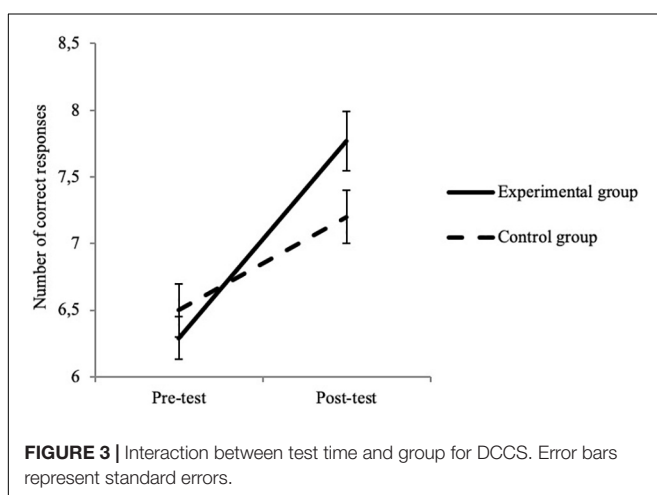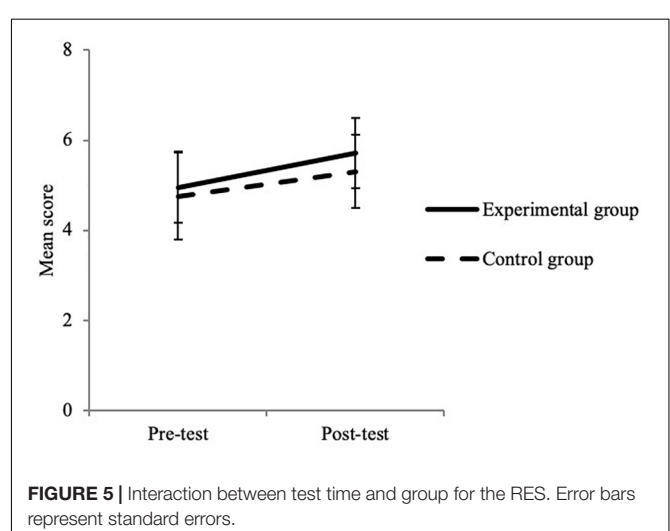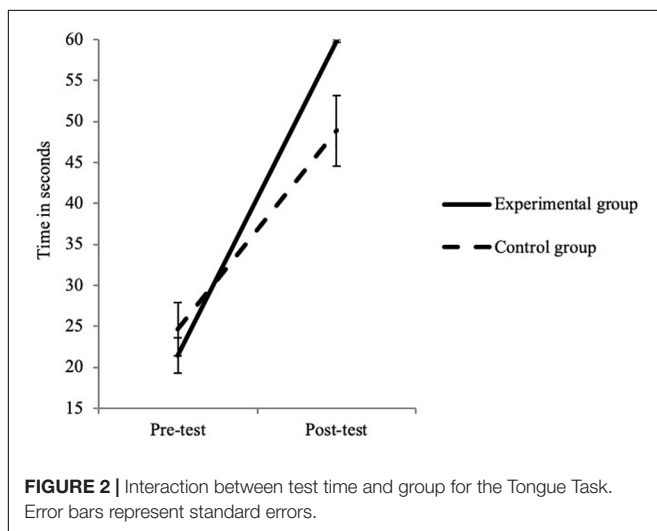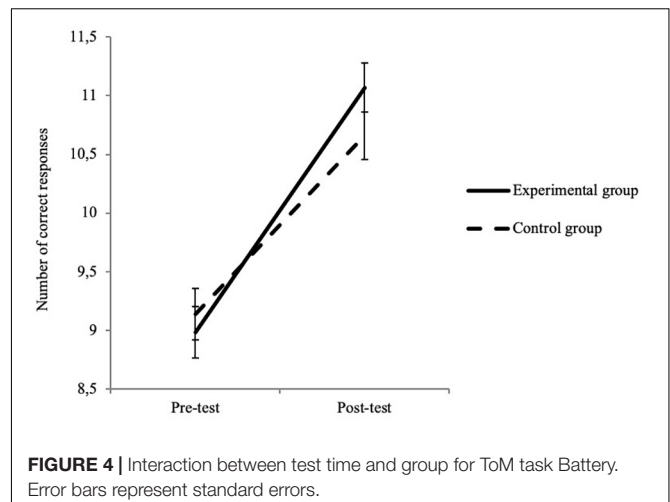The intervention thus successfully improved performance in ToM and in SIP.

Lastly, we looked at possible indirect effects of the intervention on academic learning. The repeated-measures analyses revealed no significant interaction effect between test time and group for any of the tasks assessing academic learning (**Table 7**). However, as we wanted to examine the potential effect of intervention in greater depth, and as the two groups' performances were equivalent at pre-test, we compared their post-test performances by computing *t*-tests for independent samples. The results of these analyses (**Table 7**) indicate a marginal difference between the two groups in the Number Conservation Task (K3), with a higher score in the experimental group (1.31 ± 1.71) than in the control group (0.79 ± 1.33).

These supplementary analyses suggest a slight transfer effect to numerical development.

Impact of Teachers' and Children's Characteristics

An exploratory factorial analysis was computed in principal component analysis on four of the six EF tasks (Face Cancelation, Fruits Stroop, Traffic Lights and DCCS; the Tongue Task was excluded because of the small N and the Teddy Task because performances decreased from pre-test to post-test) and on the

FIGURE 1 | Interaction between test time and group in the Face Cancelation Task. Error bars depict standard errors.

FIGURE 2 | Interaction between test time and group for the Tongue Task. Error bars represent standard errors.

FIGURE 3 | Interaction between test time and group for DCCS. Error bars represent standard errors.

FIGURE 4 | Interaction between test time and group for ToM task Battery. Error bars represent standard errors.

FIGURE 5 | Interaction between test time and group for the RES. Error bars represent standard errors.

two social cognition tasks (ToM task and RES) in order to compute a single factor for performance in EF and another for performance in social cognition; these would represent the latent variable and be less sensitive to variables that were not of interest (e.g., aspects of the tasks, motivation, etc.). The factorial analyses were computed on pre-test performance; post-test factors were then calculated with the values of loadings of the pre-test factors. Change from pre-test to post-test was calculated by subtracting the pre-test factorial score from the post-test factorial score. We then computed correlational analyses between these factors and teachers' and children's characteristics. The sampling adequacy was calculated with the Kaiser–Meyer–Olkin which is 0.56 for the EF factor and 0.50 for the SEC factor (which is not high but not considered as unacceptable; Kaiser, 1974). The results of the factorial analyses are displayed in **Table 8** for the EF factor in **Table 9** for the social cognition factor.

The correlational analyses (**Table 10**) showed a significant negative correlation between the change in the EF factor and the EF factor at pre-test as well as between the change in the social cognition factor and the social cognition factor at pre-test. However, all other correlations were non-significant.

Thus, the lower the level of EF performance before the intervention, the more it improves after the intervention.

TABLE 7 | *T*-tests for independent samples on academic learning tasks.

Measures	*t*	*p*-value
Language K3	−0.38	0.706
Language P1	0.97	0.335
Number conservation K3	1.85	0.067
Additions K3	0.25	0.803
Mathematics P1	−1.08	0.285

TABLE 8 | Task loadings for the EF factor.

EF tasks	Loading on the factor
Face cancelation task	0.329
Fruits Stroop	0.792
Traffic lights task	0.762
DCCS task	0.537
Percentage of explained variance	40.12

TABLE 9 | Task loadings for the social cognition factor.

Social cognition measures	Loading on the factor
ToM task battery	0.828
RES	0.828
Percentage of explained variance	68.62

TABLE 10 | Correlations between the change in the EF factor, the change in the social cognition factor and teachers', children's, and family's characteristics.

	Change in EF factor	Change in social cognition factor
EF factor at pre-test	−0.457**	0.031
Social cognition factor at pre-test	−0.009	−0.535**
Evolution of EF factor	−	0.019
Age	−0.016	−0.142
School year	0.019	0.070
Attendance	−0.049	−0.059
Involvement of teacher	0.050	0.089
Number of years of service	0.121	−0.067
Mothers' level of education	−0.13	−0.03
Fathers' level of education	−0.11	−0.10
Family incomes	−0.07	−0.07

**p<0.001.

Similarly, the weaker social cognition skills are before the intervention, the more they improve after the intervention. However, the other correlations are non-significant, which means that the change in EF and social cognition does not depend on the age and school year of the children, the number of sessions they attended, or the intensity of their teacher's involvement in the project or their number of years of service.

DISCUSSION

It is now established that inhibition (Volckaert and Noël, 2015; Diamond and Ling, 2016 for a review) and social cognition skills (Houssa et al., 2013 for a review) can be improved through training. To our knowledge, there is no data in the literature concerning the potential benefit of a training program focusing on both inhibition and social cognition abilities for young typically developing children. Therefore, the innovation of the present study was to develop an intervention program aiming to stimulate typically developing young children's inhibition and social cognition capacities. But also, to implement it in the school setting and to evaluate its direct impact on both inhibition and social cognition competences, but also on other EFs, as well as its indirect impact on academic learning. Currently, teachers need to have at their disposal pedagogical activities in a coherent and efficient program, applicable easily in their classroom of preschoolers or children at the beginning of primary school. This study therefore responds to a growing demand in kindergarten and primary classes.

Our results showed that the program was effective at improving inhibition and other EFs. A significant effect of training was observed in the selective visual attention task (Face Cancelation), in one of three inhibition tasks (Tongue Task) as well as in one of the two flexibility tasks (DCCS). After the intervention, the children thus showed a better ability to focus attention. This may perhaps facilitate entry into learning to write and read because, thanks to better attention skills, the child will be able to focus on relevant cues to solve a task, correctly discriminate letters, etc. Good attention skills will also help to better detect facial expressions of others in social situations. We also showed better inhibition capacities to control themselves and to prevent a predominant behavior. We have seen that inhibition capacities are crucial in any school and social situation. For example, having good inhibition capacities allows children to be less impulsive; be able to wait your turn; to take the time to think, to read or listen to instructions before acting; to reread yourself and check your answers before returning your sheet; to raise your hand and wait to speak before answering aloud, not to interrupt; to be more patient in conflictual or frustrating situations. So many essential skills to develop as a future adult. Finally, we highlighted that children were more able to switch between mental processes, in other words to disengage from a process to engage in another one. These flexibility capacities make it possible, for example, to make transitions easier and more fluid between two activities. They can also facilitate changes in arithmetic operation within a mathematical exercise, as well as allowing children to consider different alternatives to an obstacle or problem solving in social interaction or at school level. All these results corroborate previous findings suggesting that it is possible to enhance young children's executive abilities (Diamond et al., 2007; Barnett et al., 2008; Röthlisberger et al., 2012; Volckaert and Noël, 2015, 2016).

For social cognition, our intervention program led to an improvement of ToM understanding capacities and of SIP skills. Children were better able to put themselves in someone else's place, to understand their own as well as others' emotions, desires, thoughts and beliefs, to judge the appropriateness of a social situation, to choose an appropriate reaction in their repertoire, to develop new strategies and to resolve a critical social situation (e.g., quarrel), notably because they have expanded their repertoire of adapted strategies to apply them in social

situations. Socio-cognitive conflicts and metacognition have probably allowed to develop ToM and SIP skills. Indeed, the use of metacognition allows notably the child to mark a pause in order to take into account other's point of view, generated by the socio-cognitive conflict.

In summary, as for EF abilities, our results showed that young children's social cognition skills can be improved through training (Domitrovich et al., 2007; Merrell et al., 2008; Houssa et al., 2013; Houssa and Nader-Grosbois, 2015). In reference to links emphasized in literature between EF and SEC (Kloo and Perner, 2003) after our intervention, children are more able to inhibit their own perspective to be able to put themselves in someone else's perspective Furthermore, children have better understanding of what induces emotions (causes of emotions) and how to react by alternative behaviors, notably by using inhibition in order to control inappropriate behavior or by putting attention on relevant and positive aspects of social situations.

A marginal transfer effect was also observed on the task assessing the understanding of the principle of number conservation. However, the intervention program did not impact the other academic learning tasks. It is worth noting that the only academic learning task showing a sensitivity to intervention was the only one involving an aspect of inhibition. To succeed in this task, the child has to inhibit the perceptive aspect of the tokens (the amount of space they occupy) in order to use a numerical strategy. These weak results in terms of academic performance are not in line with the literature, which shows that higher EF and SEC are associated with better performance at school (Gumora and Arsenio, 2002; Blair and Diamond, 2008). However, to our knowledge, there is no data in the literature showing that a training program focusing on inhibition and/or social cognition alone can enhance academic performance, so it is possible that in order to impact literacy and mathematics skills, the intervention would need to tackle these competences. For instance, an EF training program has been shown to produce larger effects when it is implemented in the school curriculum (Bodrova and Leong, 2006; Blair and Raver, 2014) than when it is used as an add-on to the existing curriculum (Bodrova and Leong, 2006; Clements et al., 2012). In addition, it has been found that math and reading abilities can be improved when children have been taught how to use EF strategies in these disciplines (Naglieri and Johnson, 2000; Iseman and Naglieri, 2011).

Finally, our results showed that the weaker a child's EF are at the beginning of the school year, the more they improve after the intervention. In the same way, the lower their social cognition skills are at pre-test, the greater the improvement in SEC. This finding highlights the effectiveness of such a program in terms of prevention. We were thus able to draw up a "learner profile": the children who benefited the most from the intervention were those with the weakest performance prior to it, regardless of their age, their school year, the number of sessions they attended, the involvement of the child's teacher in the project or their number of years of service. It could be interesting to analyze if the children benefiting the most from the program are children whose families speak more about mental states, or have

structuring educational practices, or even better language skills in understanding and expression.

Two results may seem challenging: the lack of impact of the number of sessions attended by the child and of the level of involvement of the teacher in the project. However, these results can be interpreted as follows: most children attended at least 16 out of 18 sessions and therefore participated in the majority of EF and SEC activities. In addition, as part of this research, an external experimenter conducted all the sessions to ensure the proper implementation of the intervention; thus, regardless of teacher involvement, children received a minimum level of stimulation. Teacher involvement was in most of the cases moderate to high. Therefore it was sufficient for this partnership, so that children benefited from the intervention.

The limitations of the study should be addressed. First, the control group was engaged in the usual classroom activities and did not receive any other intervention, which may have biased our results. Also, although we tried to reduce the variability in terms of teacher involvement by suggesting activities to complete and tools and concepts to use during the week, not all teachers showed the same level of involvement, which is very likely to have impacted our results. Secondly, despite our request to the teachers of the control group not to implement new activities stimulating social cognition or executive functions during the year, most of them did in fact discuss emotions and conflict resolution and used games/activities tackling inhibition in the classroom. Thirdly, ideally, or in a future study, half of the children in each class should be randomly selected to be part of the experimental group. This has already been done in previous studies (Houssa and Nader-Grosbois, 2015; Volckaert and Noël, 2015) but in the present study the idea was to intervene in the classes to also train teachers in care and encourage them to use the tools even in our absence. In a later study, it would be interesting to go further, train teachers and see if their training has a beneficial effect on the children in their class. Finally, another limitation concerns our baseline in which we did not measure the WM. It would have been interesting to see if our intervention had a positive effect on this, which could eventually mediate some of the effects obtained.

Our intervention program had a positive impact on EF, with higher selective attention, inhibition and flexibility capacities, and on social cognition, with higher ToM understanding and SIP capacities. Moreover, a slight transfer effect was observed in a numerical task requiring inhibition skills. In other words, we observe that the transition from one activity to another in the classroom is easier. These children have a better understanding of emotions and take better other peers' perspective, which allows them to react in a more adapted way when they are confronted with a situation and helps them to better regulate their emotions. We also highlighted that teachers take more account of the child's point of view. This program is then a prevention and intervention tool, which meets the demand of many teachers as mentioned above. Furthermore, these results are encouraging because they show that teachers could easily implement activities that enhance young children's EF and SEC, and especially those of the children who need it most. Although activities are already implemented by teachers in kindergarten, it is important to optimize their

effectiveness with reference to a program with evidence-based positive effects.

As previous studies have shown that it is possible to improve atypically developing children's EF (Halperin et al., 1999; Tamm et al., 2013 for children with ADHD) and social cognition (ToM and SIP) (Jacobs and Nader-Grosbois, 2020a,b for children with intellectual disabilities) with intervention programs carried out in small groups, it would be interesting for future studies to implement a program similar to that of the present study (i.e., combining EF and social cognition in the classroom) in specialized schools. Moreover, to maximize the effects of intervention, it would be worth training the teachers so that they can implement the intervention themselves throughout the year.

To conclude, by providing teachers with a framework of activities and effective techniques to teach children to manage their agitation and impulsivity (i.e., metacognition, encourage to appeal the socio-cognitive conflicts when they have to resolve a quarrel,. . .), to regulate their behavior, to perceive that one child's point of view may differ from another, it is possible to consolidate some acquired skills and to reinforce their efficacy.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: According to the consent obtained for the present study, only the researchers, on the supervision of the project promotors, can have access to the anonymized database. Requests to access these datasets should be directed to NN-G, nathalie.nader@uclouvain.be.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics committee of the Psychological Sciences Research Institute. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

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Psychosocial Factors and Chronic Illness as Predictors for Anxiety and Depression in Adolescence

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Adolescence is a challenging time when emotional difficulties often arise. Self-esteem, good relationships with peers, and emotional competences can buffer the effects of these difficulties. The difficulties can be even greater when coupled with the presence of a chronic physical illness (CD). Our goal is to analyze psychosocial factors and CD as predictors for anxiety and depression. It was compared the results of structural equation models (SEM) with models based on qualitative comparative analysis (QCA) to analyze the possible influence of these variables on levels of anxiety-depression in adolescents with and without CD. The sample consisted of 681 adolescents, between 12 and 16 years old ($M = 13.94$, $SD = 1.32$). 61.50% were girls and 13.40% ($n = 222$) presented a CD (mainly pneumo-allergic and endocrine). They were evaluated by the Hospital Anxiety and Depression Scale, the Self-esteem Questionnaire, the Emotional Competences Questionnaire and the Strengths and Difficulties Questionnaire. The results obtained by SEM show that low self-esteem, problems with peers and low emotional competencies predict anxiety in 41% of the variance and depression in 72%. The results obtained by QCA show that the different combinations of these variables explain between 24 and 61% of low levels of anxiety and depression and 47–55% of high levels. Our data show how the presence of a CD, low self-esteem, problems with peers and problems in emotional skills play a fundamental role in explaining levels of anxiety and depression. These aspects will help provide increased resources for emotional adjustment in the educational context, facilitating the transitions to be made by adolescents.

Keywords: adolescent, chronic illness, qualitative comparative analysis, structural equation models, adjustment

INTRODUCTION

Adolescence is defined as the stage of development involved in the transition between childhood and adulthood, characterized by a wide variety of changes at the biological, psychological and social changes (Andrews et al., 2020), and it is often a time of considerable personal challenges and difficulties, especially regarding mental health. According to the World Health Organization (WHO), mental health is "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is

able to make a contribution to his or her community. The WHO points out that half of all mental disorders begin before the age of 14 (World Health Organization [WHO], 2011). Affecting mental health, anxiety and mood problems are the most common at this stage, and there is a great deal of comorbidity between these disorders (Sowislo and Orth, 2013). As a result, between 13.3 and 16.4% of children and adolescents in Spain suffer from anxiety, and between 5 and 13% suffer from depression (Del Barrio, 2015). Psychological problems in adolescence are the main cause of morbidity and disability during this period, suicide being the third most common cause of mortality among adolescents (World Health Organization [WHO], 2018). In addition, having psychological problems in childhood is associated with an increased likelihood of suffering from it in adulthood (Navarro-Pardo et al., 2012; Gaete, 2015; Duinhof et al., 2020).

As well as having psychological problems, the presence of a chronic physical illness (CD) during adolescence adds even more complexity and difficulties to the already challenging tasks associated with this stage of transition to adulthood (Extremera et al., 2018; Kim et al., 2020). The most common CD in adolescence are pneumo-allergic and endocrine diseases (Chueca et al., 2008; Alith et al., 2015). Living with a CD can significantly limit the day-to-day life of adolescents, given the changes it involves in their lifestyle (diet, exercise and medical treatment), and the need for continuous monitoring by health services (Lacomba-Trejo et al., 2018).

The CD can have an impact on the adolescent's emotional health, social and family relationships, and academic performance (e.g., due to school absences for medical check-ups) (Valero-Moreno et al., 2020). Studies therefore indicate a higher frequency of emotional and relational difficulties in these adolescents (Cobham et al., 2020; Kim et al., 2020; Nabors, 2020), but these results deserve to be discussed, since some studies showed that the adjustment to the disease could also be more related to personal and family variables than to the disease itself (Lohan et al., 2015). Therefore, having a CD is considered a relevant factor in adjustment in adolescence, but other risk and protective factors must also be taken into account to achieve a greater understanding of adjustment (Stanton and Revenson, 2007), such as self-esteem, social support or emotional skills.

The literature has highlighted how adequate self-esteem and social support can buffer the emotional distress associated with the CD (Igai, 2020). Similarly, it has been pointed out how emotional regulation skills can facilitate the adjustment of adolescents with CD (Trindade et al., 2017; Finlay-Jones et al., 2020) psychosocial risk and protective variables are critical to the medical and psychological adjustment of adolescents with CD, as emotional or personal difficulties can impact the control of CD, worsening the course and outcome of the disease (Kenowitz et al., 2020; Valero-Moreno et al., 2020).

Our study aims to analyze the possible influence of self-esteem, peer problems and emotional competencies on anxiety-depressive clinical levels in adolescents with and without CD. For it, the results of two statistical methodologies have been compared [structural equation models (SEM) vs. models based on comparative qualitative analysis (QCA)] to analyze. As hypotheses: (H1) self-esteem and emotional competencies will be negatively related to emotional adjustment (higher levels of anxiety and depression); (H2) problems with peers will be positively related to anxiety and depression; (H3) adolescents with CD will show lower levels of self-esteem and emotional competencies, and higher levels of anxiety, depression and problems with peers.

MATERIALS AND METHODS

Participants and Procedure

This study involved 681 adolescents from the Valencian Community. The average age of all the subjects surveyed was 13.94 years old ($SD = 1.32$), with a range of 12–16 years. The percentage of boys surveyed was 38.2%, while for girls it was 61.5%, 0.2% gender queer. 32.6% presented chronic physical diseases (CD), which were mainly pneumoallergic (asthma, allergy, atopic dermatitis) with a percentage of 27.3%, endocrine or gastrointestinal [DM1 (0.6%), celiac disease (0.6%) or obesity problems (0.3%)]. The assessment of all adolescents (with and without CD) was conducted at the same time and in a common setting, the school context. This fact facilitates better that the responses of all adolescents were more similar, and responses of adolescents with CD were less biased if there were performed within the hospital context.

The study was approved by the Bioethics Committee of the Government of the Valencian Community (CN00A/2020/42/S) and the University of Valencia's (UV-INV_ETICA-1226194). All participants received detailed information about the aims and procedures and were informed of confidentiality. Data collection and data analysis took place between October 2019 and February 2020.

Statistical Analysis

First, the descriptive analyses of the participants were estimated, and then calibration values for fsQCA were calculated. A structural equation model (SEM) and a fuzzy-set qualitative comparative analysis (fsQCA) were subsequently performed. In the structural equation model, (SEM) the estimate provided by the robust method of maximum likelihood estimation (ML), recommended to correct the possible absence of multivariate normality, was applied in all cases. A structural equation model was made to predict anxiety and depression (dependent variables) through emotional competencies, self-esteem, and problems with peers (independent variables). In addition, a multigroup was conducted to test the moderating effect of CD.

When performing the fuzzy-set qualitative comparative analysis, the raw data from the participants' responses were transformed into fuzzy-set responses. First, all the missing data were deleted as suggested in the literature, and all constructs (variables) were calculated by multiplying their item scores (Villanueva et al., 2017; Giménez-Espert and Prado-Gascó, 2018; Navarro-Mateu et al., 2020). Before performing the analysis, the values were recalibrated between 0 and 1. When considering only two values as in the variable for the presence of CD, we used 0 (healthy) and 1 (CD). However, when performing the recalibration with more than two values, we had to consider

the following three thresholds: the first (0) considers that an observation with this value is fully outside the set (low agreement); the second (0.5) considers a median point, neither inside nor outside the set (intermediate level of agreement); and the last value (1) considers the observation to be fully in the set (high level of agreement). With continuous variables or with factors from a survey, these three values must be introduced for an automatic recalibration of values between 0 and 1. In these cases, the literature suggests that with continuous variables or with factors, the three thresholds must be percentiles 10, 50, and 90 (Woodside, 2013). The fsQCA 2.5 software by Claude and Christopher (2014) recalibrated the values of self-esteem, peer problems, emotional intelligence and anxiety and depression (Woodside, 2013). SPSS (*Statistical Package for the Social Sciences*, version 23, ©IBM) was used to perform the descriptive analysis and produce the calibration values and mean differences, Cohen's *d*, EQS (*Structural Equation Modeling Software*, version 6.3, Bentler, 1985–2016, Multivariate Software Inc.), to evaluate the psychometric properties of the instruments and structural equation models, and fsQCA software (*fuzzy qualitative comparative analysis*, version 2.5, ©Raging and David, 1999–2008), (Claude and Christopher, 2014) was used to perform fsQCA.

Measures

The version of the Rosenberg Self-Esteem Scale (RSE) (Rosenberg, 1965) adapted to the Spanish context (Atienza et al., 2000) consists of 10 items [a Likert format, ranging from 1 (Strongly disagree) to 4 (Strongly agree)], and focuses on feelings of respect for and acceptance of oneself. The original study (Rosenberg, 1965) obtained an internal consistency of 0.92. The alpha scores in Spanish studies of adolescents have a reliability of 0.86 (Oliva et al., 2011). The total score ranges from 10 to 40 points, distinguishing between low (scores less than or equal to 29) and high (equal to or greater than 30) self-esteem. The psychometric properties in this study seem to be adequate: $\chi^2(df) = 217.50(35)$; S-B $\chi^2(df) = 198.73(35)$; S-B χ 2/df (5.68; CFI = 0.92; IFI = 0.92; RMSEA = 0.08 (IC = 0.07–0.09); α = 0.80.

The Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983) was developed as a screening instrument for identifying non-psychiatric patients with affective disorders attending hospitals (De Las Cuevas et al., 1995). It is divided into two dimensions: the anxiety subscale (HADS-A) and the depression subscale (HADS-D). An overall score for emotional distress is obtained by adding the anxiety and depression scales. The questionnaire has been used in adolescents and young people (Saez-Flores et al., 2018) (from 10 to 23 years old), and validated for pediatric samples (Valero-Moreno et al., 2019) obtaining adequate psychometric properties (Mihalca and Pilecka, 2015; Valero-Moreno et al., 2019). Scores between 0 and 6 represent no anxiety, 7–9 possible anxiety, and scores of over 10 probable anxiety. In depression, 0–5.4 represents no depression, 5.5–7.5 possible depression, over 7.5 probable depression and for emotional distress, below 15.5 is no emotional distress, and over 15.5 emotional is probable distress (Valero-Moreno et al., 2019). The psychometric properties in the present study seem to be adequate: $\chi^2(df) = 98.76(40)$; S-B$\chi^2(df) = 81.21(40)$;

S-Bχ^2/df = 2.03; CFI = 0.97; IFI = 0.97; RMSEA = 0.04 (IC = 0.03–0.05); α = 0.78 for anxiety, α = 0.68 for depression and α = 0.82 for emotional distress.

The Emotional Skills and Competence Questionnaire (ESCQ-21) is a self-report measure created by Takšić et al. (2009) with the aim of assessing emotional competence. The reduced version (ESCQ-21), which was adapted and validated in a Spanish sample (Schoeps et al., 2019) was used in this study, scored on a 6-point Likert scale, from 1 ("never") to 6 ("always"). The scale has three different subscales: "Perception and understanding," "Expressing and labeling" and "Handling and regulation." It has proved to be a reliable and valid measure in several contexts, showing adequate psychometric properties (Schoeps et al., 2019). The psychometric properties in this seem to be adequate: $\chi^2(df) = 573.31(186)$; S-B$\chi^2(df) = 447.15(186)$; S-Bχ^2/df = 2.40; CFI = 0.93; IFI = 0.93; RMSEA = 0.05 (IC = 0.04–0.05); α = 0.81 for perception, α = 0.90 for expression and α = 0.78 for emotional regulation.

The Strengths and Difficulties Questionnaire (SDQ) was designed by Goodman (1997). It is a self-report measure used to assess emotional and behavioral problems related to mental health in children and adolescents (Ortuño-Sierra et al., 2016). The questionnaire consists of 25 items with a Likert format of 3 response options (from "0 = not true" to "2 = true"), which are grouped into 5 dimensions: "Emotional Symptoms," "Behavior Problems," "Hyperactivity"), "Problems with Peers," and "Prosocial Behavior." The SDQ has acceptable reliability, as well as internal, convergent, and predictive validity (Goodman et al., 1998; Ortuño-Sierra et al., 2015). Only the Peer Problems scale was used in our research. The psychometric properties in this study do not seem be adequate: α = 0.52 peer problems but for its full scale (difficulties) it was 0.71.

RESULTS

First, the main descriptors and calibration values for the variables studied are presented (**Table 1**).

Descriptive Analysis and Mean Difference

In the total sample of adolescents, 48.3% presented low *self-esteem*. In the subsample of healthy adolescents, 46.4% showed low self-esteem and 52.3% in the subsample of adolescents with CD. Differences in self-esteem were found between healthy people and CD ($t_{673} = 2.48$; $p = 0.01$; $d = 0.20$), with lower levels of self-esteem shown by adolescents with CD.

Related to the *problems with peers* variable: (a) in the total sample, 12.5% showed borderline scores in problems with peers, and 3.3% abnormal ones; (b) in the subsample of healthy adolescents, 11.6% showed borderline scores and 2.9% abnormal ones; (c) in the subsample of adolescents with CD, 14.4% showed borderline scores and 4.2% abnormal ones. However, no significant differences were found between healthy and CD adolescents ($t_{669} = -0.51$; $p = 0.63$; $d = 0.05$).

Meanwhile, in *emotional competencies*, the mean scores were found to be close to 4.5 in all competencies and in the two-subsample types, indicating moderate scores. No significant

	Self-esteem	Anxiety	Depression	Peer problems	Emotional perception	Emotional expression	Emotional regulation
M	147322.63	274.54	28.97	21.26	61115.97	66087.38	62029.35
SD	218434.91	510.80	75.50	23.75	64006.52	79979.84	68212.70
Min.	0	1	1	2	2	2	1
Max	1,368,576	4,096	1,024	243	279,936	279,936	279,936
Calibration values							
P10	1,670	8	2	6	3,840	576	2,160
P50	52,488	72	8	12	40,000	32,000	36,432
P90	442,368	787	64	37	135,000	194,400	157,464

M, mean; SD, standard deviation; min, minimum; max, maximum; P10, 10th percentile; P50, 50th percentile; P90, 90th percentile.

differences were found between the two groups (healthy vs. CD) in any emotional competence: emotional perception ($t_{676} = -0.73$; $p = 0.47$; $d = 0.05$), emotional expression ($t_{678} = 0.63$; $p = 0.53$; $d = 0.05$) and emotional regulation ($t_{674} = -0.69$; $p = 0.49$; $d = 0.06$).

Regarding *anxiety*: (a) 57.9% of the total sample showed anxious symptoms and 27.8% of these presented an anxiety disorder requiring psychological treatment; (b) in the subsample of healthy adolescents, 52.4% showed anxious symptoms (22.4% of these implied an anxiety disorder that would need psychological treatment; (c) in the sample of adolescents with CD, 69.2% showed anxious symptoms (and psychological treatment was recommended in 38.9% of these).

For *depression*: (a) in the total sample, 21.8% showed depressive symptoms (8.7% of these being a possible psychological disorder); (b) in the healthy sample, 19.5% had symptoms, and 6.8% of these a possible disorder; (c) in the adolescents with CD, 26.8% showed symptoms, 12.7% of these had a possible disorder requiring psychological treatment.

Finally, differences were found between the two groups for *anxiety and depression*, with adolescents with CD presenting higher levels of anxiety ($t_{676} = -2.96$; $p \leq 0.01$; $d = 0.42$) and depression ($t_{675} = -5.21$; $p \leq 0.001$; $d = 0.25$).

Structural Equation Model (SEM)

The results of the causal relationships model showed a good overall fit: $\chi^2 = 2361.66$, df = 1012, $p \leq 0.001$; S-B$\chi^2 = 1964.73$, df = 1012, $p \leq 0.001$; S-BX^2/df = 1.94; RMSEA = 0.037 (IC = 0.035–0.040); CFI = 0.90; IFI = 0.90.

Figure 1 shows the standardized coefficients of each of the relationships that have proven to be statistically significant predictors of the anxiety and depression. The model explained 41% ($R^2 = 0.41$) of the variance of *anxiety* and the factors of self-esteem, peer's problems and emotional perception were found to present a statistically significant positive relationship for peer problems ($\beta = 0.16$) and emotional perception ($\beta = 0.12$) and a negative relationship with self-esteem ($\beta = -0.53$), respectively. The model explained 72% ($R^2 = 0.72$) of the variance of *depression* and it presented a statistically significant positive relationship for peer problems ($\beta = 0.38$) and a negative relationship negative with self-esteem ($\beta = -0.47$) and emotional regulation ($\beta = -0.15$), respectively. All the independent variables were found to be interrelated, and self-esteem was positively related to emotional

competencies and negatively related to peer problems. This latter variable was also negatively related to emotional competencies. The dependent variables were also positively correlated with each other ($r = 0.63$). The moderating effect of the structural equation model could not be determined because the indices for the disease sample did not show a goodness of fit [$\chi^2 = 1676.74$ df = 1012, $p \leq 0.001$; S-B$\chi^2 = 1455.99$, df = 1012, $p \leq 0.001$; S-BX^2/df = 1.44; RMSEA = 0.045 (IC = 0.039–0.049); CFI = 0.87; IFI = 0.87].

Comparative Qualitative Analysis of Fuzzy Sets (fsQCA)
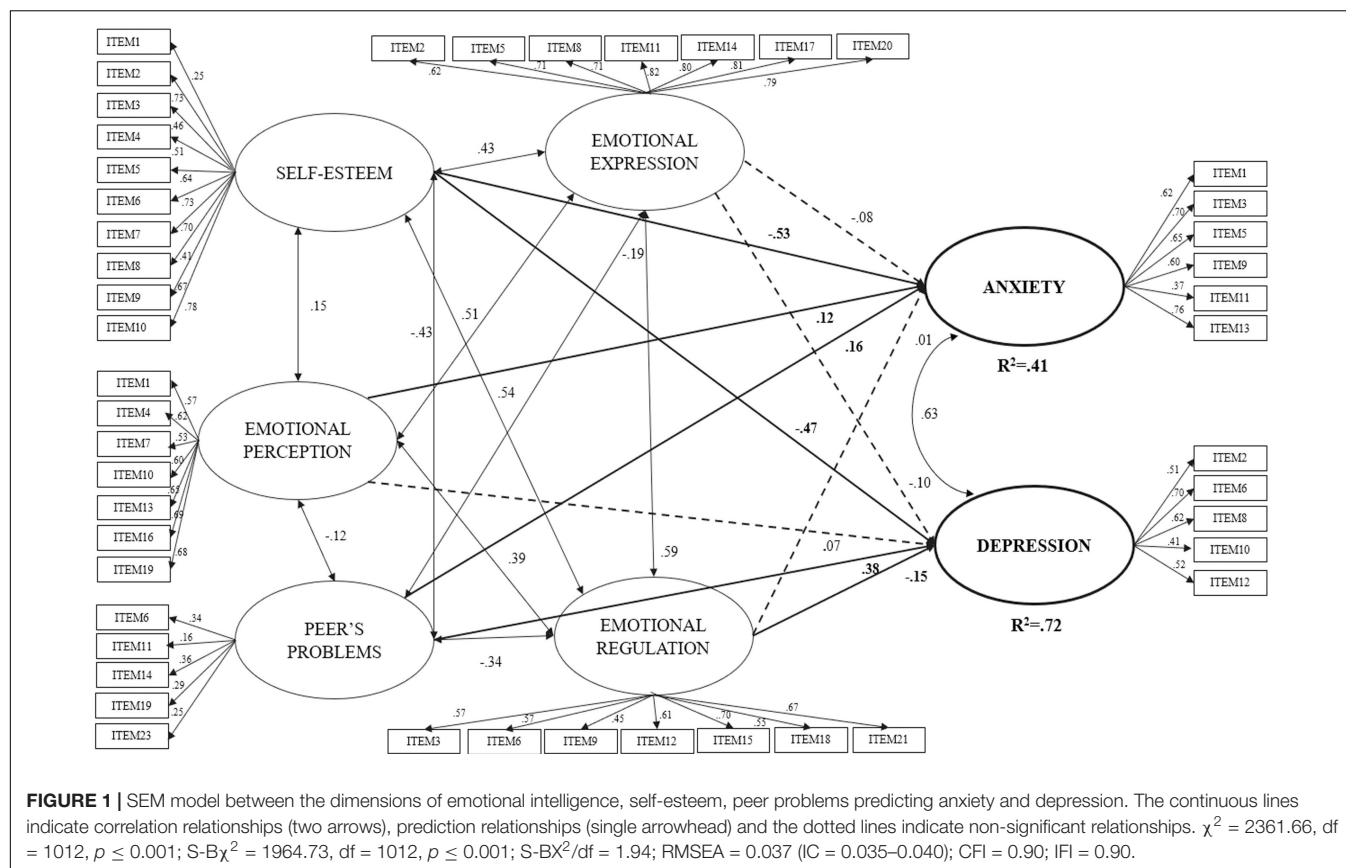### Necessary Analysis

Based on the results obtained, in the necessary analysis there appears to be no necessary condition for the occurrence or non-occurrence of anxiety or depression, as all the consistency values were under 0.90 (Ragin, 2008; **Table 2**).

Sufficiency Analysis

The combination of conditions that led to high and low levels of anxiety and depression (**Table 3**) were calculated in the sufficiency analyses. This is based on the premise that in fsQCA a model is informative when the consistency is around or above 0.74 (Eng and Woodside, 2012).

The intermediate solution indicated four combinations of causal conditions that can produce high levels of *anxiety* which accounted for 24% of cases (Overall Consistency = 0.82; Overall Coverage = 0.24) and six combinations of causal conditions that lead to low levels of anxiety that explained 47% of the cases (Overall Consistency = 0.88; Overall Coverage = 0.47) (**Table 3**). In the prediction of high levels of anxiety, the most relevant pathway for predicting high anxiety was the result of the interaction of low emotional expression, high levels of peer problems, low self-esteem and having a CD (Raw coverage = 0.19; Consistency = 0.86). Meanwhile, in the prediction of low levels of anxiety, the most relevant combination for predicting low anxiety was the result of the interaction of low emotional expression, high self-esteem and being healthy (Raw coverage = 0.27; Consistency = 0.87).

For *depression*, the intermediate solution indicated seven combinations of causal conditions that can lead to high levels of depression, which accounted for 55% of cases (Overall Consistency = 0.78; Overall Coverage = 0.55), and five pathways leading to low levels of depression that explained 61% of the cases

FIGURE 1 | SEM model between the dimensions of emotional intelligence, self-esteem, peer problems predicting anxiety and depression. The continuous lines indicate correlation relationships (two arrows), prediction relationships (single arrowhead) and the dotted lines indicate non-significant relationships. χ^2 = 2361.66, df = 1012, $p \leq 0.001$; S-Bχ^2 = 1964.73, df = 1012, $p \leq 0.001$; S-BX^2/df = 1.94; RMSEA = 0.037 (IC = 0.035–0.040); CFI = 0.90; IFI = 0.90.

TABLE 2 | Necessary analysis for anxiety and depression.

	High levels of anxiety		Low levels of anxiety		High levels of depression		Low levels of depression	
	Cons	Cov	Cons	Cov	Cons	Cov	Cons	Cov
Disease	0.39	0.54	0.27	0.47	0.36	0.48	0.29	0.52
Healthy	0.61	0.40	0.73	0.60	0.64	0.41	0.71	0.59
High self-esteem	0.45	0.45	0.65	0.81	0.41	0.41	0.66	0.84
Low self-esteem	0.81	0.65	0.56	0.56	0.84	0.66	0.53	0.54
High peer problems	0.68	0.60	0.56	0.63	0.69	0.60	0.54	0.61
Low peer problems	0.58	0.51	0.65	0.72	0.55	0.48	0.65	0.73
High emotional perception	0.82	0.54	0.78	0.66	0.78	0.51	0.80	0.68
Low emotional perception	0.59	0.64	0.46	0.76	0.51	0.66	0.43	0.72
High emotional expression	0.52	0.51	0.60	0.74	0.48	0.46	0.63	0.77
Low emotional expression	0.74	0.60	0.60	0.61	0.77	0.61	0.57	0.59
High emotional regulation	0.52	0.50	0.61	0.74	0.48	0.44	0.65	0.78
Low emotional regulation	0.72	0.60	0.58	0.61	0.77	0.63	0.54	0.57

Cons, consistency; Cov, coverage; Condition needed, consistency = 0.90.

(Overall Consistency = 0.89; Overall Coverage = 0.61) (**Table 3**). The most relevant combination for predicting high depression was the result of the interaction of low emotional regulation and emotional expression, high levels of peer problems and low self-esteem (Raw coverage = 0.44; Consistency = 0.83). Meanwhile, the most relevant pathway for predicting low depression was the result of the combination of high emotional regulation and emotional expression and high self-esteem (Raw coverage = 0.46; Consistency = 0.91).

DISCUSSION

It is necessary to assess the adjustment of adolescents in the school context, considering important variables as their emotional competencies, self-esteem, relationships with their peers and emotional difficulties. This aspect is even more crucial when we consider the presence of a CD during this period. Various studies (Chen et al., 2020; Duinhof et al., 2020; Wang et al., 2020) evaluate the impact of these variables on emotional

TABLE 3 | Summary of the main sufficient conditions for the intermediate solution of anxiety and depression.

Frequency cut-off 1	High levels of anxiety Consistency Cutoff:0.85			Low levels of anxiety Consistency Cutoff:0.92			High levels of depression Consistency Cutoff:0.81			Low levels of depression Consistency Cutoff:0.91		
	1	2	3	1	2	3	1	2	3	1	2	3
Disease	●	●	●	○	○			●	●		○	○
Self-esteem	○	○		●	●	●	○	○	○	●	●	●
Peer problems	●		●		○	○	●		●			○
Emotional perception						○				●		
Emotional expression	○	●	●	○			○	○				
Emotional regulation		○	○		○	●	○	○	○	●	●	
Raw coverage	0.19	0.12	0.11	0.27	0.21	0.20	0.44	0.22	0.19	0.46	0.35	0.34
Unique coverage	0.09	0.02	0.01	0.04	0.02	0.06	0.28	0.03	0.02	0.02	0.01	0.08
Consistency	0.83	0.86	0.87	0.87	0.94	0.94	0.83	0.81	0.85	0.91	0.90	0.91
Total consistency		**0.82**			**0.88**			**0.78**			**0.88**	
Total coverage		**0.24**			0.47			**0.55**			**0.61**	

●, presence of condition; ○, absence of condition; ∼, absence of condition. Expected vector for anxiety and depression: 1.0.1.0.0.0 (0: absent; 1: present). Expected vector for ∼ anxiety and depression: 0.1.0.1.1.1 using the format of Fiss (2011).

adjustment in a linear fashion. However, there are virtually no studies that address these issues by comparing SEM and QCA methodologies, and those involving a comparative study of these variables considering the presence or absence of a CD in adolescence are even scarcer.

Regarding the objective of studying the psychological repercussions of CD in adolescence we would like to highlight the areas discussed below. We could do this by comparing the results of SEM models with QCA models to analyze the possible influence of self-esteem, peer problems, and emotional competencies on levels of anxiety-depression in adolescents with and without CD.

For H1 and H2, the results obtained with SEM models are generally consistent with previous studies (Martínez-Monteagudo et al., 2019; Schoeps et al., 2019; Chen et al., 2020; Duinhof et al., 2020). Adolescents who show high levels of anxiety also have low self-esteem, greater problems with their peers, and greater emotional perception. These findings are consistent with other studies, which indicated that levels of emotional perception or attention should be intermediate to be considered healthy (Navarro-Mateu et al., 2020). Similarly, adolescents with more depressive symptoms present lower self-esteem and worse emotional regulation, as well as more problems with their peers. SEM model highlights the close relationship between anxious and depressive symptoms, as already observed in previous studies (Sowislo and Orth, 2013). It has observed how lower self-esteem is associated with more peer problems and poorer emotional skills (Anto and Jayan, 2016; Wang et al., 2020). Self-esteem in both cases (anxiety and depression) is the variable that best predicts the presence of emotional symptoms, and the one that is most closely associated with emotional skills. The literature has pointed out how deficits in self-esteem and emotional skills/competencies are risk factors in the development and maintenance of psychological problems (Martínez-Monteagudo et al., 2019; Schoeps et al., 2019; Wang et al., 2020). If problems with self-esteem and emotional skills are accompanied by peer problems, the impact on psychological problems may be even

greater, since less social support is considered a risk factor for physical-emotional health (Vicent et al., 2017; Chen et al., 2020).

Meanwhile, H3 is partially accepted since, at a descriptive level, adolescents with CD show a higher level of anxious and depressive symptoms, lower self-esteem, and more peer problems. However, the moderating role in the SEM model could not be verified.

In response to the comparison between the two data analysis methodologies, most studies in the health sphere have focused on analyzing the levels of anxious and depressive symptoms using linear models (Cobham et al., 2020; Duinhof et al., 2020; Kim et al., 2020; Navarro-Pardo et al., 2012) such as SEM, but they have barely studied the aspects related to this symptomatology using other non-linear relationship analyses, and examined the combination of two complementary methodologies such as SEM and QCA. This combination of methodologies gives us the opportunity to study the relationship between the variables analyzed in much more depth. The QCA models allow us to incorporate the observation of the different paths or combinations that lead to the same result (equifinality).

Our results suggest that although none of the conditions are necessary for anxious symptoms, adolescents with a CD who had low self-esteem, problems with their peers and difficulties in emotional expression and regulation presented high levels of anxiety. Similarly, the teens who did not have a CD, but had high levels of self-esteem and enjoyed positive relationships with their peers showed low levels of anxiety (even when they presented difficulties in emotional skills). Our research therefore points to the impact of CD on the lives of adolescents (Cobham et al., 2020; Kim et al., 2020; Nabors, 2020), as well as the importance of a strong social support group and good self-esteem (Valero-Moreno et al., 2020).

There are also no necessary variables for depressive symptoms, but we observed that high levels of clinical depression were associated with the combination of presence of a CD, low self-esteem, peer problems, low expression, and emotional regulation. Similarly, low levels of depression were associated

with the combination of absence of CD, high self-esteem, good relationships with peers and a good ability to regulate emotions. Our results are consistent with previous studies which suggested that high self-esteem, good social support and adequate emotional skills act as an important protector against psychopathology (Schoeps et al., 2019; Valero-Moreno et al., 2020). Based on the comparison of the two methodologies, it can be concluded that these variables are predictors of anxious and depressive symptoms. This result appears in both methodologies, but in the QCA models, it can be highlighted how the presence of a CD is a relevant variable in the prediction of adolescents with high and low levels of anxiety and depression. However, more studies are needed to further explore these variables to determine the role of CD in adolescent adjustment. Our data seem to indicate that it is the psychosocial variables that determine this adjustment, since the presence of CD is only seen as a variable that worsens anxiety and depression when it occurs with other risk factors such as low self-esteem, poor emotional skills or inadequate social support.

After comparing both methodologies, we observed how QCAs also allow us to account for non-linear relationships by not focusing on the individual contribution or importance of each variable. The combination of both methodologies therefore allows our work to provide a much more complete picture of the behavior of the variables (Navarro-Mateu et al., 2020).

Despite the important contributions of this study, our research has some limitations. In particular, the cross-sectional design and the selection of the sample, complicate the generalization of the data to the population. Future studies will need to increase the number of participants on a randomized basis. All the adolescents go to schools in the Valencian Community. However, state schools and private schools partially subsidized by the government in both urban and rural areas were included, thereby making the sample more representative. In addition, we have more adolescents with no health conditions in our study than those with them. However, our data reflect the reality of the Spanish schools, with fewer students with chronic conditions than students without them. On the other hand, it should be noted that the subscale of difficulties with peers obtained an internal consistency lower than recommended. This may be frequent in subcategories composed of less than 6 items (Lloret et al., 2014).

Our results promote social awareness of the importance of protective variables such as self-esteem, emotional skills, and peer group social support in adolescence. They also increase knowledge of the impact that the presence of a CD has on the emotional health of adolescents. Thus, it strengthens, the importance of undertaking group interventions with adolescents, ideally in the school environment, which enhance their self-esteem, emotional skills, and social support network. This type of program will help prevent or diminish emotional problems during this period. In addition, our research highlights the importance of considering the presence of CD currently in the life cycle.

In conclusion, knowing which variables are associated with the psychological health of adolescents can help reduce their impact on their physical and emotional well-being. It is necessary to promote emotional health in adolescents by increasing emotional skills, positive social relationships, and self-esteem, with special attention to adolescents with CD who need it.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Bioethics Committee of the Government of the Valencian Community (CN00A/2020/42/S). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

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

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SUPPLEMENTARY MATERIAL

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Profiles of Mobile Phone Problem Use in Bullying and Cyberbullying Among Adolescents

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Technology is being used by individuals of all ages; young children show a high tendency of problematic use of devices such as smartphones. This study aimed to identify different profiles that vary in conflicts related to problematic mobile phone use and maladaptive communication and emotional patterns. Therefore, we examined whether there are significant differences in bullying and cyberbullying among teenagers who have a problem utilizing mobile phones. The study participants were 810 students of Compulsory Secondary Education (M = 13.99, SD = 1.32), with 52.2% being girls. Questionnaires on school violence and experiences related to mobile phones were administered. The latent profile analysis identified three different types of problematic mobile phone use: (a) low levels of conflict was associated with mobile phone abuse and low levels of communication and emotional use; (b) moderate levels of conflict was associated with mobile phone abuse and moderate levels of communication and emotional use; and (c) high levels of conflict was associated with mobile phone abuse and high levels of communication and emotional use. The study results highlight significant differences in the manifestations of school violence between the profiles. Finally, this study's findings form the basis for the development of education programs to prevent mobile phone abuse and school violence and therefore academic adjustment.

Keywords: bullying, cyberbullying, mobile phone, adolescence, academic adjustment

INTRODUCTION

Mobile phones have become essential in our daily lives. The mobile phone is a tool that allows communication, expression, access to information and leisure, and even aiding autonomy and sometimes prestige via generating symbolic appearances. Therefore, it fulfills various playful-expressive, referential, and communicative functions (García and Monferrer, 2009; Lee et al., 2014; Besoli et al., 2018). Additionally, social networks utilized via a mobile phone constitute a form of social interaction, allowing dynamic exchange and for users to expand their usual communication and emotional expression. Users can share feelings, opinions, and sometimes commit misconduct (doing and saying different things, including those not said in person) (Cornejo and Tapia, 2011; Fernández-Sánchez, 2013; Serrano-Puche, 2016; Díaz-López et al., 2020). Hence, mobile phone usage may damage interpersonal relationships (Lee et al., 2014).

Mobile phone usage is diverse and many aspects leading to its problematic usage must be considered (Carbonell et al., 2012a; Besoli et al., 2018). Behavioral addictions share characteristics similar to substance addictions (tolerance, comorbidity, neurobiological mechanisms, etc.).

Although the DSM-5 (American Psychiatric Association [APA], 2013) proposed a category of addiction and related disorders including substance-free addictions, however, problematic mobile phone use is not yet included (Grant et al., 2010). Therefore, problematic mobile phone use should be referred to as problematic or maladaptive behaviors and not as addiction (Panova and Carbonell, 2018). Thus, the person who presents with problematic mobile phone use usually recreationally utilizes a mobile phone in excessive and uncontrollable manners. The user usually submits a short-term reward search leading to dependency and a loss of control (Cía, 2013). Hence, the person seeks to relieve their emotional discomfort (boredom, loneliness, nervousness, irritability, etc.) and utilizes the mobile phone as a buffer for emotional tension (Echeburúa and de Corral, 2010; Cía, 2013; Serrano-Puche, 2016; Santana-Vega et al., 2019). Problematic mobile phone use may sometimes lead to an over-the-over-the-face economic expense from advertising or false subscriptions. Another directly associated risk is the recording and distribution of videos and images that may be mis-used in a context of school violence, coupled with the impersonation by the intrusion of fraudulent messages, the chains of pedophiles, etc. (García and Monferrer, 2009). Mobile phone usage has been associated with unhealthy interferences in an individual's daily life (Echeburúa and de Corral, 2010; Cía, 2013; Fernández-Sánchez, 2013; De-Sola et al., 2019). Problematic mobile phone use with the utilization of social networks, impacts negatively the physical, mental, and social well-being of the person (Lim and Yang, 2015; Amendola et al., 2019). There is evidence reported of addiction to mobile devices being greater than addiction to social media services (Barnes et al., 2019), the user profile for mobile phone addiction is different to the profile for someone addicted to the internet (De Sola-Gutiérrez et al., 2016).

Problematic mobile phone use has increased, especially during adolescence globally (Carbonell et al., 2012a; Besoli et al., 2018) and has been a subject of interest for other investigations due to their impact (Lee et al., 2014). The lack of maturity during adolescence may lead to inappropriate behaviors or attitudes even causing psychological discomfort (Besoli et al., 2018). Thus, the intensive use of mobile phones amongst adolescents has been associated with drug use, poor academic performance, low self-esteem, and poor social relations (Echeburúa and de Corral, 2010; Livingstone and Smith, 2014; Muñoz-Miralles et al., 2016); impulsivity, anxiety, and stress (De Sola-Gutiérrez et al., 2016); greater emotional mismatch (Amendola et al., 2019) and low family cohesion (Muñoz-Miralles et al., 2016; Santana-Vega et al., 2019). Teenagers above all, utilize mobile phones in recreational or communicative manners (surfing the internet, social networks, listening to music or collective fun) and rendering the mobile phone as a source of evasion, distraction, anger control or anxiety (Echeburúa and de Corral, 2010; Moral and Suárez, 2016; Díaz-López et al., 2020). Young teenagers show an inability to disconnect or turn off mobile phones that, consequently, reduces sleep, increases worry and anxiety, and is associated with a greater fear of missing out (or FOMO) on sharing experiences with others – which in turn increases the desire to use mobile phones more often (to feel connected) associated with psychological reasons

leading to increases and problematic mobile use (Gil et al., 2015; Santana-Vega et al., 2019). Dependence on the social environment coupled with the need for belonging is associated with mobile phones being an essential vehicle of communication but may also become problematic and addictive (De-Sola et al., 2019). Consequently, most teenagers prefer to communicate via mobile phones rather in person because it allows them to socialize, have fun, promote their social status and identity, etc. (Moral and Suárez, 2016).

Thus, the search for identity in adolescence may mean that the media will lead to users not being aware of the risks involved in sharing information on the internet (Arab and Díaz, 2015). In adolescence there is a shared technological culture since personal information and that of personal problems, mood problems, photographs, and expectations are shared without taking the risk of the loss of privacy (Sabater Fernández and López-Hernáez, 2015). For example, "doxing" is a violation of someone's information without their consent and is a form of cyberbullying (Chen et al., 2019). Cyberbullying occurs in a highly socialized environment. Therefore, harassment in cyberspace is linked to harassment in the face-to-face context (Casas et al., 2013; Kowalski et al., 2014; Arab and Díaz, 2015; Olweus and Limber, 2018; Chen et al., 2019). Teenagers with a problematic use of new technologies have been associated with increased bullying and cyberbullying problems (Arnaiz et al., 2016). Additionally, adolescents with problematic social media behavior are more involved in aggressive behaviors among the peers (Martínez-Ferrer et al., 2018). Previous research indicates that internet access via a mobile phone has been linked to greater involvement in the role of aggressor and in the role of victimization by cyberbullying regarding those not involved (Giménez et al., 2015; Kwok et al., 2017; Gül et al., 2019). Time spent communicating with friends, posting information, and browsing on mobile phones is associated with an increased risk of victimization by cyberbullying (Kwok et al., 2017).

Thus, our objective was to identify different profiles that vary in conflicts related to problematic mobile phone use and maladaptive communication and emotional patterns. Therefore, this study aimed to examine whether there are significant differences in bullying and cyberbullying among adolescents with problematic mobile phone behavior.

The main hypotheses are: (1) there are different profiles of problematic mobile phone use among adolescents; and (2) adolescents with mobile phone use problems will be more involved in problems of school violence (bullying and cyberbullying).

MATERIALS AND METHODS

Participants

Initially, 1021 adolescents were recruited from secondary education centers in different geographical areas of the Region of Murcia. It is a representative sample of the secondary pupils (with a maximal error of 5%). After excluding 211 from whom informed consent was not obtained or questionnaires incomplete, 810 were finally included. Participants were from secondary

education schools, with 52.2% being girls, and were 12 to 16 years old (M = 13.99, SD = 1.32). Further, 77.9% had not repeated a course and 4.8% were born outside of Spain. The distribution was homogeneous in terms of sex and age ($\chi2$ = 4.33, p = 0.50) there being no differences between said sociodemographic variables. The socio-economic level of the different areas and schools was average.

Design and Procedure

The study protocol was approved by the Ethics Committee of the University of Murcia (ID: 2627/2019). Afterward, the participating centers from the different geographical areas of the Region of Murcia were selected. A personal interview was arranged with the management team and the educational guidance department to indicate the objectives of the study and request participation. After permission from the schools was granted, informed consent was obtained from all participants and their parents for study participation. The study instruments (detailed below) were administered during a 50-min session, maintaining anonymity and confidentiality.

Instruments

Three assessment instruments were applied in the study. First, the following socio-demographic variables were assessed: gender (male/female), age, grade, country of birth, course repetition (yes/no), nature of the school (public/private/semi-private).

Secondly, the School Violence Questionnaire [a revision of Álvarez-García et al.'s (2011)] was administered. This included 31 items measuring the frequency of occurrence for different manifestations of school violence: violence of teachers toward students (VTS), physical indirect violence by students (VPI), physical direct violence between students (VPD), verbal violence among students (VVS), verbal violence of students toward teachers (VVT), social exclusion (SE), disruptive behavior in the classroom (DB), and violence through new information and communication technologies (VICT). The Cronbach's α coefficient range for Álvarez-García et al.'s (2011) study was 0.67 (VPD) –0.88 (VTS). For our study, it ranged from 0.66 to 0.87, being for each factor Cronbach's alpha: VTS (α = 0.85), VPI (α = 0.70), VPD (α = 0.72), VVS (α = 0.75), VVT (α = 0.66), SE (α = 0.73), DB (α = 0.78) and VICT (α = 0.87). Examples of items: "The students put annoying nicknames to their classmates"; "There are students who spread negative rumors about classmates and companions."

Last, the Mobile Related Experiences Questionnaire (CERM), as prepared by Beranuy et al. (2009), was utilized. Specifically, it measures mobile phone abuse via a survey made up of 10 items on a four-point Likert scale. This instrument consists of two factors: conflicts related to mobile phone abuse (CONFLICTS) and problems due to communicational and emotional use the mobile phone (USE COMMUNICATIONAL). The Cronbach's α coefficient 0.81 for CONFLICTS and 0.75 for USE COMMUNICATIONAL in Beranuy et al. (2009). For our study, these were, respectively, 0.91 and 0.89. Adequate reliability has been shown according to Cronbach's alpha (α = 0.80) for the whole instrument (Beranuy et al., 2009) and for our study (α = 0.94). "Do you stop hanging out with your friend because

you spend more time using your mobile?" "When you get bored, do you use the mobile as a way of distraction?"

Data Analysis

In order to meet our objective and to be able to identify the different profiles that vary in conflicts related to problematic mobile phone use and maladaptive communication and emotional patterns, it was first necessary to perform a latent profile analysis. Specifically, in this study, latent profile analysis was utilized to identify the subgroups of students (Schreiber, 2017). After analyzing the lowest values of the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), the best model was chosen (detailed below) (Muthén and Muthén, 2012). The groups of students were defined based on the different types of problematic mobile phone use: conflicts related to mobile phone abuse (CONFLICTS) and communicational and emotional use (USE COMMUNICATIONAL). To attend to the secondary objective, analysis of variance (ANOVA) was conducted to examine the different manifestations of school violence between the groups, partial eta squared (η_p^2) was used to estimate the magnitude of the differences and the *post hoc* test with the Bonferroni method and Cohen's d was estimated for the magnitude of the differences (per Cohen, 1998). SSPS Statistics version 23.0 and the Excel package (XLSTAT) to run the latent class analyses was utilized.

RESULTS

Table 1 shows the Pearson's correlation coefficient among the variables of this study. It demonstrates that they are all positive and statistically significant, so the profiles were analyzed.

Table 2 presents the models obtained (from two to six classes). All models were statistically significant. Model 3 present the best and the less BIC values, the best indicators of the Vuong-Lo-Mendell-Rubin likelihood-ratio test (VRT) was significant and the size was 0. The cluster and latent profile analyses identified three different types of problematic mobile phone use: (a) a first group of 534 students (65.9%), characterized by low levels of conflicts related to mobile phone abuse and low levels communicational and emotional use (termed non-problematic use); (b) a second group of 209 students (25.8%), characterized by moderate levels of conflict related to mobile phone abuse and

TABLE 1 | Pearson's correlation coefficient between the variables of study.

Variable	Conflicts	Use Communicational
VTS	0.382**	0.341**
VPI	0.320**	0.294**
VPD	0.341**	0.287**
VVS	0.232**	0.270**
VVT	0.172**	0.201**
SE	0.265**	0.222**
DB	0.115**	0.169**
VICT	0.410**	0.306**

**p < 0.01.

TABLE 2 | The fit of the all latent class models.

Models	AIC	BIC	BIC-adjusted	LRT	LRT-adjusted	BLRT	Entropy	Size
2	4156.294	4189.173	4166.944	0.0000	0.0000	0.0000	0.900	0
3	4023.664	4070.635	4038.879	0.0280	0.0319	0.0000	0.781	0
4	3924.906	3985.967	3944.685	0.0000	0.0000	0.0000	0.816	1
5	3876.973	3952.125	3901.316	0.0058	0.0071	0.0000	0.870	2
6	3826.933	3916.176	3855.840	0.0000	0.0000	0.0000	0.841	2

AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; LRT, Vuong-Lo-Mendell-Rubin likelihood-ratio test; BLRT, Bootstrap Likelihood Ratio test.

moderate levels communicational and emotional use (termed moderate problematic use); and (c) a third group of 67 students (8.3%), characterized by high levels of conflict related to mobile phone abuse and high levels of communicational and emotional use (termed problematic use) (see **Figure 1**).

The results of the ANOVAs revealed significant differences between the three profiles different of problematic mobile phone use regarding the manifestations of school violence (see **Table 3**).

Post hoc comparisons (see **Table 4**) reported that in general, the non-problematic use group obtained significantly lower scores for the manifestations of VTS, VPI, VPD, VVS, VVT, SE, DB, and VICT than the moderate problematic use group. The former group also obtained significantly lower scores than the problematic use group. Similarly, moderate problematic use group also obtained significantly lower scores than the problematic use group, regarding the manifestations of school violence.

DISCUSSION

In this study, the cluster and latent profile analyses, identified three different types of problematic mobile phone use, as described above. Similar to our study, Carbonell et al. (2012a) showed the existence of three clusters for problematic mobile phone use via the CERM, based on low, moderate or high scores for participants between 11 and 25 year old. Similarly, Díaz-López et al. (2020) showed the existence of three clusters based on the more or less adapted profile of ICT. In our study, we have shown evidence of three different conflict clusters regarding the use of mobile phones and inappropriate emotional and communication patterns, instead of taking them as one. This indicates that the objective and the first hypothesis of the study has been confirmed.

The second hypothesis of our study has been demonstrated. Our results indicate that there are significant differences in the manifestations of school violence between the profiles. Generally, in the different manifestations of school violence it has been found that the non-problematic use group showed values below the moderate problematic use group and still lower values compared to the problematic use group. The problematic use group achieved significantly higher values than the moderate problematic use group in VTS, VPI, VPP, VVS, SE, and VICT. Thus, the problematic use group is indicative of a profile of students who are at risk since they present high values of conflict with mobile use. Additionally, they indicate pattern of poor emotional adaptation and communication

and hence is the most maladaptive profile compared to the other profiles obtained. The moderate problematic use group values suggest intervention to promote actions to minimize the values found and prevent the risk from increasing. Finally, the values found in the non-problematic use group are appropriate values since this is a more favorable pattern compared to the other groups. Therefore, the 67 students in the problematic use group are most at risk due to the inadequate pattern of mobile phone use and the perception of greater involvement in the different manifestations of school violence. This corroborates research showing that the problematic use of new technologies relates to greater involvement in the different manifestations of school violence (bullying and cyberbullying) (Arnaiz et al., 2016). Thus, harassment in cyberspace is linked to real-life harassment (Arab and Díaz, 2015; Olweus and Limber, 2018; Chen et al., 2019). Problematic mobile phone use behavior has been associated with an increased risk of perpetuating roles of cyber-users and cyber victims, especially from decreased awareness of shared information (Giménez et al., 2015; Kwok et al., 2017; Martínez-Ferrer et al., 2018; Gül et al., 2019). Problems in social relationships, due to problematic mobile use and poor emotional and communication adaptation, may be consequent to mobile use being connected to the teenager's emotions and tensions (Echeburúa and de Corral, 2010; Cía, 2013; Serrano-Puche, 2016). Additionally, consequent is their search for identity (Moral and Suárez, 2016), and the preference for communication through new technologies versus that in person (Arnaiz et al., 2016) without being aware of the risks of sharing personal information on the Internet (Arab and Díaz, 2015) what can be associated with cyberbullying (Chen et al., 2019) with data that are worrying in our country.

Our study assists in educational programs to prevent problematic mobile phone use and school violence, and therefore supporting academic adjustment. Our data supports the need to promote actions aimed at improving coexistence and mobile phone use by teenagers because it may lead to problematic mobile phone use and therefore to a profile that implies a loss of control incurring problems at school and in social and family contexts (Fernández-Sánchez, 2013; Lim and Yang, 2015; Amendola et al., 2019). Hence, it would be advisable to perform actions that promote coexistence, social and communication skills, the management of emotions and stress, and healthy leisure activities (García and Monferrer, 2009; Echeburúa and de Corral, 2010; Moral and Suárez, 2016). Similarly, actions that involve family, teachers, school and orientation teams are required, creating
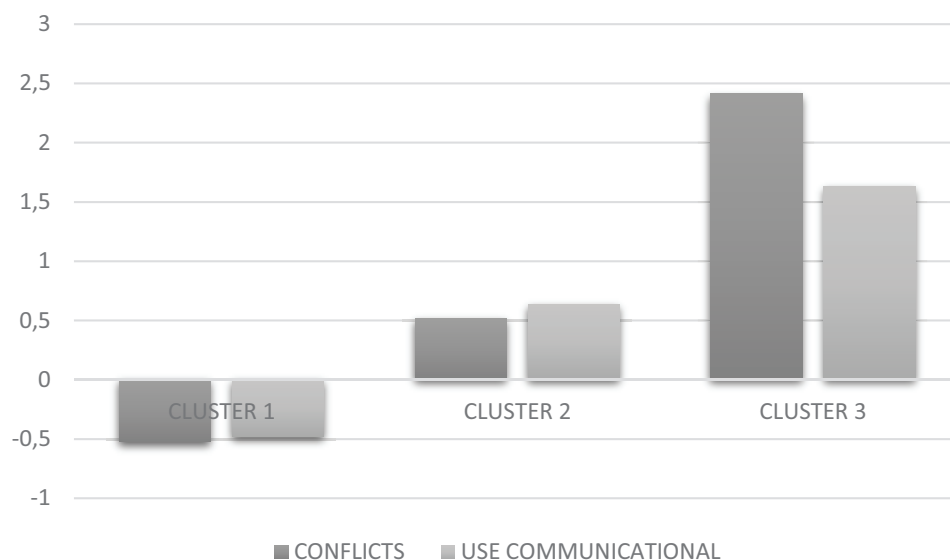
FIGURE 1 | Graphical representation of the three-cluster model. Cluster 1 (non-problematic use), Cluster 2 (moderate problematic use), and Cluster 3 (problematic use).

TABLE 3 | Means and standard deviations obtained by the three profiles for problematic mobile phone use and values of the partial eta squared (η_p^2) for each variable of school violence.

Variable	Group 1		Group 2		Group 3		Significance		
	M	**SD**	**M**	**SD**	**M**	**SD**	$F_{(2,807)}$	**p**	η_p^2
VTS	14.17	5.10	16.29	5.14	21.70	7.14	64.34	<0.001	0.14
VPI	6.03	2.26	7.23	2.47	8.70	3.28	46.67	<0.001	0.10
VPD	6.61	2.48	7.87	2.21	9.20	3.31	43.81	<0.001	0.10
VVS	10.97	3.33	11.88	3.20	14.08	3.72	28.25	<0.001	0.07
VVT	4.57	1.81	5.33	1.84	5.58	2.34	17.76	<0.001	0.04
SE	5.87	2.50	6.67	2.55	8.10	3.68	24.87	<0.001	0.06
DB	9.52	2.99	10.37	2.68	10.52	3.10	8.48	<0.001	0.02
VICT	8.68	3.66	10.81	4.22	15.07	7.86	74.01	<0.001	0.16

Cluster 1 (non-problematic use), Cluster 2 (moderate problematic use), and Cluster 3 (problematic use).

spaces that encourage responsible mobile use (Santana-Vega et al., 2019), allow for the early detection of problematic mobile use and early risk assessment leading to school violence (García and Monferrer, 2009; Echeburúa and de Corral, 2010; Carbonell et al., 2012b; Cía, 2013; Arnaiz et al., 2016). Additionally, families monitoring and improving their relationships are also essential (Muñoz-Miralles et al., 2016; Santana-Vega et al., 2019).

Our study is limited due to it being cross-sectional and the instruments used may have been associated with the effect of social desirability. Therefore, longitudinal studies are required (Livingstone and Smith, 2014) possibly up to the university level, including, among others, gathering information on emotional management (Amendola et al., 2019), focusing on other behavioral addictions possibly associated with previous psychological problems (Echeburúa and de Corral, 2010; Cía, 2013), and to investigate family communication (Santana-Vega et al., 2019) that can provide more information to the clusters.

TABLE 4 | Cohen's d indexes for *post hoc* contrast groups.

Models	Group1- Group 2	Group1- Group 3	Group2- Group 3
VTS	0.41***	1.40***	0.95***
VPI	0.52***	1.12***	0.55***
VPD	0.52***	1.01***	0.56*
VVS	0.28*	0.92***	0.66***
VVT	0.42***	0.70***	—
SE	0.32*	0.84***	0.50*
DB	0.29*	0.33*	—
VICT	0.56***	1.48***	0.80***

*p < 0.05, ***p < 0.01.

Finally, research for the delimitation of behavioral addictions, especially in DSM-5, remains necessary to advance proper diagnosis and treatment (Grant et al., 2010; Cía, 2013).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the study protocol was approved by the Ethics Committee of the University of Murcia (ID: 2627/2019). Written

informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

IM, AJ, and CR-E contributed to the conception and design of the review. IM and CR-E applied the search strategy. All authors applied the selection criteria, completed the bias-risk assessment, analyzed and the interpreted data, wrote this manuscript, and edited this manuscript.

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Test Anxiety in Adolescent Students: Different Responses According to the Components of Anxiety as a Function of Sociodemographic and Academic Variables

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Objective: Test anxiety (TA) is a construct that has scarcely been studied based on Lang's three-dimensional model of anxiety. The objective of this article is to investigate the repercussion of sociodemographic and academic variables on different responses for each component of anxiety and for the type of test in adolescent students.

Method: A total of 1181 students from 12 to 18 years old (M = 14.7 and SD = 1.8) participated, of whom 569 were boys (48.2%) and 612 girls (51.8%). A sociodemographic questionnaire and the *Cuestionario de Ansiedad ante los examenes-Adaptado (CAEX-A)* [Test Anxiety Questionnaire-Adapted] an adaptation for Spanish secondary school levels (ESO) and Bachillerato were administered.

Results: Girls scored higher on the cognitive and physiological components of TA than boys, the intensity of the physiological response increasing with age. Bachillerato level students reported more physiological anxiety than those of ESO level. Students with better marks in the previous year presented more anxiety in the cognitive component, while those who obtained the lower mark presented higher anxiety values in the behavioral component. Participants reported that the types of tests that cause them more anxiety were oral tests in front of the class, oral presentation in front of a panel, and mathematics tests.

Conclusion: Adolescents show a differential response of TA based on the physiological, cognitive and motor components, mediated by the variables of gender, age, grade, academic performance and type of exam. These results serve to design specific intervention programs to manage anxiety in situations of academic assessment.

Keywords: adolescents, text anxiety, age, gender, type of exam

INTRODUCTION

Test anxiety (TA) is the relatively stable tendency to generate a disproportionate emotional response in academic assessment situations, due to concern about poor performance and possible negative consequences (Balogun et al., 2017; Putwain and Symes, 2018). However, there is no consensus in the scientific and academic community on its conceptualization (Escolar-Llamazares and Serrano-Pintado, 2014). The lack of agreement is explained by the nature and dynamic structure of the

construct and it is underscored by the diversity of terms used in its definition: emotion, worry, tension, lack of security, irrelevant thinking, cognitive reactions to assessment situations, off-task behavior, autonomic reactions, bodily reactions, thinking, self-rumination, affective response, cognitive response, psychophysiological response, and motivational response (Liebert and Morris, 1967; Pekrun et al., 2004; Sarason, 1984; Wren and Benson, 2004; Pena and Losada, 2017).

Since the beginning, different models have been proposed for TA: one-dimensional (Mandler and Saranson, 1952), two-dimensional (Liebert and Morris, 1967), and multi-dimensional (Hodapp and Benson, 1997; Wren and Benson, 2004; Chin et al., 2017), giving rise to various evaluation instruments (Osterhouse, 1970; Valero, 1999; Lowe and Lee, 2004; García-Fernández et al., 2011; Sung and Chao, 2014). Within the multi-dimensional models, the three-dimensional theory of anxiety proposed by Lang (1968) stands out, which establishes that anxiety is composed of three response systems: cognitive, physiological, and behavioral or motor, which can be manifested in a discordant and asynchronous way (Furlan, 2006; Martínez-Monteagudo et al., 2012).

Research on TA based on Lang's three-dimensional model has focused on the university population (Valero, 1999; Rodríguez et al., 2014). However, there are some studies on non-university education levels, where differences have been found in socio-demographic variables such as ethnicity, age/grade level, and—especially—gender. The most consistent findings are that (1) girls have more TA at all levels of education (Putwain, 2007; Núñez-Peña et al., 2016; Aydin, 2017; Sari et al., 2017), which has been confirmed in different countries (Jalilian et al., 2016; Olaseni and Olomosaye, 2018; Brandmo et al., 2019; Lowe, 2019) and (2) in girls, the physiological and cognitive component of TA predominates, whereas in boys, it is the behavioral or motor component that prevails (Wren and Benson, 2004; Rodríguez et al., 2014; Aydin, 2019). Boys tend to see test situations as a challenge, and their reaction depends on their perception of their own competence in dealing with the task; if they consider themselves capable of successfully passing the test, they become involved behaviorally and emotionally, and if not, they give up, although in both cases they present low levels of TA (Rosàrio et al., 2008). Girls, on the other hand, interpret test situations as more of a threat and present higher levels of TA, which is expressed as fear, difficulty concentrating on the task, and poor academic self-concept/self-esteem (Spielberger, 1980). The gender difference in coping with test situations is probably due to the different degree of societal demand, which emphasizes the necessity for students to be involved in tasks as well as high expectations of success (Rosàrio and Soatres, 2003). This difference does not affect academic performance however, possibly because of girls' use of appropriate coping strategies (Núñez-Peña et al., 2016).

The relationship between the type of test and TA has been approached mainly from the perspective of the student's preference for the evaluation format. Zeidner (1987) found that most students prefer multiple-choice tests to essay tests, because the study and expression of ideas is more demanding in the latter type, which generates more TA. Similarly, Tas and Minaz (2019)

found that 70.67% of students choose multiple choice tests for reasons of convenience, ease, and accuracy. In the same vein, van de Watering et al. (2008) concluded that students choose written assessments, especially in multiple choice format, because oral tests are more stressful and difficult to prepare. Finally, Núñez-Peña et al. (2016) studied the differences in TA according to the type of test and gender, finding that girls had more anxiety and that anxiety levels increased in both genders according to the following sequence: test with calculations, open-ended test, oral presentation. However, in none of the reviewed studies do the results take into account the individual components of TA.

Research in this field has proven that there is discordance and asynchronism among TA response systems. For this reason, this study proposes as a general objective to analyze TA based on Lang's theory of the triple response system, considering the modulating role of sociodemographic and academic variables in adolescents. Specifically, the follow research questions were formulated:

1) Are there differences in the components of TA according to the gender and age of adolescent students?
2) Are there differences in the components of TA according to the educational level and academic performance of adolescent students?
3) Are there differences in the components of TA according to the type of test and the subject matter?
4) Are there differences in TA in the type of exam according to gender, age, and educational level?

MATERIALS AND METHODS

Participants

The initial sample consisted of 1,409 students, of which 189 (13.41%) did not attend class on the days of data collection and 39 (2.76%) did not obtain parental consent. Finally, a total of 1,181 students participated, from two public secondary schools (IES) in the Region of Murcia (Spain), selected for convenience. The age range was 12–18 years (M = 14.7 and SD = 1.8). The age groups were formed according to the classification of Oliva (2004): early adolescence (12–14 years), middle adolescence (15–16 years), and late adolescence (17–18 years). In Spain, studies during adolescence are organized into two educational levels: (a) Obligatory Secondary Education (ESO in Spanish), four school years from 12 to 15 years of age and (b) Non-Compulsory Secondary Education (Bachillerato/BAC in Spanish) two school years from 16 to 17 years of age (Organic Law 8/2013, of December 9, for the improvement of educational quality; LOMCE) (see **Table 1**).

Instruments

The *Cuestionario de Ansiedad ante los Exámenes para ESO y Bachillerato – Adaptado* [Test Anxiety Questionnaire for ESO and Bachillerato – Adapted] (CAEX-A) was used, which is an adaptation for ESO and Bachillerato students of the *Cuestionario para la Ansiedad ante los Exámenes* [Test Anxiety Questionnaire] by Valero (1999). The first part consists of 37 items that evaluate

	N	Percentage
Gender		
Male	569	48.2
Female	612	51.8
Total	1,181	100
Age group		
Early adolescence (12–14 years old)	561	41.2
Middle adolescence (15–16 years old)	379	32.1
Late adolescence (17–18 years old)	241	20.4
Total	1,181	100
School year*		
1st ESO (7th grade)	246	20.8
2nd ESO (8th grade)	186	15.7
3rd ESO (9th grade)	228	19.3
4th ESO (10th grade)	203	17.2
1st BAC (11th grade)	186	15.7
2nd BAC (12th grade)	132	11.2
Total	1,181	100
Mark (previous year)*		
Failure (D)	184	15.6
Adequate (C-)	141	11.9
Good (C +)	311	26.3
Very good (B)	405	34.3
Excellent (A)	140	11.9
Total	1,181	100

*The equivalents in the United States academic year and grading system are indicated in parentheses.

the intensity of the TA responses with a 5-point Likert type scale (0 = not at all, 1 = a little, 2 = a moderate amount, 3 = a lot, and 4 = very much) and the second of 11 items on TA caused by different test modalities evaluated with the same scale, to which the option "I have not done it" was added in case the student had never taken that type of test.

The first part of the TA questionnaire is based on Lang's three-dimensional theory of anxiety and comprises three factors: (1) physiological responses (20 items, range 0–80) (e.g., *in the test, my hands sweat. When I'm taking the test my heart beats very fast*); (2) cognitive responses (14 items, range 0–56) (e.g., I *think I'm going to get nervous and forget everything*); and 3) motor responses (3 items, range 0–12) (e.g., *I get sick and make excuses for not taking the test*). The total score is obtained by adding up the scores of the items of the three factors (range 0–148).

The internal consistency, Cronbach's α, is high except in the behavioral dimension: CAEX-A (α = 0.94), physiological responses (α = 0.90), cognitive responses (α = 0.90), behavioral responses (α = 0.50). In addition, the value of omega exceeds 0.85 in all scores. Also the test-retest reliability shows high values in the correlations, which points to the temporal stability of the instrument: r_{xy} = 0.87 for the physiological response; r_{xy} = 0.81 for the cognitive response, r_{xy} = 0.52 for the motor avoidance response, and r_{xy} = 0.66 for the total score. The percentage of variance explained by each factor is as follows:

41.33 for the physiological, 4.85 for the cognitive, and 6.84 for the behavioral. Finally, the convergent validity of the instrument with the *State-Trait Anxiety Inventory for Children* (STAI-C; Spielberger, 1973; Spielberger et al., 1990) is r_{xy} = 0.62 for the total scale (Torrano et al., 2020).

The *Questionnaire of sociodemographic and academic variables*. An *ad hoc* instrument was developed to collect the sociodemographic and academic data of interest to the study, including gender, age, and average mark from the previous year.

Procedure

Once permission was obtained from the Research Commission of the University of Murcia, the agreement of the schools was processed. Then, the authorization and informed consent was requested of the parents or guardians and the students themselves for participation in the study.

In agreement with the teachers, the moment chosen for its suitability to administer the questionnaires was a week of exams during the term's evaluation period, two weeks before the end of term.

Four psychology graduates were trained to administer the questionnaires collectively in the classroom. The students first answered the socio-demographic questionnaire and then the assessment administrators gave the standardized instructions for the CAEX-A. The administrators read the item aloud and the students responded. During the administration they answered any doubts and supervised the completion to guarantee the independent and adequate answering of the questionnaire.

Data Analysis

Since some of the assumptions of the parametric statistics were not confirmed, the Man–Whitney *U* test was used for two-group comparisons with one quantitative variable and the Kruskal–Wallis *H* test was used for three or more comparisons. In the latter case, the analysis was completed with pairwise comparisons using the Mann–Whitney *U*-test with Bonferroni-corrected *p*-value.

A Pearson correlation coefficient was established between TA in each type of exam and the global and partial scores of the CAEX-A. In addition, the same type of analysis was applied to determine the relationship between the age of the participants and anxiety components.

Finally, the differences in anxiety for each type of exam were studied according to gender, grouped age and educational level.

The *Statistical Package for the Social Sciences* (SPSS) version 22 (IBM Corp, 2011) was used for the statistical analyses.

RESULTS

Test Anxiety, Gender, and Age

Girls' scores were significantly higher, except on the behavioral component where boys scored slightly higher, but this was not statistically significant (see **Table 2**).

Test anxiety scores increased with age, except in the cognitive component where the peak was reached in middle adolescence, but again this was not statistically significant (see **Table 3**).

TABLE 2 | Gender difference in test anxiety scores.

Component	Sex	Average range	U	Z	Sig.
Physiological	Boys	498.99	118,140.50	−9.250	<0.001
	Girls	682.03			
Cognitive	Boys	501.88	120,005.00	−9.092	<0.001
	Girls	682.09			
Behavioral	Boys	596.48	170,175.50	−0.752	ns
	Girls	584.08			
Total TA	Boys	494.54	115,991.00	−9.433	<0.001
	Girls	680.84			

TABLE 3 | Age differences in test anxiety scores.

Component	Age	Average range	H	df	Sig.
Physiological	Early adolescence	545.55	17.832	2	<0.001
	Middle adolescence	608.92			
	Late adolescence	648.41			
Cognitive	Early adolescence	580.11	0.831	2	ns
	Middle adolescence	600.52			
	Late adolescence	591.56			
Behavioral	Early Adolescence	564.32	9.226	2	<0.05
	Middle adolescence	611.52			
	Late adolescence	618.51			
Total TA	Early Adolescence	557.57	7.054	2	<0.05
	Middle adolescence	602.48			
	Late adolescence	618.71			

Subsequent pairwise comparisons using the Mann–Whitney U showed that differences in the physiological component occurred between early and middle adolescence ($U = 93,293.00$; $p < 0.01$), and early and late adolescence ($U = 55,188.00$; $p < 0.001$). In the behavioral component, similar results were found to the previous ones, since differences appeared between early and middle adolescence ($U = 97,756.00$; $p < 0.05$), and early and late adolescence ($U = 61,185.00$; $p < 0.05$). Finally, the same pattern of results was repeated in the total score between early and middle adolescence ($U = 95,866.00$; $p < 0.05$) and early and late adolescence ($U = 59,294.00$; $p < 0.05$).

In addition to previous results, a Pearson correlation coefficient (Bootstrap with a 95% confidence interval) was performed between age and TA components, reaching a positive and significant relationship in the physiological t ($r_{xy} = 0.128$, $p < 0.001$) and behavioral component ($r_{xy} = 0.09$, $p < 0.01$) and the total scale ($r_{xy} = 0.088$, $p < 0.01$).

Test Anxiety, Educational Level, and Academic Performance

Firstly, when comparing TA according to educational levels, differences were found in the total score and in the physiological component, where Bachillerato students scored higher in both cases (see **Table 4**).

Closely related to age, the results obtained with the grade were similar, that is, significant differences were found in the TA total score ($H = 23.40$, $p < 0.001$), in the physiological ($H = 53.46$, $p < 0.001$) and behavioral component ($H = 20.56$, $p < 0.001$),

TABLE 4 | Difference between educational levels in test anxiety.

Component	Educational level	Average range	U	Z	p
Physiological	ESO/BAC	552.65/679.35	106,577.50	−5.70	<0.001
Cognitive	ESO/BAC	582.62/606.30	130,824.50	−1.06	ns
Behavioral	ESO/BAC	593.42/582.57	134,537.50	−0.58	ns
Total TA	ESO/BAC	564.84/637.28	118,152.50	−3.26	<0.01

TABLE 5 | Comparison by grade, Mann–Whitney U with Bonferroni correction, of significant differences found in the degree of anxiety.

	Grade	Average range	U	Z	p*
Physiological	7th/11th	194.98/239.90	17,782.500	−3.725	<0.001
	7th/12th	170.41/218.83	11,836.000	−4.141	<0.001
	8th/10th	168.08/216.90	13,890.000	−4.296	<0.001
	8th/11th	155.83/216.01	11,623.500	−5.407	<0.001
	8th/12th	134.62/193.16	7,700.500	−5.609	<0.001
	9th/11th	187.68/230.58	16,724.500	−3.636	<0.001
	9th/12th	163.17/208.94	11,161.500	−4.031	<0.001
Total	8th/10th	171.89/211.66	14,595.000	−3.508	<0.001
	8th/11th	164.47/206.53	13,222.000	−3.783	<0.001
	8th/12th	143.66/180.50	9,372.000	−3.528	<0.001

Bonferroni corrected p-value < 0.004.

TABLE 6 | Difference in test anxiety components and total TA according to academic performance.

Component	H	gl	P
Physiological	12.770	4	<0.05
Cognitive	46.898	4	<0.001
Behavioral	118.796	4	<0.001
Total TA	25.712	4	<0.001

but not in the cognitive one ($H = 7.25$, n.s). Thereby, the scores on total TA and the physiological component were higher in the upper grades (10th–12th grade) than in the lower grades (7th–9th grade) (see **Table 5**).

Analyzing the average score from the previous school year, statistically significant differences were found for all three components and the total TA score (see **Table 6**).

In the cognitive component, the mean values of the students who obtained the A mark were lower than those who obtained worse marks. On the other hand, in the behavioral component it is observed that students with marks D, C-, or C+ reached average ranges significantly higher than the rest. Finally, in the total TA, the significantly higher ranks are found in marks D, C-, C+, and B compared to mark A (see **Table 7**).

Test Anxiety, Test Type, and Test Subject

According to the degree of anxiety it provokes in students, the type of exam was ordered as follows: oral classroom test alone with the teacher ($M = 2.11$; SD = 1.25), oral test in front of the class ($M = 2.63$; SD = 1.27), oral presentation in front of a panel ($M = 2.36$; SD = 1.45), oral classwork test ($M = 2.10$; SD = 1.28), essay test ($M = 1.92$; SD = 1.31), full subject test

TABLE 7 | Comparison (Mann–Whitney's U with Bonferroni correction) of test anxiety components between levels of academic performance.

	Previous grade mark	Average range	U	Z	p*
Cognitive	**D/A**	184.65/133.39	8,804.500	−4.881	<0.001
	C-/A	169.35/110.86	5,651.000	−6.056	<0.001
	C+/A	249.94/169.96	13,925.000	−6.051	<0.001
	B/A	294.87/209.75	19,494.000	−5.515	<0.001
Behavioral	**D/C+**	282.90/226.67	21,978.000	−4.765	<0.001
	D/B	365.46/262.43	24,071.000	−8.251	<0.001
	D/A	191.51/123.43	7,410.000	−7.563	<0.001
	C-/C+	257.54/212,43	17,548.000	−3.866	<0.001
	C-/B	341.38/249.87	18,982.000	−7.316	<0.001
	C-/D	169.90/111,89	5,795.000	−7.128	<0.001
	C+/B	383.32/339.44	55,259.000	−3.617	<0.001
	C+/A	240.28/194.28	17,329.000	−4.454	<0.001
Total	**C-/A**	160.31/118,15	6,671.000	−4.380	<0.001
	C+/A	241.16/181.99	15,608.500	−4.515	<0.001
	B/A	291.01/220.90	21,056.000	−4.542	<0.001

*Bonferroni corrected p-value < 0.006.

TABLE 8 | Pearson correlation coefficient between components of TA and anxiety in different types and subjects of the test.

	Physiological	Cognitive	Behavioral	Total TA
Oral test alone with the teacher	0.323**	0.329**	0.016	0.304**
Oral test in front of the class	0.422**	0.438**	0.086*	0.457**
Oral classwork test	0.366**	0.375**	0.130**	0.398**
Multiple choice test	0.321**	0.263**	0.136**	0.313**
Essay test	0.492**	0.533**	0.154**	0.546**
Full subject test	0.431**	0.487**	0.148**	0.489**
Oral presentation in front of a panel	0.305**	0.270**	−0.035	0.299**
Practical test	0.272**	0.200**	0.152**	0.255**
General knowledge test	0.366**	0.358**	0.102**	0.385**
Math test	0.436**	0.445**	0.093**	0.467**
Physical tests	0.163**	0.140**	0.106**	0.164**

**The correlation is significant at the 0.01 level (2 tailed). *Correlation is significant at the 0.05 level (2 tailed).

($M = 1.21$; SD = 1.39), practical test ($M = 0.97$; SD = 1.17), and multiple choice test ($M = 0.97$; SD = 1.14). With respect to the examination subjects the result was math test ($M = 2.14$; SD = 1.46), general knowledge test ($M = 1.36$; SD = 1.20), and physical test ($M = 1.07$; SD = 1.33).

The type or subject of the test is related to the total score and the components of TA with two exceptions in the behavioral component: the individual test and the oral test in front of the teacher (see **Table 8**).

Next, the influence of sociodemographic and academic variables on each type or subject of examination was analyzed according to the anxiety it generated in the students. In terms of gender, it was observed that girls had significant higher level of anxiety than boys in all types of test.

Considering the grouped age, differences were obtained in oral test in front of the class, oral classwork test, multiple choice test, and essay test. Thereby, only the age group of 15–16 years indicated having more anxiety than 12–14 years old students in a oral test in front of the class ($U = 52,696$; $p < 0.05$). On the other hand, the 15–16 years old ($U = 76,941$, $p < 0.001$) and 17-18 year-old group ($U = 52,095$; $p < 0.01$) scored significantly higher in anxiety than the 12–14 years-old students in the oral classwork test. In the multiple choice test, the 17–18 years old showed more anxiety than the rest of the groups (12-14 years old: $U = 55,223$; $p < 0.001$, and 15–16 years old: $U = 40,362$; $p < 0.05$). Finally, the 12–14 years-old group showed more anxiety than the 17–18 years old in essay test ($U = 57,172$; $p < 0.05$). When establishing correlations between age and anxiety, according to test type, the following correlations appear of significance: oral test in front of the class ($r_{xy} = 0.940$, $p < 0.005$), oral classwork test ($r_{xy} = 0.550$, $p < 0.001$), multiple choice test ($r_{xy} = 0.115$, $p < 0.001$), essay test ($r_{xy} = -0.057$, $p < 0.05$), oral test alone with the teacher ($r_{xy} = 0.132$, $p < 0.05$) and general knowledge test ($r_{xy} = -0.085$, $p < 0.05$).

As a final point, when comparing academic levels, ESO students scored significantly higher in a general knowledge test ($U = 39,153$; $p < 0.01$) and a physical tests ($U = 12,2285$; $p < 0.01$); while the Bachillerato students indicated having more anxiety when performing an oral classwork test ($U = 110,815$; $p < 0.01$), multiple choice test ($U = 110,205.500$, $p < 0.001$), and oral test in front of the teacher ($U = 7541$; $p < 0.001$).

DISCUSSION

The main objective of the present study was to examine the differences in sociodemographic variables (gender and age) and academic variables (educational level, grade, mark and type and subject of test) in TA, based on the theory of the triple system of anxiety response proposed by Lang, with an adolescent population.

Firstly, it should be noted that the girls' higher level of anxiety corroborates the finding verified in the field of anxiety in general and TA in particular (Eman et al., 2012; Putwain and Daly, 2014). In line with our results, the meta-analysis on TA by Von der Embse et al., 2018 concluded that in all grades, from primary to post-secondary education, girls are more anxious. Several explanations for this phenomenon have been proposed (Aydin, 2019; Brandmo et al., 2019): (1) greater sensitivity to social approval leads girls to be more self-demanding, (2) girls have lower expectations of self-efficacy, and (3) girls have a higher perceived threat from the test situation.

In our study we proposed that the higher anxiety levels of girls would be due to the subjective component of TA, i.e., mainly to vegetative overactivation (physiological component) and, to a lesser extent, to excessive worry (cognitive component), while in accordance with Aydin (2019) there would be no difference in the objective component, i.e., in avoidance and escape responses (behavioral component), or if there were, it would be boys that scored the highest. Our results corroborate those of previous studies with adolescent (Rodríguez et al., 2014)

and college students (Cassady and Johnson, 2002). The gender gap in primary education widens as children progress through the educational system to post-secondary levels where it tends to decrease (Kurt et al., 2014).

There is a positive relationship between TA and age, such that older adolescents present higher levels of anxiety, similar to what happens in social anxiety disorder where the adolescent is exposed to social evaluation (Olivares et al., 2003). Since age is associated with the grade, and the educational level, students at the top of high school have more TA, especially in the pre-university grades where the higher academic demands may intensify TA.

The relationship of TA with academic performance has been studied mainly in the university population and the data are contradictory. Álvarez et al. (2012) found no relationship among the three components of TA and high school, post-secondary, and college entrance test scores; Ávila-Toscano et al. (2011) found that 100% of low-performing students had significant responses to all three components of TA, while only 7.2, 11.9, and 9.5% of high-performing students had physiological, cognitive, and behavioral TA responses. From the perspective of the theory of the reduction of processing efficiency, Piemontesi and Heredia (2011) found a negative relationship of interference and lack of confidence with TA, but not of worry or emotionality. It is possible that the TA of students with low marks worsens academic performance, but it may also be that the high degree of self-pressurizing of students with high marks interferes with their performance, which would explain the disparity in the results. Academic performance is a complex phenomenon that depends on multiple factors, not only personal factors such as TA, but also variables outside the student's control such as the teaching method or classroom climate. This issue requires further studies in the adolescent population to shed light on the relationship between TA and academic performance.

The results show differences in the degree of anxiety caused by the type of test. In line with the study by Núñez-Peña et al. (2016), the oral test in front of the class is the most feared situation. This type of test has been linked to social anxiety because the student is exposed to being evaluated not only by the teacher, but also by their peers. In addition to demonstrating academic knowledge, public speaking in the classroom requires the student to possess social and communication skills, which prevent the appearance of fear of negative social evaluation and its possible negative repercussion on performance during the oral test (Laurin-Barantke et al., 2016). The math test is another very feared modality (Carey et al., 2017; Kiliç and Çetin, 2018); it is worth noting, however, that it is associated more with high failure (Wu et al., 2012) than with difficulty in learning (Brown et al., 2020).

Our results are consistent with previous works that revealed that girls are more anxious about taking different types of tests (Rodríguez et al., 2014; Van Mier et al., 2019; Milovanović, 2020), with the exception of the study by Devine et al. (2012), which found no difference according to gender. In the particular case of the math test, the data are contradictory (Sevgi and Arslan, 2020).

This study has several limitations. Firstly, the generalization of the results is limited by the selection of the participants, conditioned by the availability of the educational centers that were willing to allow an investigation to be carried out during the exam period with all the inconveniences this involves. Secondly, the evaluation was limited to questionnaires answered by the students; it would have been desirable, in the framework of the multi-method and multi-source evaluation, to administer other instruments and collect data from other informants such as teachers and parents. Thirdly, it is worth to point out the limitations relative to anxiety assessment before the specific type of tests due to the method employed. Finally, although our study is the first to analyze the relationship of sociodemographic and academic variables with TA, using the adaptation of an instrument for the university population, it would be desirable to develop a specific questionnaire for the adolescent population.

Future studies should extend the research to personal variables, such as the general and anxiety symptoms of the student; family variables, such as the parenting style of the parents; and educational ones, such as the teaching and evaluation of the subjects of study.

Our study highlights the importance of adapting the intervention to the student's TA profile, according to a prescriptive approach to assessment and treatment of the anxiety disorders in childhood and adolescence (Eisen and Schaefer, 2005; Méndez et al., 2014; Orenes et al., 2017). Additionally, it would be beneficial to prepare risk groups for types of tests that generate high TA, e.g., for girls in the last grades of high school who have to take oral tests in front of their classmates.

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 study was reviewed and approved by Ethics Committee of the University of Murcia. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

All authors participated in the design of the study, the analysis and interpretation of the data, the writing of the initial version of the manuscript, and approval of the final version. RT, in addition to these tasks, coordinated the data collection.

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Cognitive Flexibility in Schoolchild Through the Graphic Representation of Movement

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Neuroconstructivism postulates the progressive complexity of mental representation over the course of cognitive development and the role of the graphic representation of movement in the transformation of mental schemas, cognitive flexibility, and representational complexity. This study aims to: (1) understand children's resources in the drawing of movement (5–8 years); and (2) verify whether there are differences in the graphic representation of movement as an indicator of cognitive flexibility. The participants were N = 240 children aged 5–8 years; 1,440 drawings were collected representing 2,880 characters (both animate and inanimate) from six stories. The analysis consisted: (1) data quality control, using the kappa coefficient, and Generalizability Theory to test the instrument's validity and reliability; (2) Multivariate General Analysis and Mixed Linear Analysis of the factors (age and stories); (3) Multivariate General Analysis of the graphic components: categories and microcategories, as well as the elements that make up the macrocategories: "Static," "Indication," and "Movement"; and (4) calculation of the generalizability coefficient (G-coefficient). The results show that: (a) age best explains variability, with a high effect size (η^2 = 0.732) across all components (F = 153.445; p < 0.001), thus increasing its complexity and (b) at ages 6 and 7, "Indication" appears as a modulator of "Static" (age 5) toward "Movement" (age 8). The generalizability coefficient is optimal (0.995). It is concluded that changes in the initial graphic representation of movement may interactively transform mental representation, thus increasing cognitive flexibility and prompting teaching applications to optimize such changes.

Keywords: Neuroconstructivism, mental representation, drawing, schoolchild, education, movement, flexibility

INTRODUCTION

From a neuroconstructivist approach (Johnson, 2011; Dumontheil and Mareschal, 2020), cognitive development emerges as a dynamic and contextualized change in neural structures that enable the emergence of increasingly complex mental representations, supported by multiple brain regions and at different temporal scales, in response to the person's proactive interaction with their physical and social environment (probabilistic epigenesis). This successive transformation follows a trajectory that begins with the initial constraints of neural structures, giving rise to different developmental stages throughout life (Sastre-Riba, 2014).

In this differential trajectory, mental representation is a key element for cognitive development and for understanding the emergence of child drawing, and changes thereof, as a graphic representation of internalized models of reality (Sirois et al., 2008). Child drawing is therefore the first marker that enables the study of mental representation as an external manifestation of internalized reality, by showing what is known about it.

It has been shown that events are naturally more attractive than objects, and their foremost feature is their movement. Therefore, part of the content of the first mental representations turns around the identity of events, objects, and people, and their movement and position, which forms the basis of the dynamic representations produced. The first external representative manifestation is the child's scribble, in which the action of drawing already contains expressive and representational meanings relating to shapes, movements, and emotions (Quaglia et al., 2015), even if there is no real figure that relates to meaningful movement for representational purposes. Current studies are in agreement in supporting this early emergence (Matthews, 2010; Panesi and Morra, 2018).

Research on rigidity and flexibility in drawings (premanipulation) (Picard and Vinter, 2007) and their possible inhibitory or facilitating role in representational change (Barlow et al., 2003) remains scarce. Some authors argue that young children may have access to their own drawing procedures and show some flexibility in them (Lange-Küttner and Friederici, 2000; Burkitt and Barrett, 2010), inserting new elements earlier than proposed by Karmiloff-Smith's (1999) representational redescription (RR) model, which suggests that procedural rigidity may be associated with the permanent notational trace or subroutines in drawing.

The three resources that may explain an increase in the development of graphic flexibility are (Cox, 2013; Allen et al., 2016): the availability of external models, endogenous changes in mental representations, and the theory of graphic representation among non-expert children (Berti and Freeman, 1997). The second of these would be comparable to RR, although it does not imply that early representations are necessarily rigid procedures, but that they may be transformed flexibly.

As an alternative to the RR model, some studies propose (Adi-Japha et al., 2010) the adoption of an integrative form that considers changes in information processing regarding control, executive functioning, and task complexity, along with the interaction between all of these, and their influence throughout development. Specifically, Morra (2005) puts forward three influencing factors: (a) the amount of attentional resources (M capacity) that a child can use to activate operative and figurative schemas in the relevant tasks; (b) the automatic activation of figurative schemas from perceptual input; and (c) executive activation, which sets appropriate objectives and monitors performance, emphasizing the relationship of working memory with children's capacity to plan drawings and with their skill to modify usual schemas therein. Authors like Diamond et al. (2007) propose the special role of cognitive flexibility (also called shifting) as one of the core elements of executive functions because it is relate to mental flexibility, mental set shifting and closely linked to creativity. Other authors, in a similar sense, put forward factors associated with other executive functioning elements such as planning, monitoring, inhibition, and working memory (Riggs et al., 2013; Morra and Panesi, 2017; Panesi and Morra, 2020) thereby supporting previous hypotheses (Cox et al., 2001).

In addition, Braswell and Rosengren (2008) examine the role of biomechanical, cognitive, and contextual constraints in the development of drawing in order to understand how it may be conditioned by certain constraints.

As such, drawing is a complex representative skill that involves biomechanical, graphomotor, perceptive, cognitive, and social skills (Braswell and Rosengren, 2008; Salsa and Vivaldi, 2017). It is the outcome of multiple factors, such as underlying representational processes (Emmorey et al., 2008), attention to detail (Lange-Küttner et al., 2002), and executive functioning and its components, including working memory (Morra and Panesi, 2017), inhibition (Riggs et al., 2013), and flexibility.

In this vein, other authors have highlighted the lack of a thorough quantification of the graphic signs of movement typical of each stage of child development (Picard and Vinter, 2007) and of the levels of rigidity in the graphic representation of movement in usual drawings (premanipulation). On the other hand, Hollis and Low (2005) consider that most studies involve tasks that children cannot easily relate to, and which predetermine a lack of understanding or engagement in carrying them out.

In short, as it is a very important issue for understanding representational transformation, the lack of studies on the graphic representation of movement demands (Spelke, 2005; Mandler, 2008; de Hevia et al., 2014) further research in order to understand its genesis and progress, during a period that may lie between the ages of 5 and 8 years. This would enable an understanding of graphic representational processes as indicators of changes in cognitive development. In other words, capturing the signs of movement as part of a continuum of changes and transformations would allow us to infer the underlying representational restructuring process in children's minds.

In accordance with the above, the aim of this study is two-fold: (1) to understand the differences in resources during the development (5–8 years) of the drawing of movement according to Age, Story, and their interaction and (2) to verify whether there are differences in the representation of movement as an indicator of cognitive flexibility. The main hypothesis is that there would be changes in the representation of movement in children's drawing from the age of 5 influenced by cognitive flexibility, which would promote changes in internal representations.

MATERIALS AND METHODS

Participants

The sample, extracted using intentional non-probabilistic sampling, comprised $N = 240$ schoolchildren aged 5–8 years with typical development, and was balanced with $n = 60$ participants per age group. A total of 1,440 drawings were collected, featuring a total of 2,880 characters. No participant received financial compensation of any kind.

Materials

The stimulus material, adapted from Munuera (1999), consisted of six stories explicitly presenting action scenes that children could relate to, and which required movement to be graphically represented with varying degrees of difficulty, depending on whether or not the characters in each story have their own movement. Specifically, the content could be: (a) animate, i.e., stories in which both characters moved of their own accord or (b) mixed, where one of the characters was animate and the other was inanimate and had to be made to move. The names of the stories were as follows: (1) Two Rabbits, (2) Rabbit and Butterfly, (3) Rabbit and Wolf, (4) Two Persons, (5) Person and Bus, and (6) Person and Ball.

These stories met the following requirements: (1) evoking a complex movement, consisting of two simultaneous actions and (2) graphically representing movement, claiming the child's involvement in the story.

An *ad hoc* coding instrument to capture movement in the drawings was adapted and validated according the Systematic Observational Methodology paramaters (Urraca-Martínez, 2015). This consisted of a mixed system of field formats and categories (Anguera et al., 2001), made up of the following components: (a) $n = 3$ macrocategories: "Static,"" Indication," and "Movement"; (b) $n = 12$ categories comprising different positions-orientations; and (c) $n = 49$ microcategories as corporal and external indicators.

The categories consisted of the positions-orientations: Vertical front (Vf), Vertical back (Vb), Vertical front face profile (Vffp), Vertical full profile (Vfp), Horizontal front (Hf), Horizontal back (Hb), Horizontal front face profile (Hffp), Horizontal full profile (Hfp), Front tilt (Ft), Back tilt (Bt), Front face profile tilt (Ffpt), and Full profile tilt (Fpt). The microcategories comprised two types of indicators: Corporal (C) (e.g., articulated arm, stretched leg, etc.) and External (E) (e.g., scrollworks, lines, etc.).

The microcategories, combined with the above-described categories, enabled the graphic representation of participants' drawings to be encoded as follows: "Static," when there was no indicator of movement; "Indication," when a precursor indicator of the expression of movement appeared; and "Movement," when movement was clearly expressed in the figures drawn. On the other hand, since the stories featured two characters, the following modalities arose, depending on the combination of macrocategories defining the type of movement represented by each character: Static/Static, Static/Indication, Static/Movement, Indication/Indication, Indication/Movement, and Movement/Movement. The categories that conform the instrument are nested exhaustively for each one of the criteres that conform the mixed system of field formats and categories.

Indication refers to the introduction in children's drawings of some lines, spirals, etc., expressing no rigidity in the static figure, as a precursor indicator of the expression of movement. Cognitive flexibility is measured according to the specialized literature through the specific microcategories of the mixed system of analysis. The evaluation of the appearance of indicators is the result of the application of this mixed analysis system, allowing their empirical concretion and differential operationalization based on the interobserver reaibility. All of the above made it possible to rigorously capture the level of representation of movement.

Measure and Data Analyses

The study was administered to each school group (years 2 and 3 of early childhood education; years 1, 2, and 3 of primary education, in order to ensure the presence of all ages range), during school hours. The administration interval ranged from 60 to 75 min. As a prompt, the researcher told each of the stories, stressing the aspects involving movement and asking participants, at the end of each story, to draw it.

The data analysis plan consisted of:

1. Data quality control. $n = 28$ drawings were randomly drawn from each of the four groups of participants, based on the age being studied, and from each of the six types of story administered. The Aleatori 1.0 program (Vargas, 1999) was used.

Cohen's kappa coefficient (Cohen, 1960) was calculated to measure inter-rater reliability. In order to calculate the validity of the coding instrument, the G-coefficient was identified using a two-faceted measurement plan: Observers^{x}Categories. The Ysewijn's (1996) Generalizability Theory (GT) program was used.

- Analysis of the factors Age and Stories by means of: (a) the Multivariate General Linear Model (GLM) to verify the interaction, significance, and the effect size and (b) the Mixed Linear Model (MLM) to estimate the facets of variability.
2. Multivariate analysis of the components of categories, microcategories, and modalities.
3. Calculation of the effect size for the components "Static," "Indication," and "Movement" of the macrocategories by the Multivariate Lineal General Analysis. The SPSS Statistics 24.0 program was used for analyses 2, 3, and 4.
4. Calculation of the generalizability of the results using the G-coefficient (Cronbach et al., 1972), with a measurement plan in which participants constituted the instrumentation or generalization facet, while Age and Stories composed the differentiation facet. The Ysewijn's (1996) GT program was used.

RESULTS

Regarding data quality control, Cohen's kappa coefficient was $k = 0.802$. The generalizability study revealed that the reliability of the results was optimal (0.999) with values close to 1, and the value of the interaction of the two facets Category^{x}Observer (C^{x}O) was 0%, thus accounting for most of the variance.

The validity of the coding instrument reported a generalizability coefficient of (0.000), with a variability of 100% for the Category facet and null for the Observer facet and for the interaction between the two, so a highly significant category goodness was estimated. This confirmed the instrument's consistency. **Table 1** shows these values.

TABLE 1 | Interrater reliability and validity of the coding instrument.

		F	*SS*	*VC*	*%*	*CG*
Reliability	O	0.35	0.00490	0	0.999
	C	4962.96	48.61086	100	
	CO	4.65	0.09125	0	
		V	*SC*	*CV*	*%*	*CG*
Validity	O	0.04	0.00000	0	0.000
	C	5019.65	49.19306	100	
	OC	1.96	0.03846	0	

O, Observer; C, Category; SS, Sum of squares; VC, Variance components; GC, Generalizability Coefficient.

TABLE 2 | Multivariate linear analysis: age and stories.

Factors	*F*	*DF*	*p*	η^2
Age	214.695	3	<0.001	0.732
Stories	28.052	4.010	<0.001	0.106
Age^{x}Stories	4.942	12.029	<0.001	0.059

TABLE 3 | Mixed multivariate linear analysis of age and stories.

	F	*p*	σ^2	*Wald Z*	*P*
A	153.445	<0.001			
St	10.366	<0.001			
A*St	0.798	0.681			
R			4.140	26.777	<0.001
			1.729	26.796	<0.001

A, Age; St, Stories; R, Residual.

Table 2 shows the initial approximation of the values of the effect size of Age and Stories in the representation of movement, indicating that: (a) Age influences changes in the representation of movement in child drawing [$F_3 = 214.695$; $p \leq 0.001$] with a high effect size ($\eta^2 = 0.732$); (b) for Stories, the values of the effects between them are statistically significant [$F_{4,010} = 28.052$; $p \leq 0.001$; $\eta^2 = 0.106$], therefore the representation of movement differs according to its content; and (c) there are statistically significant changes [$F_{12,029} = 4.932$; $p \leq 0.001$; $\eta^2 = 0.059$] in the Age^{x}Stories intersection with a low effect size.

These results indicate that: (a) the greatest effect is that of Age, rather than the content of the Stories, with a smaller magnitude in the interaction between the two; (b) changes in drawing that involve expressing more indicators of movement with age demonstrate flexibility; and (c) the stories include content that facilitates, to a greater or lesser extent, the graphic representation of movement across all ages.

Table 3 shows the results of the analysis (MLM), providing a more precise view of the influence of Age and Stories on the representation of movement. Specifically, taking into account the four ages under study and the six stories, the contrast of fixed effects is statistically significant for Age ($F = 153.445$; $p < 0.001$) and for Stories ($F = 10.366$; $p < 0.001$), but not for their intersection ($F = 0.798$; $p = 0.681$). In other words, both Age and the content of

TABLE 4 | Multivariate linear analysis of macrocategories: static, indication, and movement.

Factors	Macrocategories	*F*	*p*	η^2
Age	Sta	217.416	<0.001	0.315
	Ind	9.278	<0.001	0.019
	Mov	163.464	<0.001	0.257
Stories	Sta	11.339	<0.001	0.038
	Ind	7.577	<0.001	0.026
	Mov	10.231	<0.001	0.035
Age^{x}Stories	Sta	0.994	0.458	0.010
	Ind	1.462	0.111	0.015
	Mov	0.768	0.692	0.008

*Sta, Static; Ind, Indication; Mov, Movement*

Stories influence changes in the representation of movement, corroborating the previous findings that there are contents that, at any ages, encourage a greater or lesser extent the representation of movement.

On the other hand, a Mixed Multivariate Lineal Analysis of the estimation of the effect of Age confirms that the representation of movement increases with age ($\gamma_5 = -01.133$, $\gamma_6 = -0.716$; $\gamma_7 = 0.400$; $\gamma_8 = 0.011$) ($p < 0.001$) and, after controlling for the Stories factor, the representation of movement differs with Age by 95%. However, after controlling for the Age factor, the content of Stories only produces an effect of 6%. In other words, the effect of Age has the most influence on how movement is graphically represented.

As for the components, statistically significant values are obtained for all of these across all Stories with intervals between ($F = 2.61$; $p < 0.001$) and ($F = 11.14$; $p < 0.001$). This result demonstrates their influence on changes in the representation of movement in child drawing. The values in global scores point to the influence of the positions and orientations ($F = 27.43$; $p < 0.001$); corporal indicators ($F = 10.70$; $p < 0.001$) and modalities ($F = 32.64$; $p < 0.001$) as resources that children use to graphically represent movement, either statically or dynamically, in their drawings.

Finally, **Table 4** shows the results relating to the macrocategories ("Static," "Indication," and "Movement") and the influence of the Age^{x}Stories intersection to graphically signal movement. The results indicate that both Age ($F_{s=}217.416$; $p < 0.001$; $\eta^2 = 0.315$; $F_i = 9.278$; $p < 0.001$; $\eta^2 = 0.019$ and $F_m = 163.464$; $p < 0.001$); $\eta^2 = 0.257$ and Stories ($F_e = 11.339$; $p < 0.001$; $\eta^2 = 0.038$; $F_i = 7.577$; $p < 0.001$ $\eta^2 = 0.026$ and $F_m = 10.231$; $p < 0.001$); $\eta^2 = 0.035$ influence changes in the drawing of the "Static," "Indication," and "Movement," but this is not the case for the Age^{x}Stories intersection ($F_s = 0.994$; $p = 0.458$; $\eta^2 = 0.010$; $F_i = 1.462$; $p = 0.111$; $\eta^2 = 0.015$ and $F_m = 0.768$; $p = 0.692$); $\eta^2 = 0.008$.

These results show, yet again, that both age and the content of stories influence the use of "Indication," "Static," and "Movement" in drawing, but this is not the case for their intersection. The results that follow further establish this. Age is what best accounts for the variability of the results found (to the tune of 58%). Within this, the "Static" macrocategory accounts for up to 31% of said

FIGURE 1 | Representation of macrocategories according to age.
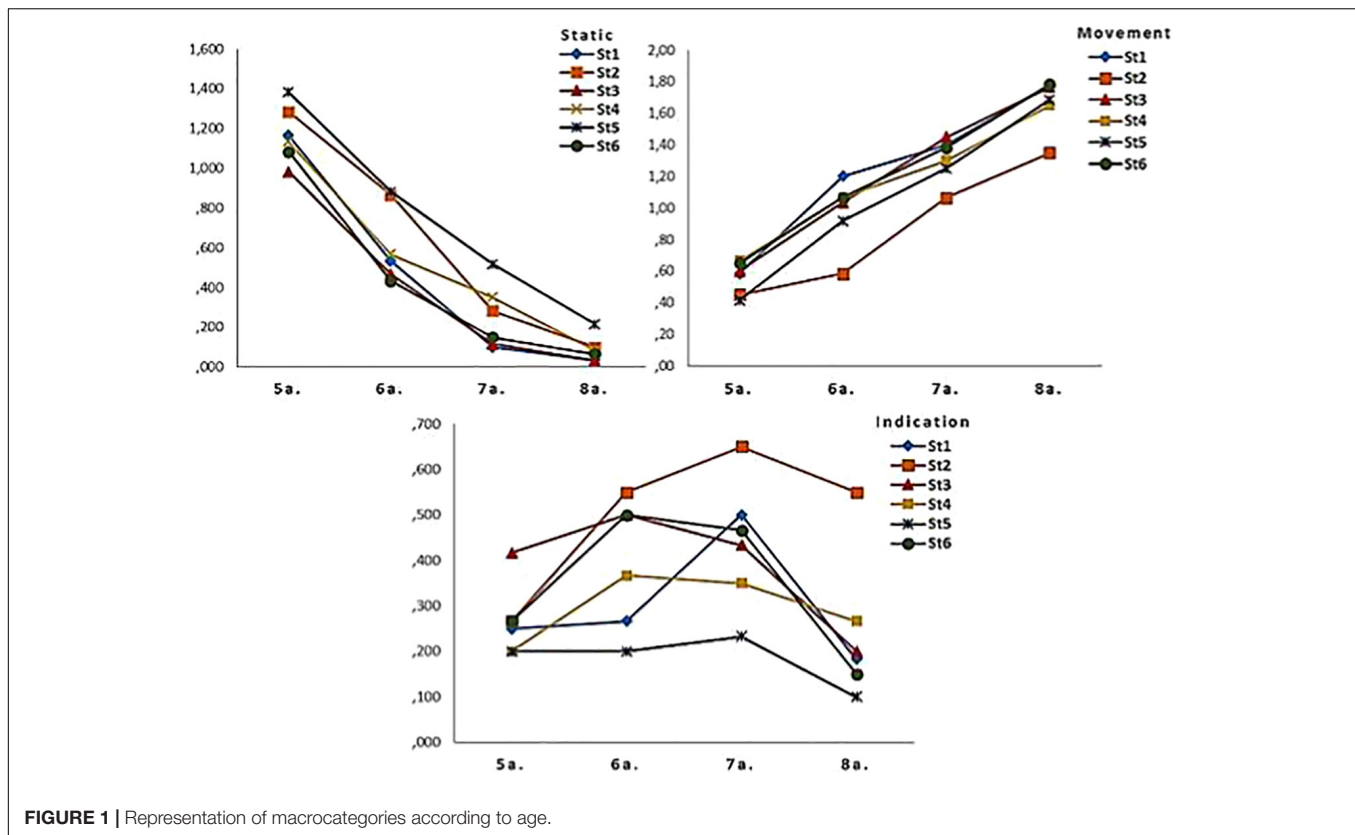
variability, that of "Movement" accounts for 26%, and that of "Indication" for just 2%.

All of this is presented in **Figure 1**, which shows a linear trend for age in the drawing of movement, which is predominantly characterized by the "Static" macrocategory at age 5, and by that of "Movement" at age 8, with a noticeable decline in "Static" as age increases, while "Indication" increases at ages 6 and 7 and declines at age 8. In specific terms, "Static" representation is dominant at age 5, while the increase in "Indication" at ages 6 and 7 suggests a phase of transition toward "Movement," which is dominant at age 8. Therefore, not only does the dynamic representation of movement increase progressively with age, but children show flexibility by redefining their drawing strategy.

As regards the role of stories and their content, **Figure 2** shows a non-linear trend. While there are differences in representation as "Static" and as "Movement" for each story between the different ages, this follows a common trend: there are more drawings that make use of the "Static" indicator for story 5, but "Movement" is dominant for story 3 (except at age 5); "Indication" is dominant for story 1 (except at age 5), but is lower for story 2 at all ages. This explains why there are no significant differences in the Age^{x}Stories (A^{x}S) factor.

As we have seen, "Indication" appears significantly at ages 6 and 7, as an indicator of the transition in children's skills in graphically representing movement, from "Static" at age 5 toward "Movement" proper at age 8.

The generalizability of these results is guaranteed given the high generalizability coefficient obtained (0.995), marginally improved upon in the optimization plan, which considers $n = 80$ and 100 participants for each age group studied.

DISCUSSION

This study highlights changes in the representation of movement in child drawing from age 5–8, indicating the early flexibility and graphic resources of children at age 5, confirming the hypotheses proposed. Age-related differences related could be the result of the construction of new representations based on existing ones, thus explaining the continuous process of mental transformation (Sirois et al., 2008; Mareschal and Westermann, 2010). These progressive changes (Cox et al., 2001; Picard and Vinter, 2007) show that flexibility in child drawing increases with age, in line with the greater structural and functional complexity of cognitive development.

The results agree with those of other studies into the role of cognitive flexibility in the representational changes expressed in child drawing throughout development, based both on the RR approach (Karmiloff-Smith, 1999) and on that of endogenous changes in mental representations (Berti and Freeman, 1997), recursive re-representation (Spensley and Taylor, 1999), or the effect of executive functions (Miyake et al., 2000; Jolley et al., 2013; Morra and Panesi, 2017).

At the same time, the results are in line with authors who suggest the existence of cognitive flexibility from ages 5 or 6 (Freeman and Adi-Japha, 2008), noting that, from age 5, children
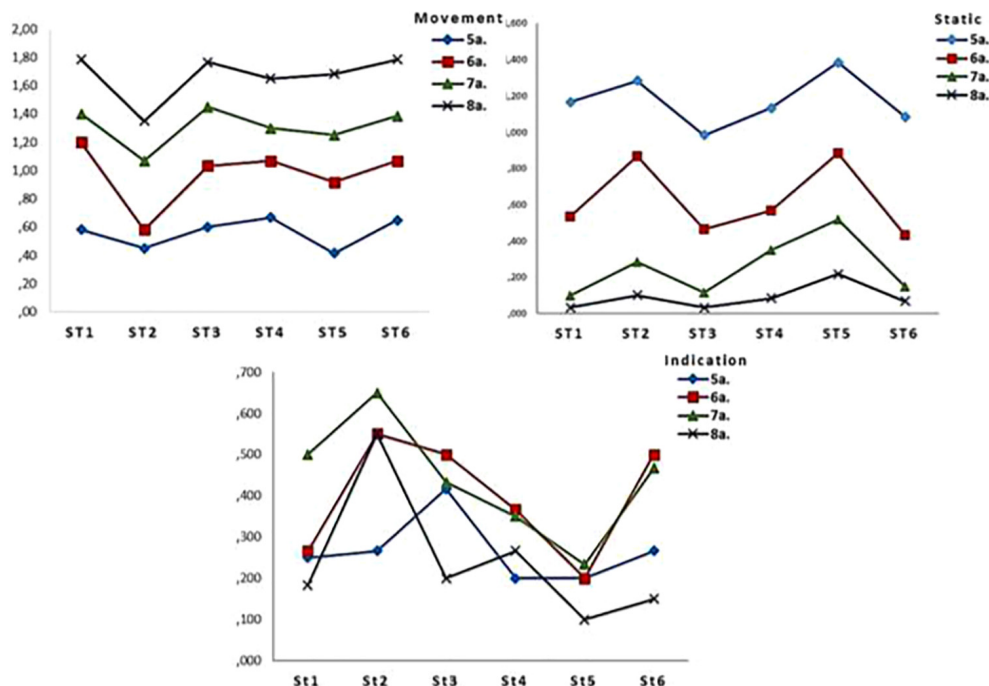
FIGURE 2 | Representation of macrocategories according to stories.

are able to reorder their subroutines within process restriction (Barlow et al., 2003; Allen et al., 2016) and to modify their usual graphic schemas, showing flexibility in producing their drawings (Adi-Japha et al., 2010) with the aim of graphically representing the movement of the key characters and elements involved in a story (Cox, 2005; Quaglia et al., 2015). Results obtained show that since age 5 there are indicators thereof in their attempt to represent "Movement" in drawing using "Indication," which points to their inhibition of "Static" rigidity. Moreover, changes in drawing at all ages studied reveal the emergence of increasingly elaborate resources (as highlighted by "Indication"), which play a role in both external and internal representation in their attempts at graphic expression in images, until they are successfully able to draw clear signs of movement in said images, according to Braswell and Rosengren, 2008; Mareschal and Westermann, 2010). This supports the hypotheses of the early emergence of cognitive flexibility (Bialystok et al., 2006) and the capacity to adapt to new demands through the other executive components of inhibition and working memory (Diamond et al., 2007), in keeping with a neuroconstructivist approach (Westermann et al., 2007; Sirois et al., 2008; Dumontheil and Mareschal, 2020).

Although there are different ways to represent movement at different ages and for different stories, the tendency is to use these components according to the content, across all ages. Moreover, in support of other studies (Hollis and Low, 2005; Cox, 2013), story content is shown to have an influence across all ages as an extrinsic motivator in the graphic representation of movement, in particular increasing the number of indicators used when there are two animate characters and when the topic is one that children can relate to.

As a contribution of this study, it is worth stressing the existence of "Indication" as a graphic indicator situated on the continuum between "Static" drawing (at age 5) and drawing showing "Movement" proper (at age 8). "Indication" has high prevalence at ages 6 and 7, but declines thereafter, practically disappearing at age 8, when the child is now equipped with other procedures to graphically represent the movement of characters and objects. At the same time, this is an important factor that supports the argument of child flexibility (Bialystok et al., 2006; Freeman and Adi-Japha, 2008; Matthews, 2010; Allen et al., 2016).

This contribution may also relate to studies that indicate that children at age 5 are metacognitively satisfied with the representation of movement they achieve (Bonoti and Metallidou, 2010), without adding changes to what they have drawn, despite limitations in the dynamic expression achieved, but that, starting at age 6, given greater awareness of the task's requirements and greater regulation of their resources, they attempt to modify the available schema in order to solve the task in question (Touroutoglou and Efklides, 2010). "Indication" is therefore a resource that enables the graphic representation of movement when the child, despite having a mental representation of the movement, does not possess sufficient graphic strategies to modify the characteristics of the figure in order to convey it.

As a conclusion, graphically representing movement may prompt a change in the representation of reality (Braswell and Rosengren, 2008; Rose and Jolley, 2020), since its external reconstruction may interactively transform the mental representation, thereby increasing cognitive flexibility (Freeman, 2004; Cox, 2013). If the manifestation of external representations

expresses the transformation of internal representations through the progressive increase in the capacities of the cortex in interaction with external events (Karmiloff-Smith, 2009), we can see the relevance of adjustments in the graphic representation of movement for progress in the management of internal representations, as well as the role of partial representations that facilitate more complex changes, which are determined by proactivity and progressive specialization (Sirois et al., 2008).

This suggests some educational applications aimed at optimizing changes in the graphic representation of movement between ages 5 and 6, which may functionally encourage the redefinition of internal representation, that is, cognitive change relating to knowledge of reality and its organization.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article would be made available by the authors.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

SS-R supervised the study, analyzed the data, and wrote the manuscript. M-U-M collected the data, performed the analyses, and contributed to the writing of the manuscript. All authors revised and approved the submitted version.

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Early Detection of Academic Performance During Primary Education Using the Spanish Primary School Aptitude Test (AEI) Battery

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The aim of this study was to assess the predictive capacity of some of the most relevant cognitive skills pertaining to the academic field as measured by the Spanish Primary School Aptitude Test Battery. This psychometric tool was applied to all students who were enrolled in the final year of Early Childhood Education (631 students) in the public schools of the province of Alicante (in the South-East of Spain) and a follow-up of their academic progress was carried out when they completed Primary Education (6 school years). The results obtained show that medium-high and high scores in Verbal Aptitude and Numerical Aptitude tests in Early Childhood Education (5 years of age), can predict academic success at the end of Primary Education (12 years of age) in instrumental subjects such as: (1) Language (Verbal Aptitude Odds Ratio = 1.39 and Numerical Aptitude Odds Ratio = 1.39) and (2) Mathematics (Verbal Aptitude Odds Ratio = 1.47 and Numerical Aptitude Odds Ratio = 1.52). We have determined the importance of developing pedagogical programs that stimulate the development of these skills during Early Childhood Education, while implementing support strategies during Primary Education, for those students who present underdeveloped aptitudes in these areas. In this way, school difficulties would be prevented in the instrumental subjects that provide access to other academic areas.

Keywords: cognitive skills, mathematics, language, learning difficulties, primary education

INTRODUCTION

The starting point for the present study was a certainty in the knowledge that academic difficulties do not suddenly appear without warning, but that they develop throughout the early stages of the teaching-learning process (Kern and Friedman, 2009; Garon-Carrier et al., 2018). From a child's first steps, differences in the level of progress of his/her different capacities begin to occur, and in most cases individuals compensate possible deficiencies with motivation and a positive attitude toward the task to be learned. However, a large number of situations are observed

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Abbreviations: AEI, Spanish Primary School Aptitude Test; χ^2, Chi-Square; R^2, R^2 Nagelkerke; B, Coefficient; p, probability; OR, Odds Ratio; C.I., Confidence Interval.

whereby these difficulties prevent children from acquiring, in a reasonable period of time initial knowledge which is fundamental in the construction of further and more extended knowledge (Garon-Carrier et al., 2016).

In the body of literature on the field of educational research, academic performance is presented as worthy of constant concern. Over the years, it seems that there has been a change in the focus of these studies and currently the emphasis is on finding causal relationships between academic performance and different variables that may be the subject of research on intervention programs, such as math skills, language skills, spatial orientation, memory, or cognitive and psychomotor maturity to develop reading and writing skills (Risso et al., 2010; Alloway and Passolunghi, 2011; Phillipson and Phillipson, 2012; Cheng and Mix, 2014; Bonti and Tzouriadou, 2015; Geary and VanMarie, 2016; Hill et al., 2016; Park et al., 2016; Pitchford et al., 2016; Serpell and Esposito, 2016; Cornu et al., 2017). Therefore, it is evident that a special effort must be made in identifying and defining the variables that can be manipulated, controlled or modified in order to improve academic performance (Rohde and Thompson, 2007; Gay, 2010; Carlson et al., 2013; Núñez et al., 2014; Toll and Van Luit, 2014; Cerda et al., 2015; Puerta, 2015; Cassidy et al., 2016). At the same time, to our knowledge, in the body of specialized literature the definition of academic performance is understood to be the learning out come in the student and generated by the pedagogical intervention of the teacher, keeping in mind that this performance cannot be the product of a single aptitude, but is the result of the symbiosis of a sum of elements that act upon, and emanate from, the person who learns (Córdoba et al., 2011; Miñano and Castejón, 2011; Moliner et al., 2012; García-Fernández et al., 2013; Grivins, 2013; Meneses-Botina et al., 2013; Duckworth and Yeager, 2015).

On the other hand, low academic performance affects a large number of students and can pose a particular problem in each case. Low academic performance should not be understood as being associated to learning disorders, but rather associated to slight difficulties in the ordinary acquisition of curricular contents. A high percentage of students who show underdevelopment in their performance during Primary Education corresponds with children who have not presented obvious problems in their school development during the previous cycles (Pérez et al., 2005; Robles and Vázquez, 2014; Navarro-Soria, 2016). The increase in curriculum demands as the student advances, and the detection and late initiation of classroom reinforcement systems, aggravates the difficulties and increases the differences in levels of development in relation to other students in the classroom. Although these differences become more noticeable from around the mid-point of Primary Education, the problem arises during Early Childhood Education and can be noticed during the first stage of Primary Education, when the students face complex learning processes, such as the acquisition of reading and writing, numerical calculation or problems solving (Prior et al., 2011; Ye et al., 2016).

Therefore, it would seem evident that there is a need to detect whichever variables might act as determinants in the development of students in relation to their academic environment. In this way, a teaching team would be able to detect the problem and intervene before it fully presents itself, by applying measures that eliminate possible deficiencies in student adaptation to the academic context (Grañeras et al., 2011; Prior et al., 2011; Geary and VanMarie, 2016). For this purpose, these objective indicators of learning difficulties should be detected during the first years of schooling (Alloway and Alloway, 2010; Navarro-Soria and González-Gómez, 2010; Murray and Harrison, 2011; Schmitt et al., 2012; Peng and Fuchs, 2016), since it would facilitate an individualized intervention and the initiation of those psycho-pedagogical resources, which currently act on the problem from a welfare perspective (Rogowsky et al., 2013), rather than from a preventive perspective (Bergman et al., 2011; Raver et al., 2011; Blair and Raver, 2014; Blair et al., 2016; Di Lieto et al., 2017).

From the documentation process involved in the present study, it can be affirmed that intelligence and aptitude are the most researched cognitive phenomena in the body of literature pertaining to the field of psychology. Notwithstanding, among the most prominent authors, there is no clear agreement regarding what intelligent behavior is, whether its nature is inherited or learned, whether it has a static or dynamic capacity, how we can better evaluate it r, or in the case of a psychoeducational intervention if this would allow us to enhance its development (Nisbett et al., 2012; Sternberg, 2012; Richardson and Norgate, 2014; Pietschnig and Voracek, 2015). However, a greater consensus is reached when regarding that intelligence and the differential abilities that compose it are the most influential variables when predicting academic success (Sternberg and Kaufman, 1998; Gagné and Père, 2001; Kuncel et al., 2004; Fergusson et al., 2005; Strenze, 2007; Kytala and Lehto, 2008; Taub et al., 2008). In fact, both classical and current research emphasize that Verbal Aptitude is the best predictor of academic performance, followed by Numerical Aptitude and Reasoning Aptitude and lastly, Spatial Orientation (Smith, 1964; Maccoby and Jacklin, 1974; Burnet and Lane, 1980; Cooper and Reagan, 1982; Kenney-Benson et al., 2006; Prior et al., 2011; Hawes et al., 2015; Duffy et al., 2020). This aptitude hierarchy is modified when it comes to predicting areas of academic performance that require a specific knowledge such as Mathematics. In this case, Numerical Aptitude takes first place in the hierarchy, displacing Verbal Aptitude, which occupies a second position (Marrero and Espino, 1988; Spinath et al., 2006). Similarly, when the area to be predicted is closely related to language management, Numerical Aptitude may be displaced to third position, with Logical Reasoning Aptitude taking second place. The conclusions reached by these previous investigations and other more current investigations, is that an important part of the learning difficulties in the academic context find their etiology in the cognitive aptitudes that are required for the development of traditional school activities (Bennett et al., 2000; Pérez et al., 2005; Miñano and Castejón, 2008; Robles and Vázquez, 2014; Navarro-Soria, 2016; Navarro-Soria et al., 2020).

Based on the above description, we consider it important to study which psychometric tools present, at an early age of the evaluated student, an adequate predictive capacity for academic performance, since the results of the implementation of these tests could be the trigger for a whole series of pedagogical support

measures that anticipate school failure. The main interest of this research lies in analyzing the predictive capacity of one of the most widespread tests at the school level, within the bounds of the Spanish territory. Hence, the main objective of this research was to verify that cognitive skills measured in Early Childhood Education, using the Spanish Primary School Aptitude Test (hereinafter termed AEI, Spanish acronym of Aptitudes en Educación Infantil) Battery, have a greater predictive capacity for academic performance throughout Primary Education. The specific aims of the present study were: (a) to verify which cognitive aptitudes have greater predictive capacity with respect to the non-repetition of school years by the student at the end of Primary Education; (b) to evaluate whether the use of oral language (Verbal Aptitude) presents predictive capacity of academic success in the instrumental subjects (Mathematics and Language); (c) to determine whether the knowledge of basic numerical concepts (Numerical Aptitude) presents a predictive power of academic success in the instrumental subjects; (d) to verify whether Spatial Orientation and Reading and Writing Maturity have a predictive power of academic success in the instrumental subjects; (e) to determine whether General Intelligence presents a predictive power of academic success for the instrumental subjects.

In relation to the proposed objectives, our research hypotheses are: (Ha) Verbal Aptitude and Numeric Aptitude will have the greatest predictive power for the non-repetition of the course by the student at the end of Primary Education (a student repeats if he fails math and language at the end of the course); (Hb) Verbal Aptitude, which determines the correct use of language and its different dimensions, will be the aptitude with greater predictive capacity of future academic success for the Language discipline; (Hc) Numerical Aptitudes will be decisive in explaining academic success in Mathematics as in Language; (Hd) Reading-Writer Maturity and Spatial Orientation will present a predictive power of low academic achievement; (He) General Intelligence, contrary to what many studies in the literature claim and despite having some predictive power, will not be among the most powerful aptitudes when it comes to predicting both non-repetition of a school year throughout Primary Education, as with the academic success for the instrumental subjects.

MATERIALS AND METHODS

Participants

In the present study, the sample consisted of the total number of students enrolled in Early Childhood Education (5 years of age) from the four public schools of the province of Alicante (Spain), with a sum total of 631 students. In undertaking a longitudinal study of the sample during the complete period of Primary Education, at the end of the follow-up those students who did not have continuity in their schooling in the municipality and who were unable to complete their follow-up in terms of their evolution have been excluded. Consequently, after the follow-up the total sample was reduced to 512 students. Furthermore, the inclusion criterion used was that students should maintain their schooling in the same school, from Infant Education starting at

5 years of age until completion of the Primary Education stage (12 years of age).

The experimental group of students consisted of 232 males (45.4%) and 280 females (54.6%). The socioeconomic level of the families was distributed among families with income in categories of middle-high with 92 students (18%), middle with 220 students (43%), middle-low with 122 students (24%), and low with 78 students (15%). With regard to the academic training of the families of the students that made up the sample, 22% (113) had undergone university studies, 28% (144) had chosen a vocational training, 41% (209) had finished secondary school and 9% (46) did not have neither an academic background nor qualified training had an academic background or some qualified training.

Before initiating student evaluation and monitoring in this research, the procedure was presented before the District Education Board, which is the highest decision-making body of an educational center in Spain. The District Education Board, related to the four target schools from where the sample was to be drawn, approved the research procedure for those schools. In addition, the psychometric evaluation and the corresponding analysis of the results of the evaluation were reported to all families through mail. In the letter that the families received, families were given the option for their children to not participate in the investigation. None of the families of the total sample exempted their children from participating in the evaluation and subsequent follow-up. This research was conducted in accordance with the 1964 Declaration of Helsinki and its later amendments. Finally, approval was requested from the Ethics Committee of the University of Alicante, which provides and approves the methodology used, and the approval was assigned the file number UA-2018-03-08.

Instruments

The Spanish Primary School Aptitude Test (AEI) was designed with the objective of evaluating aptitudes that are essential for school learning (Numerical Aptitude, Verbal Aptitude, Spatial Orientation, Auditory Memory, Visomotricity, and Reading and Writing Maturity). One of its great potentials lies in the fact that it allows to measure transcendental cognitive aptitudes for the academic field, long before students have started reading and writing. The Verbal Aptitude and Numerical Aptitude Scales are each composed of 21 items, while the Spatial Orientation Scale consists of 9 items. In these three scales, the student must mark with a cross the image that has the best correspondence to the instruction provided by the evaluator (Lakin and Gambrell, 2012; Lohman and Gambrell, 2012). The Auditory Memory Scale consists of the student listening to the names of a series of objects and then being presented with a template that has a set of images, among which are the aforementioned objects that must be marked with a cross. The Visomotricity Scale consists of three sub-tests, which require the student to draw different figures. All of the scales are scored in relation to the successes or errors of each of the items that compose it. This direct score can be transformed into a percentile score. From the results of the different scales, a Total Score Index and a Reading and Writing Maturity Index are obtained.

This is one of the most widespread tests within the Spanish territory. At a professional level, school counselors use this test to verify the maturity level of the student with respect to acquiring reading and writing skills during the first year of Primary Education, with the scale having a sample of more than 12.000 subjects nationwide. The purpose of the AEI tool is to provide primary school teachers with basic information on the maturity level of each student in order to adapt the rhythms and contents of the program to the real needs of each student in different academic areas. However, from the perspective of the present study, the intention of the AEI tool is the early detection of students with suspected deficiencies in their aptitudes which should be the object of specific work that is aimed at maturation (Navarro-Soria and González-Gómez, 2010).

To check internal consistency, the AEI Battery was subjected to the Cronbach alpha coefficient, obtaining a total score of 0.90 for the data collected from the control sample while this same coefficient was 0.87 for our study sample. In addition, reliability studies were carried out on the AEI Battery using the split-half method, with a result of 0.68 for the sample of 4 year olds and 0.90 for the group of 5 year olds.

Another important psychometric element is validity, in this case the relationship between the different tests of the battery. This data will indicate whether the variations in subject's performances are due to differences in aptitude. The data from the correlations can be observed in **Table 1**, as well as the results obtained by the 4 and 5 year olds through which the scale has been elaborated.

Procedure

In order to verify that cognitive skills, as measured by the AEI Battery, are more influential for academic development, the team of school psychologists conducted an aptitude assessment at the end of the final year of Early Childhood Education (5 years of age), with the subsequent follow-up, at the level of achievement of curricular objectives for the reference course (passed/failed) and promotion to the next level (not failing the two instrumental subjects),throughout 6 years of schooling, collecting information annually on the performance of the sample during their development in Primary Education. The follow-up consisted of annual meetings in which information was collected on regular school attendance, family involvement, changes in family structure, and diagnosis of learning difficulties/disorders. In case of any of these circumstances, and after assessing that this situation could be affecting the performance of the student, the

research team decided upon the continuity of the participant in the sample. Therefore, the exclusion criteria for the groups in which the follow-up was carried out were: absenteeism, diagnosis of a clinical disorder and/or family breakdown or negligence.

The evaluation of the students that made up the sample was undertaken during the last quarter of the 5-year period of Early Childhood Education, at which time the AEI psychometric test was implemented (De la Cruz, 1999). The application of this test is collective hence it was carried out by two researchers, one providing instructions for its realization ("Cross the drawing of the open hand, cross the one with hair, cross the drawing of food"), while the other researcher supported those students who presented some difficulties in understanding the test. Its implementation takes approximately 60 min. The student does not require reading and writing skills, since the answering consists of the recognition of images following oral instructions that the evaluator provides to the group during the implementation of the test.

To verify the academic performance of the students, a follow-up of the achievement of curricular objectives (observing if students achieve a pass/fail) in the instrumental subjects (Mathematics and Language) has been undertaken throughout Primary Education, whether the curricular objectives have been passed or not has been used to analyze the differences between students. Taking into account their cognitive abilities (high, medium or low) and based on their school results (pass or fail), the influence of their aptitude differences in their academic performance has been determined.

Statistical Analysis

To analyze the influence of the predictor variables, logistic regression was used following the Forward Selection procedure based on the Wald statistic. Logistic modeling allows estimation of the probability of an event, a success, or a result occurring, as opposed to not occurring, in the presence of one or more predictors. This probability is estimated by using the odds ratio (OR) statistic. If the OR is greater than one, for each time the event occurs in the absence of the independent variable, it will be given twice if that independent variable is present. On the contrary, if the OR is less than one, the probability that the event occurs in the absence of the independent variable will be greater than if that independent variable were present (De Maris, 2003). To analyze the adjustment of the proposed models, two indicators were taken into account: (a) Nagelkerke's R^2 (an adjusted version of the Cox and Snell R^2 that adjusts

TABLE 1 | AEI Battery reliability (De la Cruz, 1999).

	Verbal	Quantitative	Spatial O.	Memory	Viso. A + B + C	Total	Reading and writing mat.
Verbal aptitude		0.65	0.23	0.28	0.31	0.65	0.59
Numerical aptitude	0.41		0.34	0.27	0.47	0.73	0.61
Spatial orientation	0.24	0.39		-0.10	0.46	0.76	0.80
Auditive memory	0.23	0.23	0.15		0.17	0.31	0.29
Visomotricity	0.18	0.36	0.38	0.14		0.77	0.78
Total	0.53	0.70	0.79	0.39	0.71		0.98
Reading and writing maturity	0.49	0.54	0.82	0.39	0.72	0.97	

the scale of the statistic to cover the full range from 0 to 1), which indicates the percentage of variance explained by the model (Nagelkerke, 1991) and (b) the percentage of correctly classified cases, which allows to determine to what extent the predictor variable is useful for estimating the criterion variable in the proposed model.

RESULTS

The data permitted the creation of the logistic regression models, which make it possible to effect correct estimations regarding the probability of passing the two instrumental subjects (Language and Mathematics) and not repeating the school year, based on the scores in Cognitive Maturity (Total Index Score) in the different cognitive aptitudes evaluated: Verbal Aptitude (μ = 12.82; SD = 3.27), Numerical Aptitude (μ = 13.07; SD = 2.98), Spatial Orientation (μ = 13.89; SD = 6.38), Auditory Memory (μ = 3.62; SD = 1.99), Visomotricity (μ = 16.37; SD = 4.56), and Total Score (μ = 59.70; SD = 14.41).

Table 1 shows the steps followed by the model in the introduction of explanatory variables that have been significant for the probability of passing the instrumental language subject. For the evaluation using the AEI of a child of 5 years of age, the proposed model allows a correct estimation of 72% of the cases in Verbal Aptitude, 71% in Numerical Aptitude, 74% in Spatial Orientation, 61.5% in Auditory Memory, 68.2% in Visomotricity, 75% in Reading and Writing Maturity, and 75.4% in Total Score.

Nagelkerke's R^2 oscillates in the estimation of the adjustment value between 0.05 for Auditory Memory and 0.40 for both Reading and Writing Maturity and Total Score.

The odds ratio (OR) obtained for the elaborated models of the sample oscillates between 1.11 for Total Score and 1.51 for Numerical Aptitude (Table 2). Thus, during Primary Education

the probability that students do not fail the subject of Language, is higher for each incremental point in the result obtained in the following indices: Verbal Aptitude (39%), Numerical Aptitude (47%), Spatial Orientation (20%), Auditory Memory by (23%), Visomotricity (23%), Reading and Writing Maturity (13%), and Total Score (11%), for the entire sample and by entering the variables one by one.

In Table 3, the introduction of explanatory variables that have been significant for the probability of not failing the instrumental subject of Mathematics is shown. For the evaluation using AEI of a child of 5 years of age, the proposed model allows a correct estimation of 71.8% of cases in Verbal Aptitude, 69.6% in Numerical Aptitude, 72.6% in Spatial Orientation, 62.4% in Auditory Memory, 69.2% in Visomotricity, 76% in Reading and Writing Maturity, and 75.8% in Total Score.

Nagelkerke's R^2 oscillates in the estimate of the adjustment value between 0.04 for Auditory Memory and 0.41 for Total Score.

The odds ratio (OR) that was obtained for the elaborated models of the sample oscillates between 1.11 for Total Score and 1.52 for Numerical Aptitude. Thus, the probability that students do not fail the instrumental subject of Mathematics during any of the Primary Education courses, is greater for each incremental point in the result obtained in the following indices: Verbal Skills (39%), Numerical Aptitude (52%), Spatial Orientation (21%), in Auditory Memory (20%), Visomotricity (22%), Reader and Writing Maturity (13%), and Total Score (11%), for the entire sample and by entering the variables one by one.

In Table 4 are the steps followed by the model in the introduction of explanatory variables that have been significant for the probability of not repeating a school year. For the evaluation with AEI of a child of 5 years of age, the proposed model allows a correct estimation of 89.2% of the cases in Verbal Aptitude, 88% in Numerical Aptitude, 88.4% in Spatial Orientation, 87.5% in Auditory Memory, 87.4% in Visomotricity, 90% in Reading and Writer Maturity, and 90.6% in Total Score.

TABLE 2 | Logistic regression for the predictive probability of each one of the cognitive aptitudes of the AEI Battery and non-failure of the Language instrument.

Variable		Language						
	χ^2	R^2	B	E.T.	Wald	p	OR	C.I. 95%
Verbal aptitude	109.73	0.26	0.33	0.03	81.60	<0.001	1.39	1.30–1.50
		Constant −3.99		0.48	67.62	<0.001	0.01	
Numerical aptitude	112.81	0.27	0.39	0.04	80.39	<0.001	1.47	1.35–1.61
		Constant −4.79		0.57	69.52	<0.001	0.00	
Spatial orientation	134.68	0.31	0.18	0.01	101.02	<0.001	1.20	1.16–1.25
		Constant −2.29		0.27	67.19	<0.001	0.10	
Auditive memory	21.36	0.05	0.21	0.04	20.55	<0.001	1.23	1.12–1.35
		Constant −0.47		0.19	6.15	0.01	0.62	
Visomotricity	88.74	0.21	0.21	0.02	70.21	<0.001	1.23	1.17–1.29
		Constant −3.12		0.41	56.36	<0.001	0.04	
Reading and writing maturity	179.57	0.40	0.12	0.01	110.56	<0.001	1.13	1.11–1.16
		Constant −5.71		0.58	95.55	<0.001	0.00	
Total score	181.56	0.40	0.11	0.01	112.34	<0.001	1.11	1.09–1.13
		Constant −6.24		0.62	98.85	<0.001	0.00	

χ^2, Chi-Square; R^2, R^2 Nagelkerke; B, Coefficient; p, probability; OR, Odds Ratio; C.I., Confidence Interval.

TABLE 3 | Logistic regression for the predictive probability of each one of the cognitive aptitudes of the AEI Battery and non-failure of the Mathematical instrument.

	Mathematics							
Variable	χ^2	R^2	**B**	**E.T.**	**Wald**	**p**	**OR**	**C.I. 95%**
Verbal aptitude	109.23	0.26	0.33	0.03	81.25	<0.001	1.39	1.30–1.50
		Constant −4.01		0.48	68.03	<0.001	0.01	
Numerical aptitude	124.13	0.29	0.41	0.04	85.80	<0.001	1.52	1.39–1.66
		Constant −5.17		0.59	75.51	<0.001	-5.17	
Spatial orientation	143.63	0.33	0.19	0.01	105.10	<0.001	1.21	1.17–1.26
		Constant −2.44		0.28	72.06	<0.001	0.08	
Auditive memory	16.45	0.04	0.18	0.04	15.97	<0.001	1.20	1.10–1.32
		Constant −0.40		0.18	4.50	0.03	0.67	
Visomotricity	85.60	0.21	0.20	0.02	68.26	<0.001	1.22	1.17–1.29
		Constant −3.07		0.41	55.30	<0.001	0.46	
Reading and writing maturity	180.63	0.40	0.13	0.01	110.78	<0.001	1.13	1.11–1.16
		Constant −5.78		0.58	96.46	<0.001	0.00	
Total score	183.62	0.41	0.11	0.01	112.89	<0.001	1.11	1.09–1.14
		Constant −6.34		0.63	100.04	<0.001	0.00	

χ^2, Chi-Square; R^2, R^2 Nagelkerke; B, Coefficient; p, probability; OR, Odds Ratio; C.I., Confidence Interval.

TABLE 4 | Logistic regression for the predictive probability of each one of the cognitive aptitudes of the AEI Battery and non-repetition of a school year.

	Repetition							
Variable	χ^2	R^2	**B**	**E.T.**	**Wald**	**p**	**OR**	**C.I. 95%**
Verbal aptitude	71.73	0.25	0.35	0.04	57.86	<0.001	1.42	1.29–1.55
		Constant −2.11		0.56	17.48	<0.001	0.12	
Numerical aptitude	76.54	0.26	0.41	0.05	55.96	<0.001	1.51	1.35–1.68
		Constant −3.00		0.63	22.52	<0.001	0.05	
Spatial orientation	94.05	0.32	0.22	0.02	68.02	<0.001	1.24	1.18–1.31
		Constant −0.40		0.26	2.42	0.11	0.66	
Auditive memory	18.37	0.06	0.28	0.06	17.72	<0.001	1.33	1.16–1.53
		Constant 1.01		0.23	18.81	<0.001	2.76	
Visomotricity	66.57	0.23	0.26	0.03	52.18	<0.001	1.30	1.21–1.39
		Constant −1.89		0.49	14.38	<0.001	0.15	
Reading and writing maturity	126.83	0.42	0.13	0.01	77.04	<0.001	1.14	1.11–1.82
		Constant −3.63		0.58	38.04	<0.001	0.02	
Total score	124.38	0.41	0.11	0.01	75.43	<0.001	1.12	1.09–1.15
		Constant −4.23		0.66	41.07	<0.001	0.01	

χ^2, Chi-Square; R^2, R^2 Nagelkerke; B, Coefficient; p, probability; OR, Odds Ratio; C.I., Confidence Interval.

Nagelkerke's R^2 oscillates in the estimation of the adjustment value between 0.06 for Auditory Memory and 0.42 for Reading and Writing Maturity.

The odds ratio (OR) that was obtained for the elaborated models of the sample oscillates between 1.12 for Total Score and 1.51 for Numerical Aptitude. Thus, the probability that students do not repeat a school year during Primary Education is greater for each incremental point in the result obtained in the following indices: Verbal Aptitudes (42%), in Numerical Aptitudes (51%), in Spatial Orientation a (24%), in Auditory Memory (33%), in Visomotricity (30%), in Reading and Writing Maturity (14%) and in Total Score (12%), for the whole sample and introducing the variables one by one.

DISCUSSION

From the analysis of the results, we conclude that Verbal and Numerical Aptitudes are the variables with greater predictive capacity respect to the development of the different competences academic and probability of repeating a course. Thus, the results confirm that the AEI tool has a good predictive capacity for Early Childhood Education with respect to the appearance of difficulties in overcoming the curricular objectives during Primary Education, thus confirming the hypothesis H$_a$.

When evaluating student aptitude development using the AEI battery prior to the start of Primary Education, it was noted that for each incremental point in the results for Verbal and Numerical Aptitudes, the probability that the student does

not repeat an academic year oscillates between 42 and 51%, respectively. These data reinforce the results of previous research that also conclude that Verbal and Numerical Aptitudes are valid predictors of learning difficulties (Burnet and Lane, 1980; Cooper and Reagan, 1982; Bennett et al., 2000; Pérez et al., 2005; Robles and Vázquez, 2014). This conclusion underlines the importance of these skills being acquired through specific training to enhance their development. Therefore, training in Verbal and Numerical Aptitudes is considered an adequate academic response which favors acquisition by students of the curricular objectives that are proposed for the different disciplines in the first cycles of Primary Education.

In the same line, when the results are analyzed with a focus on which aptitudes present a greater predictive capacity, with a possible failure of the instrumental subjects throughout Primary Education, it was observed that in the AEI Battery and for the instrumental subject of Language, it is Numerical Aptitude which, with a slightly higher result (72.6%), is ahead of Verbal Aptitude (69.6%) at the level of predictive capacity, confirming the hypotheses H_b and H_c. These results, which initially could seem inconsistent, are justified if one considers that in the AEI test, Numerical Aptitude is measured by using the knowledge of verbal concepts that are associated with learning Mathematics (for example: more/less, bigger-number/smaller-number, same/different, superior/inferior, first/last, equal/not equal, etc.). This is a numerical vocabulary that is less used in everyday conversations with children at this age, but it would measure a deeper knowledge of Language. On the one hand, different authors in the literature have highlighted Mathematical Competence during the first school years as a powerful predictor of academic success, not only for the discipline itself but also for other domains such as Language (Aubrey et al., 2006; Duncan et al., 2007; Jordan et al., 2010; Geary et al., 2013; Martin et al., 2014; Park et al., 2016).

On the other hand, indices such as Spatial Orientation, Reading and Writing Maturity and Visomotricity do not stand out as predictors of academic success in the instrumental subject of Language, which contrasts with the results obtained in other investigations where these skills are understood to be crucial in the acquisition of Reading and Writing skills (Frostig et al., 1964; Smith, 1964; Mlodnosky, 1968; Bender, 1977; Koppitz, 1980; Valett, 1989; Spitz, 2009), thus confirming the hypothesis H_d. It is possible that these data could present a more significant difference in relation to the other indices if, instead of making the estimate by taking into account the whole of Primary Education, the results would be isolated at the academic level during the First Cycle of Primary Education in the subject of Language. In that, the First Cycle of Primary Education is a particular period when the acquisition of Reading and Writing skills is a priority objective and they are academic competences that require adequate maturity at the level of Spatial Orientation, Reading and Writing Maturity, and Visomotricity. In the same way, the Spatial Orientation Index, the Reading and Writing Maturity Index and the Visomotricity Index do not present any significant relevance at the level of predictive capacity of academic success in Mathematics, which also contrasts with recent research, for which the results highlight that the Visuospatial Skills Index, measured

between the ages 5 and 6 years, is a powerful predictor of success in the field of mathematics (Cheng and Mix, 2014; Hawes et al., 2015; Pitchford et al., 2016; Cornu et al., 2017, 2018).

A further notable result, that coincides with various investigations in the body of literature, is that General Intelligence is not a determining variable in predicting school success (Edel, 2003; Laidra et al., 2006; Deary et al., 2007; Watkins et al., 2007; Miñano and Castejón, 2008). While it is true that this statement is controversial and has many defenders as well as detractors, it is not difficult to find a diversity of research which determines that General Intelligence can be considered as one of the best predictors of academic success (Deary et al., 2007; Kaufman et al., 2012; Roth et al., 2015; Schult and Sparfeldt, 2016; Gygi et al., 2017). However, for our sample and with the aptitude being measured using the AEI tool, the fact of having higher scores in this particular index has not been associated with greater possibilities of non-repetition of school years. Therefore, although General Intelligence has some influence over success with respect to achieving the curricular objectives of the reference course, it is not the most determining factor among the measured aptitudes, thus confirming the hypothesis H_e.

Finally, if the results for the aptitudes that are measured with the AEI tool and the instrumental subject of Mathematics are observed and analyzed, the Numerical Aptitude Index stands out as the best predictor of possible failure, over and above the rest of the aptitudes/skills. This fact is indeed justified. In that, if a student in the First Year of Primary Education does not understand the concepts that are used to explain the numerical operations, they will find great difficulties in correctly executing exercises in Mathematics, due to the great level of abstraction required by cognitive processes associated with this type of activity at this educational level. These results are in agreement with those obtained in recent investigations (Matthews et al., 2015; Ye et al., 2016; Harvey and Miller, 2017), whose conclusions highlight the importance of the development of the language of Mathematics in Early Childhood Education for the adequate acquisition of Mathematics in later stages of the educational process.

In terms of study limitations, it is noteworthy that for future investigations, the sample of both subjects and provinces in which information was collected should be expanded, and this is among the most important limitations of this study. In addition, it would be advisable to not limit the study to a single evaluation instrument, but to include different psychometric tests that allow the collection of data from other variables beyond cognitive aptitudes, in order to be able to assert in a more substantial manner what academic successes and failures can be attributed to.

CONCLUSION

The most relevant conclusion of this study is the finding that a psychometric tool such as AEI presents an adequate capacity to predict academic success or failure in the instrumental subjects of Mathematics and Language. In that, these two instrumental subjects provide the basis for the remainder of the required academic knowledge. This predictive capacity is

available throughout 6 years of schooling before any difficulties are evidenced. One can assume that this is an ample period of time in which to be able to promote preventive actions that could reduce the probability of academic failure.

Based on the obtained results, we propose that the AEI tool can be considered effective in anticipating learning difficulties when it is included in an early detection program that aims to implement pedagogical strategies which favor an adequate maturity at the student aptitude level, thus avoiding any future academic failure. The AEI tool should be linked to the development of models of psychopedagogical intervention (Prior et al., 2011; Raver et al., 2011; Geary and VanMarie, 2016) which are aimed at reducing learning difficulties in the First Cycles of Primary Education. At that stage, if student difficulties go unnoticed or they do not receive the necessary focus or importance, the first deficiencies will affect student learning capacity, which in many cases will then accumulate in each following school year. In fact, recent research (Serpell and Esposito, 2016) highlights the importance of this type of strategy being transferred from government institutions through relevant legislation to educational programs that are aimed at the early prevention of learning difficulties, in order to reduce the worrying current rates of school failure in Spain.

As a final conclusion and in agreement with other research where by data were collected during Primary Education and Secondary Education (Duncan et al., 2007; Murray and Harrison, 2011; Serpell and Esposito, 2016; Harvey and Miller, 2017), we wish to emphasize that early academic performance is a robust predictor of later academic ability. Children with greater knowledge and understanding of Mathematics and Language concepts at the beginning of compulsory schooling achieve higher academic levels in later education than their less-prepared peers. Regarding the relevance of this research and the data obtained from it, the Spanish Primary School Aptitude Test (AEI) Battery is an adequate prediction tool at an early age

which provides technical arguments and objectives for initiating reinforcement measures at an initial level of schooling, in order to avoid later learning difficulties that may arise.

DATA AVAILABILITY STATEMENT

ETHICS STATEMENT

AUTHOR CONTRIBUTIONS

IN-S contributed to the project idea, article concept, and design, as well as planning the timeline, substantially involved in the data, material, and article acquisition, mainly responsible for drafting, writing, and revising the review article, and responsible for selection and final approval of the scholarly publication. JÁ-T participated in drafting the work and revising it critically with respect to important intellectual content in all its phases. LG-A participated in drafting the work and revising it critically with respect to important intellectual content in all its phases. RL-C provided substantial help with the concept and design, contributed substantially to the project by drafting and revising the review article, and being responsible for the final approval of the scholarly publication. All authors contributed to the article and approved the submitted version.

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The Effect of Psychological *Suzhi* on Suicide Ideation in Chinese Adolescents: The Mediating Role of Family Support and Friend Support

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In this study, we examined family support and friend support as potential mediators between psychological *suzhi* and suicide ideation in a sample of 1,369 Chinese adolescents (48. 1% men, 15.52 ± 1.76 years). The results showed that family support and friend support were found to adequately mediate the relationship between psychological *suzhi* and suicide ideation. In addition, the effect of psychological *suzhi* on adolescents' suicide ideation was stronger for family support than friend support. These findings demonstrated the key roles of psychological *suzhi,* family support, and friend support in reducing adolescents' suicide ideation. It enlightens us that we are supposed to improve adolescents' psychological *suzhi* and perceived social support (including family support and friend support) through many ways in order to better play its protective role in the future.

Keywords: psychological *suzhi*, family support, friend support, suicide ideation, adolescents

INTRODUCTION

The 1990–2016 Global Suicide Disease Burden Analysis Report pointed out that, overall, ∼800,000 people die of suicide every year in the world. Although the age-standardized death rate of suicide has dropped by 32.7% over the past 20 years, the phenomenon of suicide among teenagers has increased. It has become more and more common and has become a major global public health problem. Suicide has become the second leading cause of death among adolescents worldwide. Especially in the past 10 years, the suicide rate among people aged 10–14 years has almost tripled (Curtin and Heron, 2019); the rate of suicide among Chinese adolescents also did not decrease significantly (Liu Z. R. et al., 2017). Studies have pointed out that an individual's suicide will not only harm themselves and cause great grief to the family, but also induce friends or family members to increase suicide ideation or engage in suicidal behavior, which will have a great negative impact on society (Nanayakkara et al., 2013). Suicidal behavior includes suicide ideation, nonfatal suicide attempts, and fatal suicide (Silverman et al., 2007). Among them, suicide ideation refers to the loss of the desire to live, the start of thinking about plans and ways of suicide, and the notion and behavior that have not caused physical injury for the time being (Beck et al., 1973). From the perspective of suicide formation process, suicide ideation is the main link and inevitable stage of suicidal behavior, and it is also the most sensitive predictor (Miranda et al., 2014; Ni and Chen, 2016). Therefore, it is of great significance for the prevention and intervention of suicidal behavior of teenagers to find out the protective factors that influence suicide ideation and further reveal its influencing mechanism.

The stress-susceptibility model of suicide believes that suicide is a process jointly affected by stress factors (stress events), environmental factors (including family, social, cultural, and other factors), and individual qualities (including susceptibility, personality, cognition, etc.). The protective factors affecting suicidal behavior of adolescents mainly involve resilience, social support, and positive coping styles (Mann and John, 2002). Although there are abundant researches on the factors affecting suicide ideation, there is no research to examine if psychological *suzhi* affects the suicide ideation of adolescents during middle-school stage, or aiming at identifying a mechanism underlying such an effect (Johnson et al., 2010; Kristin and Sean, 2011; Evan et al., 2013). Therefore, this research aims to investigate the influence of middle-school students' psychological *suzhi* on suicide ideation from the perspective of psychological *suzhi*.

Psychological *suzhi* is a psychological concept with Chinese characteristics. It was first proposed under the background of Chinese vigorous promotion of quality education in the 1980s. Based on theoretical and empirical studies among Chinese students in the past 30 years, we defined it as a basic psychological quality. It has a derivative function related with individuals' developmental, adaptive, and creative behaviors and a multilevel self-organized system that involves steady implicit mental qualities and explicit adaptive behaviors (Zhang et al., 2011; Nie et al., 2020a). The psychological *suzhi* structure is based on the two-factor model, including general factors and special factors. The former highlights the basic characteristics of psychological *suzhi* and participates in all aspects of mental activities; the latter is specifically composed of three dimensions: cognitive quality, personality quality, and adaptation (Wu et al., 2017). Cognitive quality is the most basic component in the structure of psychological *suzhi*, which mainly refers to the mental quality of individuals when reflecting objective things, involving specific operations such as perception. Personality quality is the core of the structure of psychological *suzhi*, which reflects the individuals' personality psychology. Although it does not directly participate in the specific operations of cognition, it has motivation and regulation functions for the cognitive process. Adaptation mainly reflects the derivative function of psychological *suzhi*. It reflects the individuals' ability to continuously adapt to environmental changes during the process of interaction with the environment and to coordinate itself with the environment. It is a comprehensive manifestation of the integration of cognitive and individual factors into the individuals' external behavior (Nie et al., 2020b).

At present, the psychological factors concerned by suicide research mainly focus on variables such as self-esteem, depression, and hope, and there are few studies from the perspective of psychological *suzhi*. For a long time, depression has been regarded as an important risk factor for suicide. A large number of studies have shown that depression can significantly predict individual suicide ideation (Bradvik et al., 2008; Troister and Holden, 2013). At the same time, cognitive theory believes that the appearance of psychological feelings such as depression, loneliness, and suicide ideation is inseparable from self-knowledge (Beck, 1967). People with low self-esteem have insufficient problem-solving skills, and they are prone to extreme, absolute, and one-way judgments when encountering setbacks, which can lead to suicide ideation (Jibeen, 2017). In addition, studies have shown that the sense of hope is not only an effective negative predictor of suicide ideation, but also plays a significant role in regulating ruminant thinking and suicide ideation (O'Keefe and Wingate, 2013; Tucker et al., 2013), which means that hope can reduce the possibility of suicide ideation. Although no research has directly investigated the relationship between psychological *suzhi* and suicide ideation, many empirical studies have shown that adolescents' psychological *suzhi* can significantly positively affect self-esteem and hope (Liu G. Z. et al., 2017; Peng et al., 2020) and significantly negatively affect negative emotions such as depression and anxiety (Zhang et al., 2017). Therefore, we speculate that compared to specific mental health indicators such as self-esteem, depression, and hope, psychological *suzhi* as a comprehensive quality may play a more basic role, but the specific impact mechanism still needs to be further explored.

Perceived social support is the degree of emotional satisfaction that an individual feels subjectively supported and understood (Sarason et al., 1991). The buffer model of social support points out that social support can alleviate the negative effects of negative events and improve the individuals' physical and mental health (Cohen and Wills, 1985). Perceived social support and actual social support are not exactly the same. The former is psychological reality, and the latter is social reality. However, psychological reality is often more able to influence individuals' psychology and behavior; that is, perceived social support is also a potentially important protective factor (Brenning et al., 2015). There are abundant studies on perceived social support and suicide ideation. Some studies have found that compared with economic pressure and psychological resilience, perceived social support has a more significant influence on suicide ideation of adolescents (Lee et al., 2017), and other studies have pointed out that when adolescents have a higher level of perceived social support, it can significantly reduce the negative impact of bullying and reduce the possibility of suicidal ideation (Liu X. Q. et al., 2017). From the specific sources of social support, studies have pointed out that various family factors are risk factors for suicide among teenagers. Family function and parental warmth will have a significant impact on teenagers' suicide ideation (Sylvia, 2011; Li et al., 2016a). Some studies have also pointed out that after controlling for family structure and parental attachment, perceived peer support still has a strong predictive effect on suicide ideation (Li et al., 2016b). Perceived social support itself includes family support, friend support, and other support. Existing studies when investigating the relationship between social support and suicide ideation all consider social support as a whole or examining one aspect of support separately. Few studies examine the effects of family support and friend support separately, but this study aims to compare the two that have more significant effects. Therefore, we speculate that family support and friend support may simultaneously affect adolescents' suicide ideation, but we do not make assumptions about the specific impact mechanism.

Psychological *suzhi* and perceived social support are the potential factors affecting suicide ideation in adolescents, and

there is also a close relation between them. The model of the relationship between psychological *suzhi* and mental health points out that psychological *suzhi* will affect the perception of external protective factors (such as social support), thereby affecting the individual's mental health (Zhang and Wang, 2012). As a core and basic psychological quality of adolescents, psychological *suzhi* has been shown to positively predict perceived social support, and can negatively influence social anxiety through the chain-like mediation of self-esteem and perceived social support (Zhang and Zhang, 2019). In other words, individuals with higher psychological *suzhi* have a higher level of perceived social support, and psychological *suzhi* can enhance the individual's mental health and social adaptation level by enhancing the perceived social support. And because it is mentioned above that perceived social support can significantly negatively affect adolescents' suicide ideation, we speculate that perceived social support may play a mediating role in the relationship between adolescents' psychological *suzhi* and suicide ideation.

In summary, this research will explore the relationship between psychological *suzhi*, perceived social support (family support, friend support), and suicide ideation in Chinese adolescents for the first time and subsequently attempt to examine internal mechanisms that account for these associations. Thus, we hypothesized that:

H1: Psychological *suzhi* is negatively related to suicide ideation.
H2: Psychological *suzhi* is positively related to friend support and family support.
H3: Friend support and family support would mediate the association between psychological *suzhi* and suicide ideation.

METHODS

Participants and Procedures

Participants included 1,369 students recruited from six compulsory secondary education schools in eastern, central, and western China. We randomly selected 30 classes from 7th to 12th grade at six schools (272, 197, 204, 213, 284, and 199 participants, respectively). No significant differences were found in other demographic variables such as gender among schools, so these participants had a good sample representation. Two hundred thirty-six participants were in 7th grade, 211 were in 8th grade, 232 were in 9th grade, 237 were in 10th grade, 222 were in 11th grade, and 231 were in 12th grade. There were 658 (48.1%) boys and 711 (51.9%) girls. Participants were aged 11 to 20 years (mean = 15.52 ± 1.76 years).

The Research Ethics Committee of Chinese Southwest University approved this study. Before the start of the research, we contacted the administrators of the relevant schools, obtained permission for the questionnaire test, and obtained informed consent from the students and parents at the parents' meeting. At the beginning of the test, the researcher introduced the research objectives and procedures to the participants. Then, the participants filled out the questionnaire under the supervision of the researcher and completed it within the specified time. All participants were tested during regular school hours in their classrooms.

Measures

Psychological *Suzhi*

Psychological *suzhi* was measured by the Psychological *Suzhi* Questionnaire for Middle School Students (Hu et al., 2017). This scale contains 24 items. It measures psychological *suzhi* from three dimensions including cognitive quality (e.g., "I always have explicit pathways when doing exercises"), individuality (e.g., "I always press myself to complete what I should do"), and adaptability (e.g., "I am a popular person"). Please see full details of the questionnaire in the Supplementary Materials. Each item was rated on a 5-point scale (1 = totally disagree, 5 = totally agree), with higher scores indicating greater psychological *suzhi*. In this study, Cronbach α of the total scale was 0.92 and ranged from 0.79 to 0.84 for the subscales.

Perceived Social Support

Perceived social support was measured by the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988). This scale contains 12 items, which were answered using a 7-point rating scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating greater perceived social support. It measures perceived support from three aspects including family, friends, and significant others. This scale is suitable for use with adolescents in the Chinese school environment, and the reliability of the whole scale is excellent (Chen et al., 2016). For research purposes, this study selected only eight items to evaluate family support and friend support and scored the two parts separately. In this study, Cronbach α values of family support and friend support were 0.83 and 0.86, respectively.
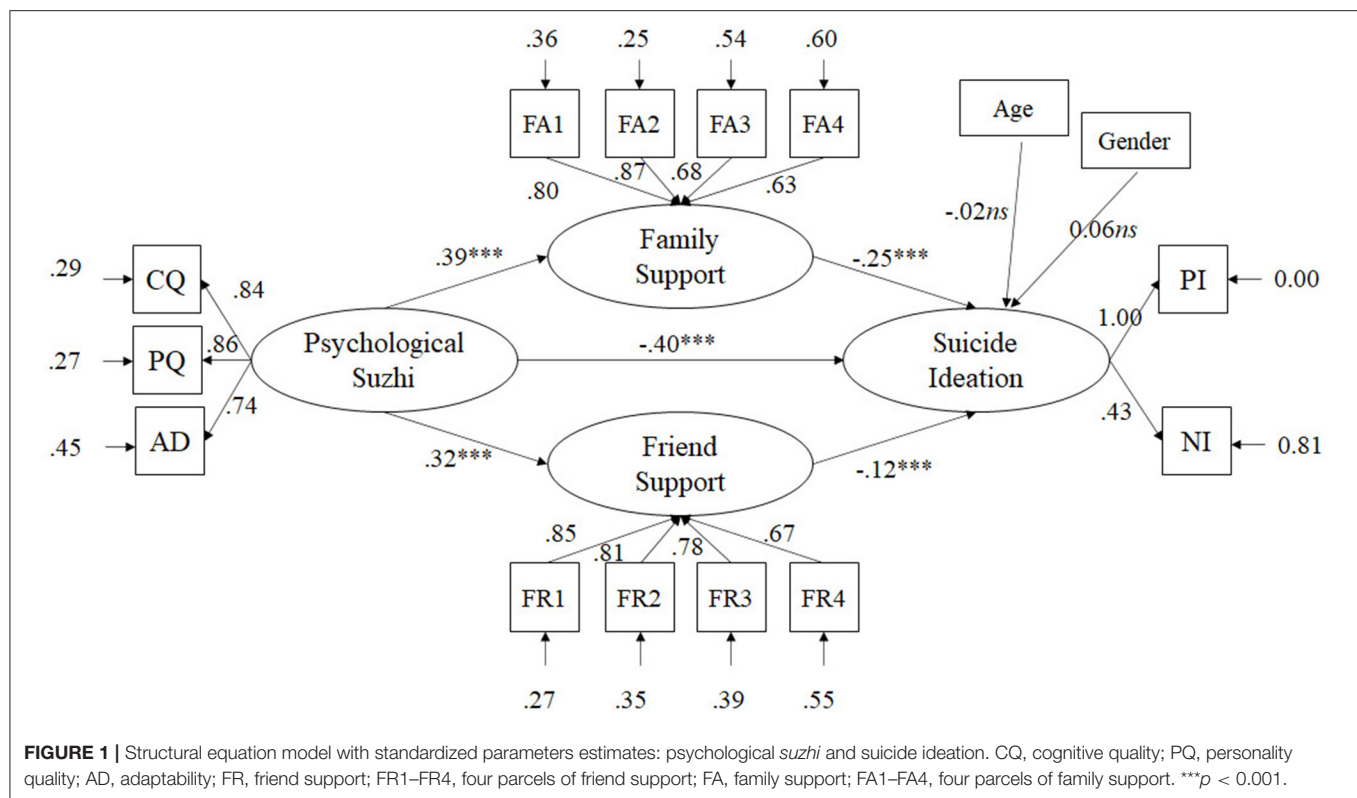
Suicide Ideation

Suicide ideation was measured by the Positive and Negative Suicide Ideation (PANSI; Osman et al., 1998). This scale contained a six-item subscale of positive suicide ideation and an eight-item subscale of negative suicide ideation. Positive suicide ideation was scored in reverse, and the total score of negative suicide ideation was added to obtain the total score of suicide ideation. Higher scores on the PANSI indicate stronger suicide ideation. Each item was rated on a 5-point scale (1 = none of the

TABLE 1 | Descriptive statistics and bivariate correlations between study variables.

Variables	1	2	3	4
1. Psychological *suzhi*	–			
2. Friend support	0.29***	–		
3. Family support	0.34***	0.48***	–	
4. Suicide ideation	−0.38***	−0.29***	−0.39***	–
Mean	86.05	19.36	19.65	25.73
Standard deviation	13.52	5.04	5.05	7.72

***p < 0.001.

FIGURE 1 | Structural equation model with standardized parameters estimates: psychological *suzhi* and suicide ideation. CQ, cognitive quality; PQ, personality quality; AD, adaptability; FR, friend support; FR1–FR4, four parcels of friend support; FA, family support; FA1–FA4, four parcels of family support. ***$p < 0.001$.

time, 5 = most of the time). PANSI has been shown to have high reliability and validity in the Chinese school environment (Wang et al., 2011). Cronbach α values of positive suicide ideation and negative suicide ideation were 0.82 and 0.93 respectively, and 0.89 for the total scale in this study.

Analytic Strategy

The collected data were analyzed using SPSS Statistics version 24.0 and Mplus 7. First, descriptive analysis was conducted to calculate the mean and standard deviation for each variable. Next, correlational analyses were conducted to examine whether psychological *suzhi* was associated with the friend support, family support, and suicide ideation in the expected directions. And then, the measurement model's goodness of fit was evaluated. The following indexes were used to assess goodness of fit for the measurement model: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and TLI values of ≥ 0.90, SRMR values of ≤ 0.08, and RMSEA values of ≤ 0.08 indicated good model fit (Hu and Bentler, 1999). Finally, multiple mediation analyses were conducted to examine the mediating roles of family support and friend support in the relationship between psychological *suzhi* and suicide ideation by using SEM. Following existing studies, age and gender were included as control variables. In this study, we obtained 5,000 bootstrap resamples and used them to determine the 95% confidence intervals (CIs) of the indirect effects. If the CI did not include zero, then the indirect effect was significant at $p = 0.05$ (Preacher and Hayes, 2008).

RESULTS

Descriptive Statistics Among the Variables

Table 1 displays the means and standard deviations, and the correlations between psychological *suzhi*, friend support, family support, and suicide ideation. Psychological *suzhi* was significantly positively correlated with friend support and family support. Both of them were significantly negatively correlated with suicide ideation.

Mediation Analysis

As two potential parallel mediators, friend support and family support were entered into a mediation model to examine whether they mediated the link between psychological *suzhi* and suicide ideation in Chinese adolescents. The test of the hypothesized mediator model showed a good date fit ($\chi^2 = 863.45$, $df = 84$; CFI = 0.91, TLI = 0.88, RMSEA = 0.08, SRMR = 0.07).

The standardized path coefficients among the main variables are presented in **Figure 1**. Psychological *suzhi* significantly related to suicide ideation ($\beta = -0.40$), supporting Hypothesis 1. The path coefficients between psychological *suzhi* and friend support ($\beta = 0.32$) and family support ($\beta = 0.39$) were both significant, supporting Hypothesis 2. Moreover, paths to suicide ideation from friend support ($\beta = -0.12$) and family support ($\beta = -0.25$) were both significant in the predicted directions. Therefore, friend support and family support mediated the association between psychological *suzhi* and suicide ideation; Hypothesis 3 was supported.

TABLE 2 | Standardized indirect effects from psychological *suzhi* to suicide ideation.

Indirect effect	β (standardized indirect effect)	SE	*p*	95% CI standardized indirect effect
Sum of indirect	−0.134	0.019	<0.001	−0.174, −0.100
Via family support	−0.097	0.017	<0.001	−0.137, −0.067
Via friend support	−0.037	0.011	<0.01	−0.061, −0.017

We subsequently used model constraint command of Mplus to create auxiliary variables and used bootstrapping in order to compare the mediation effects (**Table 2**). Psychological *suzhi*'s indirect correlation with suicide ideation was significantly stronger via family support than via friend support [$\beta = -0.074$, SE = 0.028, *p* < 0.01, 95% CI = (−0.025, −0.137)].

DISCUSSION

In this research, we examined the relations of psychological *suzhi* and suicide ideation with the effect of family support and friend support as mediators. Our study findings showed that adolescents' psychological *suzhi*, family support, and friend support were significantly positively correlated with each other, and the three were significantly negatively linked with suicide ideation, which supports our Hypothesis 1 and Hypothesis 2. Consistent with prior research, whether it was objective social support or perceived social support, psychological *suzhi* had a good predictive effect (Zhang and Zhang, 2019; Zhang et al., 2019). Additionally, prior studies showed that perceived social support (including family support and friend support) could significantly negatively predict individuals' problem behaviors or even suicide ideation (Pace and Zappulla, 2013; Corbitt-Hall et al., 2018). Although there has not been any research investigating the relationship between psychological *suzhi* and suicide ideation, a follow-up study on Chinese adolescents found that students' psychological *suzhi* had a positive effect on individuals' depression, loneliness, and friendship quality (Zhang et al., 2017). These above variables were closely related to the individual's suicide ideation. Therefore, as the core element of mental health (Liu G. Z. et al., 2017), psychological *suzhi* could also effectively predict individuals' suicide ideation. This result suggests that improving adolescents' psychological *suzhi* may make them feel more support from family and friends and show a lower level of suicide ideation.

Regarding our third hypothesis, we found that psychological *suzhi* could affect individuals' suicide ideation through parallel mediation effect of family support and friend support by our model. That is to say, high level of psychological *suzhi* not only could directly reduce the individuals' suicide ideation, but also could be achieved by enhancing the individuals' perception of support from family and friends. This result supported the notion that family support and friend support had an essential part in the study life of Chinese students, which were consistent with previous studies (Rehman et al.,

2020). It reveals that the mental health of adolescents is inseparable from the support and help of family and friends. At the same time, it is also vital to improve their psychological suzhi so that they can better perceive the support of others.

Moreover, we further compared the impact of family support and friend support, and the result showed that family support and friend support partially mediated psychological *suzhi*'s effect on suicide ideation, and the indirect effect was significant stronger via family support than via friend support. However, a study on migrant children in China showed that active friend support had an important protective effect on the individual's emotional and behavioral adaptation, while the protective effect of family support is only reflected in the field of behavioral adaptation (Wang et al., 2018). According to Poulin et al. (2012), in the background of Chinese culture, family support has a greater impact on the individuals' physical and mental health than friend support, but in Western countries, the result is the opposite. A possible explanation for this result is that teenagers are mainly in school life, and the connection between peer relationship and the daily emotional changes of adolescents is closer, but the parental rearing styles, behavior, and attitude toward their children have more important influence on serious problem behaviors such as suicide and crime. This is backed up by some studies. For example, family parenting had a significant impact on the personality traits in juvenile delinquents, and peer relationship only played a moderating role in some ways (Peng et al., 2013). Other studies pointed out that when it comes to stable and long-lasting emotions such as subjective well-being, compared with friend support, the predictive effect of the individuals' own behavior is more obvious (Traylor et al., 2016).

LIMITATIONS AND FUTURE DIRECTIONS

Some limitations of this research should also be noted, which can provide some suggestions and guidance for future research. First, we used a cross-sectional design to test our hypotheses, thereby the current results are preliminary, and we try to use longitudinal or experimental design in the future. Second, this study was conducted in Chinese students; the cultural discrepancies may result in different consequences. Future research can further compare the results under different cultures. Finally, perceived social support may not be consistent with the actual social support, and comparing their impact is also a meaningful topic.

CONCLUSIONS

In conclusion, this study investigates how adolescents' psychological *suzhi* influences suicide ideation. Specifically, we found that adolescents' psychological *suzhi* is negatively related to suicide ideation, and family support and friend support partially mediate this effect. Meanwhile, compared with friend support, family support plays a more important role in reducing adolescents' suicide ideation.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

On the basis of reading the relevant literature, ZZ put forward the research questions and the solution, and assisted in study design, data collection, and writing work. At the same time, according to the teachers' and cooperative researchers' recommendations and comments have been amended to formally form the final submission manuscript. DZ was mainly responsible for the supervision and guidance of the entire research process and providing financial support. WT and GL were mainly responsible for modifying and providing guidance to this paper, played an important role in the successful writing of the paper. All of the authors participated in the final approval of the version to be published and agreed to be accountable for all aspects of the work.

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SUPPLEMENTARY MATERIAL

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Dream Big: Effects of Capitals, Socioeconomic Status, Negative Culture, and Educational Aspirations Among the Senior High School Student Athletes

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To understand the impact of social, financial, cultural capitals, negative culture, and socioeconomic status of families on educational aspiration in the senior high school student athletes, it will be beneficial to promote their career developments. The purpose of this study is to explore the influence of ethnicity, year of sport experience family income, the educational expectations of significant others, and the three aforementioned types of capital on educational aspiration among the senior high school student athletes. This study was conducted with a sample of 262 U-18 male baseball student athletes. Of the participants, 20.20% had attained the qualifications to play on the national team. The results showed that monthly family income positively affected social capital and positively indirectly affected educational aspirations through social capital, whereas monthly family income negatively affected negative culture and positively affected educational aspirations through negative culture. Moreover, social capital positively affected educational aspirations compared with negative culture negatively affected educational aspirations. The results serve as a reference for the formulation of educational policy as it relates to student athletes.

Keywords: educational aspiration, negative culture, capitals, outstanding student athletes, monthly family income

INTRODUCTION

Academic performance plays a role in adolescent students' educational attainment and school dropout (Widlund et al., 2018). Senior high school student athletes (student athletes) are pressured to maintain both academic and athletic excellence. In particular, the athletes' significant others, who are an object of personal identification and imitation such as parents, teachers, or friends, hold high expectations for their academic performance, perceiving good grades to improve one's socioeconomic prospects and opportunities for further education (Huang, 2011). However, the senior high school athletes often prioritize their sports to the detriment of their studies. This is unsurprising; athletic training is rigorous, and poor performance on the field harms both their athletic career and prospects for further education (Hung, 2016). Furthermore, some senior high school athletes, who are concerned with their living expenses and the cost of tuition should

they enroll in a university, opt for direct employment instead. By contrast, other senior high school athletes continue their studies with the aspiration of obtaining tertiary qualifications and advancing their careers (Göllner et al., 2018). A longitudinal study corroborated the popular belief that academic excellence increases one's professional and socioeconomic prospects (Marsh and Kleitman, 2005; Hung and Chen, 2010; Göllner et al., 2018).

Regarding their educational aspiration, Coleman (1988) noted that such aspiration is affected by an individual's social, cultural, and financial capital. Previous studies have demonstrated that consistent social capital – from parents, teachers, and peers – drives student athletes to persist in their training (Fawcett et al., 2009; Hung, 2012; Zheng and Hung, 2018; Hasan et al., 2019). Social capital manifests as parents investing resources – including time, money, and energy – to support their children's educational goals (Xie, 2014). Similarly, social capital is used when student athletes acquire resources through their relationships with others, whether in their studies, careers, or athletic training (Carron et al., 1996; Li, 2007; Fawcett et al., 2009; Hung, 2016). For instance, educators facilitate the establishment of students' professional career (Jensen and Jetten, 2015). Student athletes can also acquire cultural capital from being socialized into the tastes and practices of those in a higher socioeconomic bracket, thus allowing them to better utilize their educational achievements (Li and Yu, 2005). Finally, financial capital is crucial for student athletes because playing a sport is expensive. With ample financial resources, student athletes can participate more in their sport, thereby allowing them to acquire more experience, hone their athletic skills, and advance their athletic careers (Jagsi et al., 2009). Therefore, a student athlete's degree of social, cultural, and financial capital affects their educational aspirations.

When selecting a university to attend, students consider factors such as whether they can continue to compete and train in their sport, their family circumstances, the cost of tuition, and their living expenses (Li and Yu, 2005; Marsh and Kleitman, 2005; Jagsi et al., 2009; Hung and Chen, 2010; Göllner et al., 2018). A student athlete's demographic characteristics, level of aspiration, and access to capital determine their likelihood of terminating their athletic career (Hung, 2016). However, student athletes in Taiwan represent different socioeconomic backgrounds and may have different influence of social, cultural, financial capital, and negative culture on educational aspiration (Zhang, 2006, 2015; Hwang and Yang, 2007; Su and Hwang, 2009; Hung, 2012, 2016; Hung and Lee, 2013). Therefore, the purpose of this study is to investigate effects of ethnicity, year of sport experiences, family income, negative culture, and the three aforementioned types of capitals on educational aspiration among the senior high school student athletes.

> *Hypothesis* 1. Student athletes with better social capital will have higher educational aspiration.
> *Hypothesis* 2. Student athletes with better financial capital will have higher educational aspiration.
> *Hypothesis* 3. Student athletes with better culture capital will have higher educational aspiration.
> *Hypothesis* 4. Student athletes with lower negative culture participation will have higher educational aspiration.

Our aim mainly contributed to the growing literature by conducting the research for capitals, negative culture, and socioeconomic status of families on educational aspiration. It is the first to combine these variables in the context of educational aspiration among senior high school students. The study also provides a new perspective that the socioeconomic differences of ethnic groups have no influences on students' educational aspirations among the student athletes. Practically, the coaches, teachers, parents, and school faculties can take our findings to be solid evidence to make effective strategies to promote educational aspiration among the senior high student athletes.

MATEIALS AND METHODS

Participants

The study first passed the IRB examination, acquire the consent of parents, and participants were obtained before the questionnaire. The participants were (1) baseball players from a sports school that was affiliated with the National Taitung University and (2) the senior high school students participating in the 2020 East Coast Baseball League U-18 invitational tournament. A total of 282 questionnaires were distributed, excluding the invalid questionnaires that were missed. We obtained 262 valid questionnaires, average age was 17.34 ± 0.89, and 20.20% of the participants had attained the qualifications to play on the national team.

Measurements

Background

The questionnaire inquired into the following variables.

1. Ethnic group: either Han Chinese or indigenous Taiwanese. Indigenous ethnicity was used as the control in regression analysis.
2. Years of playing the sport.
3. Monthly family income: scored from 1 to 5 for <NT\$20,000, NT\$20,001–NT\$40,000, NT\$40,001–NT\$60,000, NT\$60,001–NT\$80,000, and >NT\$80001, respectively.

Capitals and Negative Culture

We consulted relevant literature to measure the three types of capital (Wu, 1999; Li and Yu, 2005; Zhang, 2006, 2015; Su and Hwang, 2009; Hasan et al., 2019). Social capital was measured by asking student athletes to rate, on a five-point Likert-type scale from strongly disagree (1) to strongly agree (5), how true the following three statements were: "My family cares about my studies," "My family discusses school affairs with me," and "My family discusses my plans for the future with me." Cultural capital was measured using ratings for the following four statements: "I go to bookstores," "I listen to classical music," "I attend concerts or plays," "I visit museums, in particular, art museums," and "I visit various exhibitions, such as art exhibitions and book exhibitions." Financial capital was measured using the statements "I own athletic clothing," "I own sporting equipment," and "I own sporting accessories." We also asked about cultural

influences that impede socioeconomic advancement (negative cultural factors) by using the statements "I play video games regularly," "I smoke regularly," and "I have a rich nightlife" (Cronbach's α = 0.71).

Educational Aspiration

A questionnaire of educational aspiration was assessed which degree student athletes want to have a high school, a university, a master, or a doctor degree after graduating from the senior high school (Hwang and Yang, 2007). We switched the educational aspiration into the educational year, such as 12 for high school, 16 for university, 18 for master, and 21 for doctor degree.

Data Analysis

The distributions of demographic variables were analyzed using descriptive statistics. A regression analysis was used to analyze the effect of social capital, cultural capital, financial capital, and negative cultural factors on educational aspiration after controlling for ethnicity, years of playing the sport, and monthly family income. The regression analysis also is used to verify the relevant theoretical hypotheses involved in the causal model and to explore the causal mechanism of the differences in educational aspiration from different variables, namely, path analysis. In this path analysis, the standardized regression coefficient (β) is the path coefficient (Lin, 1976).

RESULTS

Distribution of Background Variables

Among the student athletes, 36.70% were Han Chinese, (63.30% were aboriginal Taiwanese), and the average number of years of playing the sport was 7.46 ± 1.92 years. Parents, coaches, and peers expected respondents to pursue their education for, on average, 15.97 ± 1.00, 15.97 ± 1.04, and 15.92 ± 1.28 years, respectively.

Influence on Educational Aspiration

In **Table 1**, when social capital was used as an intermediary variable in a new regression model (1), social capital was significantly and positively affected by the background variable of monthly family income (β = 0.19, $t = 2.84$, $p < 0.05$); 3.20% of the variation in educational aspiration was explained in this model.

Second, when negative cultural factors were used as an intermediary variable in a new regression model (2), educational aspiration was significantly and negatively affected by the background variable of monthly family income (β = −0.15, $t = 2.18$, $p < 0.05$); 2.50% of the variation in educational aspiration was explained in this model.

Third, the regression analysis model of educational aspiration (3) was not significantly affected by the background variables of ethnicity, years of playing the sport, or monthly family income; they explained only 4.10% of the variation in educational aspiration.

Finally, after social capital, cultural capital, financial capital, and negative cultural factors were included in the regression model (4), educational aspiration was significantly and positively

TABLE 1 | The regression analysis of educational aspiration in senior high student athletes.

Variables	Social Capital (1)				95%CI		Negative Culture (2)				95%CI		Educational Aspiration (3)				95%CI		Educational Aspiration (4)				95%CI	
	B	SE	β	t	L	H	B	SE	β	t	L	H	B	SE	β	t	L	H	B	SE	β	t	L	H
Han (Indigenous as reference)	−0.14	0.10	−0.10	−1.40	−0.34	0.06	0.04	0.10	0.03	0.42	−0.15	0.24	0.29	0.18	0.10	1.51	−0.09	0.64	0.35	0.18	0.13	1.51	0.00	0.71
Years of sport participation	−0.01	0.03	−0.02	−0.36	−0.05	0.04	−0.03	0.02	−0.07	−1.11	−0.07	0.02	0.07	0.04	0.10	1.52	−0.02	0.15	0.06	0.04	0.08	1.53	−0.03	0.14
Monthly family income	0.12	0.04	**0.19**	**2.84***	0.04	0.20	−0.10	0.04	**−0.15**	**−2.18***	−0.17	−0.01	0.14	0.08	0.12	1.79	−0.01	0.29	0.06	0.08	0.05	1.80	−0.10	0.21
Social capital																			0.32	0.12	**0.17**	**2.59***	0.08	0.55
Cultural capital																			0.08	0.09	0.06	0.97	−0.09	0.25
Financial capital																			−0.02	0.10	−0.01	−0.18	−0.21	0.17
Negative culture																			−0.33	0.11	**−0.18**	**−2.94***	−0.56	−0.10
R Square	0.032						0.025						0.041						0.114					

*$p < 0.05$. Those bold values meant $p < 0.05$.
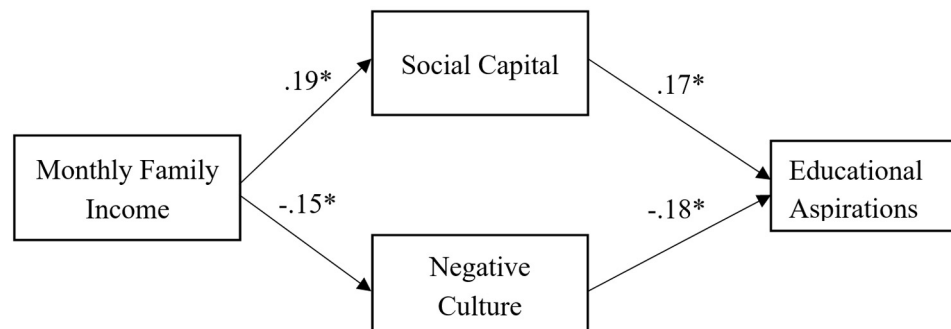
FIGURE 1 | A path analysis of educational aspiration.

affected by social capital (β = 0.17, t = 2.59, p < 0.05) but significantly and negatively affected by negative cultural factors (β = −0.18, t = −2.94, p < 0.05); 11.40% of the variation in educational aspiration was explained in this model.

Overall, the results of regression model revealed that student athletes with better social capital and lower negative culture participation have higher educational aspiration, so Hypotheses 1 and 4 were supported and Hypotheses 2 and 3 were not supported.

A Path Analysis of Educational Aspirations

In **Figure 1**, the results showed that monthly family income positively affected social capital (β = 0.19, p < 0.05) and positively indirectly affected educational aspirations through social capital (β = 0.03, p < 0.05), whereas monthly family income negatively affected negative culture (β = −0.15, p < 0.05) and positively affected educational aspirations (β = 0.03, p < 0.05) through negative culture. Moreover, social capital positively affected educational aspirations (β = 0.17, p < 0.05) compared with negative culture negatively affected educational aspirations (β = −0.18, p < 0.05). The model fit indices of the path analysis were 11.40% of the variation in educational aspiration (R^2 = 0.114, F = 4.53, p < 0.05).

DISCUSSION

Our results indicate that for the senior high school athletes, a higher monthly family income indirectly increases educational aspiration by increasing social capital and decreasing the influence of negative cultural factors. This result is consistent with the findings in the literature (Sewell et al., 1970; Naidoo et al., 1998; Lin, 2016; Zheng and Hung, 2018) that social capital facilitates career development and the achievement of educational goals. We measured social capital with respect to student athletes' academic performance, school life, and career development by using the questions of "My family cares about my studies," "My family discusses school affairs with me," and "My family discusses my plans for the future with me," respectively. Parents from higher-income families tend to devote substantial time and effort to their children's education, particularly by

discussing their children's educational goals with them (Coleman, 1988; Zhou, 2006; Zhang, 2015). Our results further confirm the importance of parental support and interaction on their children's education.

Student athletes from lower-income families had greater contact with negative cultural factors, which reduced their educational aspiration. We measured the degree of negative cultural factors by asking respondents how much they smoked, were addicted to video games, and indulged in nightlife; these activities distract student athletes from learning and training. This result is consistent with those of previous studies that exposure to high levels of cultural factors makes students more likely to leave a bad impression on teachers, interact poorly with their parents, perform poorly in school, and be less ambitious (Li and Huang, 2004; Huang and Chen, 2005). Negative cultural factors are thus important and especially common in student athletes with a low socioeconomic status. Because parents with a low socioeconomic status have limited resources and knowledge in guiding their children's learning and career development, schools and social welfare units should intervene to provide such guidance (Lin and Huang, 2008).

All of the regression models were low which is explained in the 2.5–11% in variation These results are consistent with previous studies (Chen and Cheng, 2000; Lee and Hwang, 2004). Lee and Hwang (2004) suggested that to add more background variables or mediating variables could increase the explanatory power of the model. Although this study conducted three background variable of ethnic groups, year of sport participant, and monthly family income, the explanatory power of the model is lower. We speculated that there may be other more important changes that affect students' educational aspirations, which needs to be further studied.

CONCLUSION AND SUGGESTIONS

Student participation in sports is marked by inequality due to inequalities in society (Lin, 2016). A student athlete's socioeconomic prospects are limited by the socioeconomic status of their family, which cannot be completely overcome by the athlete's talent and hard work (Guillet et al., 2002). Moreover,

student athletes from low socioeconomic status tend to have different views on gender roles, the family, and work due to a cultural milieu that differs from that of the general population (Harrison and Lawrence, 2003). Their career choice is affected by their family situation (Naidoo et al., 1998). Therefore, their educational aspiration is affected by hard work and talent at the personal level, the social capital from parent–child interaction, and exposure to negative cultural factors. Generally, socioeconomic status, as reflected in monthly family income, directly affects the social capital that athletes have and the negative cultural factors that they are exposed.

Educational aspiration in the senior high school student athletes increases with higher family monthly income, greater social capital, and less exposure to negative cultural factors. Educational aspiration can be improved in student athletes through guidance from teachers, interactions with parents, and less exposure to negative cultural factors. School faculties should establish a platform for parents to interact with their children and other parents and cultivate appropriate everyday habits in student athletes and encourage them to engage in meaningful activities during their spare time, such as participating in club activities (Li and Huang, 2004). To participate in leisure activities can also increase student athletes' feeling of accomplishment and personal development (Kelly and Godbey, 1992). School faculties and parents should give more guidance to enhance student athletes' desire to pursue their educational aspirations.

A long-term study of the Wisconsin model demonstrated that family socioeconomic status affects individual achievement and income (Sewell et al., 2004). Educational aspiration is a key to the future success of student athletes. In this study of student athletes, not only social capital but also negative cultural factors were key determinants of educational aspiration after background factors such as ethnicity and family income were controlled and the three types of capital were included as intermediary variables. Negative cultural factors stem from peer influences, and the influence of peers has been suggested by findings that students perform better in school if members of their peer group expect each other to succeed academically, and classmates with the same educational expectations tend to cluster (Raabe and Wölfer, 2019). Therefore, for a more comprehensive understanding of educational aspiration in student athletes, future studies can analyze more determinants, such as family socioeconomic status and the influence of peers and coaches.

The study should be interpreted along with its limitations. The sample of the study may be representative of economic advantage male student athlete in Taiwan since professional baseball is played by males only; however, the finding may limit external validity for other settings or among any subset of our sample. Resources of each professional sport is unique – thus the process of emergence of social capital in each context. We recommend further research to concern different professional student athletes for explanation of educational aspiration.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the National Cheng Kung University Human Research Ethics Committee. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

H-CH and C-WL conceptualized the study, developed the methodology, analyzed the data, and reviewed, edited, and wrote the final manuscript. M-CY, C-WL, and H-CH prepared and wrote the original draft. All authors contributed to the article and approved the submitted version.

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The Learning to Be Project: An Intervention for Spanish Students in Primary Education

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Despite the emphasis placed by most curricula in the development of social and emotional competencies in education, there seems to be a general lack of knowledge of methods that integrate strategies for assessing these competencies into existing educational practices. Previous research has shown that the development of social and emotional competencies in children has multiple benefits, as they seem to contribute to better physical and mental health, an increase in academic motivation, and the well-being and healthy social progress of children. This study aims at assessing the possible changes in children's self-esteem, socio-emotional competencies, and school-related variables after participating in the Learning to Be project (L2B) project.

Methods: This quasi-experimental study included an intervention group (L2B) and a control group. The participants were 221 students in primary education (55.2% girls) between the ages of eight and 11 ($M = 9.31$; SD = 0.89). The L2B intervention program took place over a period of 5 months. The assessment was carried out twice, before and after the intervention through three main evaluation instruments: the Rosenberg's Self-Esteem questionnaire, the Socio-Emotional competence questionnaire (SEQ), and self-report scales for measuring school difficulties, school engagement, opinions about school, and school absence. Ten schools from different Spanish provinces participated.

Results: The results indicate that those participants in the experimental group show higher self-esteem, better responsible decisions, and higher self-awareness than those in the control group. There were no other statistical differences between groups.

Conclusions: The results of this work suggest that the implementation of the L2B program did not improve social and emotional competencies in primary school students. Further research related to how include formative assessment in SEL programs is needed.

Keywords: social emotional learning, socioemotional competencies, learning to be, longitudinal study, educational policies

INTRODUCTION

The term Social and Emotional Learning (SEL), which describes a framework that encompasses the acquisition of personal and positive relationship skills (CASEL, 2013; Schonert-Reichl, 2019), was first introduced in 1994. In this sense, school based SEL involves the implementation of policy practices to promote social, personal, and ethical behaviors in both students and teachers (Taylor et al., 2017). Following The Collaborative for Academic, Social and Emotional Learning (CASEL) guide, SEL interventions are focused on five interrelated competencies clustered into self-awareness, self-management, social awareness, relationship skills, and responsible decision making (CASEL, 2015; Weissberg et al., 2015; Abrahams et al., 2019). SEL includes, among others, the process of developing effective communication skills, of cooperating with peers, and of solving problems, recognizing and regulating emotions effectively (CASEL, 2005). Although in a variety of formats, most SEL programs are delivered by teachers during school hours (Wigelsworth et al., 2016).

Among the competencies suggested by CASEL for SEL interventions, the principles of self-awareness and self-management are related to students' approaches toward the self (self-esteem, confidence, persistence, self-efficacy, and self-concept) and to achievable personal and academic goals. These competencies have proven to be protective factors as they reduce the probability of problem behaviors (Catalano et al., 2003) and increase the probability of success at school and later in life (Clarke et al., 2015; Weissberg et al., 2015). Regarding the effects of CASEL programs, recent systematic reviews and meta-analyses have shown the major benefits of SEL programs at schools (Corcoran et al., 2018; Mahoney et al., 2018). Several meta-analyses highlight that SEL interventions improve prosocial behavior, promoting academic performance as well as enhancing positive self-esteem. The same studies reveal that these interventions serve as a protective factor against several problems, such as emotional distress, mental problems, or drug use (Durlak et al., 2011; Sklad et al., 2012; Wigelsworth et al., 2016; Taylor et al., 2017). In addition, the meta-analysis carried out by Taylor et al. (2017) finds that the achieved improvements reported in the included studies remain after several years. Finally, the results reported by these meta-analyses highlight that the main outcomes for SEL programs are clustered into social behaviors, emotional problems, and academic achievement (Weare and Nind, 2011).

Despite the positive results obtained with the implementation of SEL in several schools across different countries, there is a lack of a general model that would integrate SEL into the educational curricula. On the contrary, and as a result, a wide diversity of approaches to social and emotional competencies are being developed (Cefai et al., 2018). The European Union Analytical Report on social and emotional education highlights that the vast majority of research and socio-emotional interventions have taken place in the United States. Specifically, in Spain, the legal educational framework integrates emotional competencies into the curriculum, although it does not stipulate their implementation and development (BOE, 2006). It would be, thus, necessary to develop a training program

in SEL for the whole educational community, following the recommendations given by the European Union (Cefai et al., 2018). Furthermore, previous studies have pointed out cultural differences in the way of expressing, interpreting, and giving meaning to emotions (Hoemann et al., 2020) as these emotions should not be considered mere individual experiences, but experiences constructed in social interactions and influenced by cultural contexts (Holodynski and Friedlmeier, 2006). Therefore, blind adoption of United States models without appropriate cultural adaptation could be problematic.

Taking this into account, the project Learning to Be (L2B) adapted SEL standards from Illinois State Board of Education (Illinois State Board of Education (ISBE), 2018) and proposed a framework for SEL implementation at schools in Europe [for a review of the project see Aguilar et al. (2019)]. This project was an opportunity to contribute to the development of innovative educational policies at both national and international levels.

The Learning to Be Project

Despite the importance of social and emotional competencies in education, acknowledged by most national curricula, how to assess those competencies and how to integrate assessment strategies into education practices were yet to be determined. There are several practical approaches to work with socio-emotional competences such as the INTEMO or "Aprende a convivir" program, among others (Ruiz-Aranda et al., 2008; Alba et al., 2015). However, it is also necessary a common understanding of what social and emotional competencies were and how they could be encouraged and assessed. Social and emotional competencies must be understood as the set of knowledge, capacities, abilities, and attitudes necessary to understand, express, and regulate social and emotional phenomena appropriately (Bisquerra and Pérez, 2007).

For these reasons, the main objective of the L2B project was to design a formative assessment method and the tools necessary for the development and evaluation of social and emotional competencies at primary and secondary schools. L2B project aims at overcoming limitations of previous programs in terms of evaluation. In order to achieve this goal, seven European countries developed the "Toolkit for Assessing Social and Emotional Skills at School" (Agliati et al., 2020) which could serve as a theoretical and methodological model for assessing social, emotional, and health-related skills. This Toolkit is designed for teachers in primary and secondary schools without distinction of the subjects where it would be applied. In addition, it can also be used by other educators in non-formal contexts. The Toolkit includes the theoretical introduction related to what socio-emotional competences are; description of teaching methods, assessment tools for teachers and students, and socio-emotional learning standards for two different age groups, (i.e., primary and secondary school students).

The SEL model developed by the L2B project presents some key elements: Social and Emotional Competencies (SEC), Social and Emotional Learning (SEL) Standards; Social and Emotional Learning in Class and Assessment Practices. The toolkit provides teachers, managers and students with self-assessment tools so that they can evaluate the SEL situation

of the school. In addition, it offers tools that educators can use to track progress and to monitor the achievement of social and emotional competencies in their students, to foster learning experiences compatible with these competencies and to check on their students' learning development. The whole project is based on a formative assessment approach, that is to say, a constant process of assessment and feedback in class that helps teachers and students track their progress and identify areas and needs for improvement. It is an active practice that can be applied for assessing not only subject-based learning but also the development of social and emotional skills in the classroom. This Toolkit presents an easy-to-follow model of Formative Assessment developed by Dylan Wiliam (2011) and expressed in five main strategies to be used in class: (1) clarifying, sharing, and understanding learning intentions and criteria for success (2) eliciting evidence of student learning (3) providing feedback that moves student forward (4) activating learners as instructional resources for one another (5) activating learners as the owners of their learning.

The L2B project was carried out in five countries (Italy, Latvia, Lithuania, Slovenia, and Spain). Each country selected twenty schools (ten primary schools and ten secondary schools) to be into the control group or the experimental group. The main goal of the project was to develop and implement the Toolkit in the experimental schools, so the teaching staff and management teams of those schools received specific training in the development of socio-emotional competencies. In tandem with this effort, the project intended to develop a SEL model which would impact the European educational policies.

The Current Study

Our study aims to assess if there are changes in socio-emotional competencies, self-esteem and school-related variables after participating in the L2B project. It was hypothesized that those participants in the experimental group would show higher socio-emotional competencies and self-esteem than those participants in the control group.

MATERIALS AND METHODS

Participants

A convenience sample of ten primary education schools located in different Spanish provinces participated in the study, half of which were state schools and the other half private. School principals of these schools were contacted and asked to join the project. Following a detailed explanation of goals and intended activities, the schools decided whether they wanted to be part of the experimental or of the control group. As such, it is a non-randomized quasi-experimental study. The main criterion for the selection of school centers was their non-involvement in any other SEL programs. After signing the agreement with the school, students' parents were informed of the project and asked for written consent for the participation of children. The participants were 221 primary education students, (55.2% girls) aged between 8 and 11 years old ($M = 9.31$; SD = 0.89). Schools were divided into experimental ($n = 103$) and control schools ($n = 118$). The median age was 8.72 years (SD = 0.67) for the control schools and 9.82 (SD = 0.72) for the experimental schools.

Instruments

The following instruments were employed:

- Social Emotional Competence Questionnaire (SECQ; Zhou and Ee, 2012): this 25-item with a 7-point Likert-type response option (1 = not at all true of me to 7 = very true of me) instrument includes the five dimensions based on SEL model (i.e., self-awareness, social awareness, self-management, relationship management, and responsible decision-making). Example items of each scale were: (a) I know what I am thinking and doing; (b) I understand why people react the way they do; (c) I can stay calm in stressful situations; (d) I am tolerant of my friend's mistakes; (e) I weigh the strengths of the situation before deciding what I will do. The scale showed good reliability in each subscale (Cronbach's α: self-awareness: 0.64, social awareness: 0.72, self-management: 0.73, relationship management: 0.69, responsible decision-making: 0.76, and total scale: 0.86).

- Self-esteem Scale (Rosenberg, 1979; Tuominen-Soini et al., 2008): the short version of the scale includes five items reflecting self-acceptance, self-respect, and overall attitude toward oneself with a 7-point Likert-type response option (1 = totally disagree to 7 = totally agree). The scale showed medium reliability (α = 0.57). The items were: (a) I feel I have a number of good qualities; (b) Sometimes I think I am no good at all; (c) I take a positive attitude toward myself; (d) I wish I could respect myself more; (e) All in all I am satisfied with myself.

Socio-demographic information, such as age (as an open-ended question) and gender (as boy, girl, or I do not want to tell), was assessed. In addition, variables related to the school context were self-reported by the students. The questions included were taken from Finnish School Health Promotion Study (2017). The original version of the questions went through a back-translation process from the original language to Spanish and from Spanish to the original language. Both versions were then compared. Due to the low alphas in the sum scores based on the school domain items, items as separate have been used. The questions were as follows:

- School difficulties: participants were asked about difficulties when doing tasks related to reading and writing. Responses ranged from 1 (Not at all) to 5 (Very much). The items were: Do you have difficulties (a) following the classes?; (b) doing tasks that require writing?; (c) doing tasks that require reading?

- School engagement: participants were asked for their opinion on going to school and their feelings concerning schoolwork. Responses ranged from 1 (completely disagree) to 5 (completely agree). The items were: (a) I like being at school; (b) I am often tired; (c) I am often excited about schoolwork; (d) There is no point in going to school; (e) I cannot cope at school.

- Opinions about school: participants were asked for their opinion on studying and about their school. Responses ranged from 1 (completely disagree) to 5 (completely agree). The items were: (a) I feel happy in my school; (b) I feel comfortable in my school; (c) Teachers encourage me to express my opinion in class;

(d) Teachers are interested in how I'm feeling; (e) The teachers treat us pupils fairly; (f) I can have an influence on issues and decisions in my school; (g) I feel my teachers accept me as I am; (h) I feel that most of my teachers care about me; (i) I feel a lot of trust in most of my teachers.

- School absence: this scale assessed how many days in the previous month the participants had been absent from school and the different reasons why they had missed school: (a) due to illness; (b) due to skipping class on purpose; (c) due to other reasons. Responses ranged from 1 (none) to 4 (more than 5 days).

Procedure

Ethical Boards of both the University of Helsinki and the Universidad Loyola Andalucía approved the study. Schools participated in the research by completing survey questionnaires which were held twice, once in September 2018 and a second time in May 2019 (i.e., at the end of the school year). Both control and experimental groups completed the questionnaires before the teachers training, so that the study avoided any influences derived from the participation in the training. Questionnaires were answered at the computer rooms of the schools. The number of students answering the questionnaires at the same time (ranging from 5 to 25) varied according to the capacity of the room. The assessment lasted 20 min approximately. All the students responded to the questionnaire using the online platform Survey Gizmo, while they were supervised by their teacher tutor and a member of the project team.

L2B Experimental Group

The Toolkit includes a theoretical component on SEL, a description of teaching methods that follow a formative assessment approach, assessment tools for both teachers and students, and SEL standards. Specifically, the Toolkit includes descriptions of different instructional teaching strategies such as setting learning goals, and practical SEL assessment tools at individual, group and whole-school levels.

Once the different school groups (students, teaching and non-teaching staff) had been assessed, teachers, psychologists, social workers and teacher assistants of each school in the experimental group were trained for 16 h on SEL principles, on formative assessment and on the techniques described in the manual. This training, which took place after the initial assessment, was delivered by psychologist and teachers with previous experience in SEL competencies who in turn had received specific training on the Toolkit (see **Table 1**). After the training, and while SEL was being implemented in the school, the teaching staff received regular support. Centers were periodically visited by supervisors who offered guidance on the use of methods and tools for socio-emotional skills learning and assessment. The teachers implemented the model described in the Toolkit in different sessions throughout 5 months. As the program follows a formative assessment initiative, the teacher could work on the different concepts addressed in the Toolkit as they were demanded by specific situations in class. In this continuous process, the teachers collected and analyzed different learning evidence and adjusted their teaching accordingly, so that learning

TABLE 1 | Contents of each training session.

Session (hours)	Contents
One (5 h)	1. Participants and L2B project presentation 2. Definition of SEL 3. SEL competencies and benefits of SEL 4. Toolkit presentation and introduction to the manual
Two (5 h)	1. SEL standards according to each group of age 2. Working with guidelines for assessing students (content included in the Toolkit) 3. Learning to work with group presentation rubrics (content included in the Toolkit) 4. Formative assessment practices for classroom use
Three (6 h)	1. Teaching methods to strengthen SEL and formative assessment strategies 2. Classroom strategies to maximize the teaching and reinforcement of SEL competencies 3. Practical application to each class by their teacher

would improve, and student progress encouraged. In other words, the teacher identified and set targets for growth in every lesson (Agliati et al., 2020).

Control Group

Schools in the control group were assigned to a waiting list and received the intervention training after a 5-month waiting period.

Design

A quasi-experimental design, with control-group and pre-test/post-test, was used. A quasi-experimental design was used because the schools were not randomly assigned to the groups. The research was conducted over a period of 10 months (from September 2018 to May 2019). It first started with the assessment (pre-test) of both teachers and students, followed by the training offered to teachers in the experimental group. The 5-month intervention program took then place and, finally, schools participated in the post-intervention assessment.

Data Analysis

The data were analyzed as follows: in order to reduce the bias caused by the differences between groups (control and experimental), the analysis followed a multi-group design with covariates (ANCOVA). This design allows to control the effect of pre-test scores (covariates) in the relationship between the dependent and the independent variables, minimizing the variation due to the ANOVA error term (Tabachnick and Fidell, 2007). Possible gender and age differences were analyzed in order to know the existence of other possible covariates. Independent t-test were carried to analyze differences in self-reported school domain. Afterward, we checked the assumptions of normality, variance homogeneity, and error-free measurement of covariates, the independence between the indirect variable and the covariate, as well as the linearity between the depending variables. When assumptions were not fulfilled, non-parametric Mann–Whitney U was carried out.

RESULTS

Since all the measures were self-reported, common method bias was established using Harman's single factor test. We found a single factor contributing less than 50% in variance ($\chi^2 = 17.378$) (Podsakoff et al., 2003).

In order to determine whether there were differences in the post-intervention due to the age and gender of participants, data were analyzed by analysis of covariance, using the pre-test results as a covariate. The assumptions of normality, variance homogeneity and the homogeneity of regression coefficients were met. Regarding gender, the analysis showed that there was no statistically significant interaction between gender and self-esteem [$F(2, 217) = 0.92$, $p = 0.39$, η^2 partial = 0.00] or between gender and total SEC [$F(2, 215) = 1.92$, $p = 0.14$, η^2 partial = 0.01]. Regarding age, the analysis showed that there was no statistically significant interaction between age and self-esteem, whilst controlling for pre-test self-esteem scores [$F(3, 216) = 2.41$, $p = 0.06$, η^2 partial = 0.03]. However, there were a significant effect of age on the SEC [$F(3, 214) = 4.96$, $p = 0.00$, η^2 partial = 0.06] after controlling pre-intervention SEC scores. Participants with 11 years old showed less total SEC ($M = 102.05$, SD = 17.14) when comparing with younger participants [10 years old ($M = 119.30$, SD = 15.48), 9 years old ($M = 118.74$, SD = 15.22), and 8 years old ($M = 117.68$, SD = 17.40)].

When analyzing SEC subscales, there was statistically significant differences in Self-Awareness [$F(3, 216) = 4.59$, $p < 0.00$, η^2 partial = 0.06], showing less total score among 11 years old participants ($M = 23.25$, SD = 5.01) when comparing with younger participants [10 years old ($M = 26.43$, SD = 4.08), 9 years old ($M = 26.71$, SD = 3.30), and 8 years old ($M = 26.90$, SD = 2.87)]. In addition, there was statistically significant differences in Self-Management subscale [$F(3, 215) = 6.41$, $p < 0.001$, η^2 partial = 0.08] showing less total score among 11 years old participants ($M = 17.36$, SD = 7.19) when comparing with younger participants [10 years old ($M = 23.80$, SD = 4.64), and 9 years old ($M = 22.20$, SD = 5.58)]. There were no statistically significant differences in the rest of subscales; Social Awareness [$F(3, 216) = 1.02$, $p = 0.38$, η^2 partial = 0.01], Relationship Management [$F(3, 215) = 1.90$, $p = 0.13$, η^2 partial = 0.02] and Responsible decision-making [$F(3, 214) = 2.07$, $p = 0.10$, η^2 partial = 0.02].

In order to assess whether there were differences between the control group and the experimental group in self-reported school variables, independent t-test analyses were carried out (see **Table 2**). Results showed that there was no statistically significant differences for School Engagement [$t(213) = 0.85$; $p = 0.19$], Opinions about school [$t(211) = 1.42$; $p = 0.07$], and School absence [$t(203) = 0.44$; $p = 0.32$]. However, participants at the experimental group ($M = 6.17$, SD = 4.27) compared to the

TABLE 2 | T-test descriptive statistics.

Variables	Experimental group		Control group	
	Pre-test	Post-test	Pre-test	Post-test
School engagement				
I like being at school	4.36 (0.93)	4.34 (0.92)	4.18 (0.89)	4.04 (0.93)
I am often tired	3.25 (1.23)	2.99 (1.22)	3.20 (1.22)	3.21 (1.21)
I am often excited about schoolwork	3.50 (1.17)	3.36 (1.16)	3.25 (1.22)	3.19 (1.13)
There is no point in going to school	4.49 (1.05)	4.69 (0.90)	4.50 (1.02)	4.66 (0.70)
I cannot cope at school	3.92 (1.42)	4.19 (1.34)	4.00 (1.19)	4.02 (1.14)
Opinions about school				
I feel happy in my school	4.76 (0.70)	4.76 (0.55)	4.57 (0.83)	4.56 (0.73)
I feel comfortable in my school.	4.70 (0.72)	4.70 (0.73)	4.59 (0.74)	4.55 (0.82)
Teachers encourage me to express my opinion in class.	4.42 (0.87)	4.43 (0.98)	4.40 (0.76)	4.31 (0.92)
Teachers are interested in how I'm feeling	4.41 (0.90)	4.40 (0.97)	4.42 (0.83)	4.37 (0.85)
The teachers treat us pupils fairly.	4.40 (1.02)	4.29 (1.05)	4.43 (0.94)	4.37 (0.93)
I can have an influence on issues and decisions in my school.	3.74 (1.30)	4.12 (1.05)	3.75 (1.06)	3.56 (1.21)
I feel my teachers accept me as I am.	4.75 (0.65)	4.69 (0.82)	4.65 (0.77)	4.61 (0.75)
I feel that most of my teachers care about me.	4.39 (0.92)	40.46 (0.97)	4.39 (0.93)	4.43 (0.86)
I feel a lot of trust in most of my teachers	4.66 (0.75)	4.61 (0.85)	4.56 (0.86)	4.48 (0.80)
School absence				
Due to illness	1.51 (0.72)	1.56 (0.75)	1.36 (0.65)	1.62 (0.78)
Due to skipping the class by purpose	1.01 (0.10)	1.03 (0.17)	1.05 (0.28)	1.05 (0.26)
Due to other reason	1.18 (0.50)	1.45 (0.72)	1.19 (0.51)	1.30 (0.59)
School difficulties				
Following teaching in class?	1.89 (1.47)	1.93 (1.53)	1.71 (1.32)	1.74 (1.30)
Doing tasks that require writing?	1.99 (1.44)	2.17 (1.56)	1.69 (1.25)	1.72 (1.16)
Doing tasks that require reading?	1.84 (1.46)	2.06 (1.66)	1.83 (1.45)	1.47 (1.14)

*$p < 0.05$.

control group (M = 4.93; SD = 3.08) showed greater School difficulties [$t(172.34)$ = 2.40; p = 0.00 d = 0.33].

To assess differences between pre-post scores, a between-groups covariance analysis (ANCOVA) was carried out. The intervention was considered as the independent variable (control group and experimental group), and the results corresponding to the dependent variables of the pre-test were considered covariables. Thus, the differences between groups were estimated with the differences in pre-test results removed. ANCOVA analysis showed no statistically significant differences at the total SEC scores. Non-parametric Mann–Whitney U test was carried out for Self-Awareness subscale. Self-awareness at the experimental group scores (MR = 127.77) were higher than those at the control group (MR = 96.36), showing that this difference was statistically significant (U = 4349.5, $p < 0.001$) (see **Tables 3**, **4**). In absence of reactivity, experimental group showed higher self-esteem and higher Responsible decision-making subscale scores when comparing with the control group after the intervention.

DISCUSSION

The aim of this study was to analyze possible changes in self-esteem, socio-emotional competencies and school-related outcomes of primary school students after their participation in the L2B project. Following the results, we have found that the initial hypotheses have only been fulfilled partially, as those students who participated in the intervention improved in relation to self-esteem, self-awareness, and responsible decision-making, while the results in school-related domain and in total score of socio-emotional competencies were not in line with

our initial expectations. These results are consistent with those presented by previous studies (Brackett et al., 2012) and suggest that students with greater emotional and social competences may use the information provided by emotions to guide attention into appropriate thoughts and make better decisions and improve their psychological functioning. A possible explanation for these results might be related to age differences in the benefits of participating in the L2B program. Some studies have suggested differences in the emotional maturation of some competencies, such as the expression or emotional regulation, showing differences from 9 to 10 years (Jones et al., 1998; Gordillo et al., 2015). Thus, there might exist a change in diverse social and emotional competences, such as self-awareness and self-management.

One of the main results pointed that there were no differences in the overall score of social and emotional competencies after participating in the L2B program. This result might be explained due to the employment of a formative assessment approach. Following this framework, teachers at the intervention group needed to recognize students' development to implement their socio-emotional learning in their classrooms. Despite the training, some teachers may have felt they did not possess enough knowledge to improve and to assess their students' improvement in SEL competencies (Corcoran et al., 2018).

The increase in the items reporting school difficulties in the experimental group can also be due to the students' awareness of their behavior, an indication that further evaluation tools which would allow a more global vision of the situation are required. A 360-degree evaluation (including parents, teachers, and students) could be useful for the implementation of this kind of programs (Bisquerra et al., 2006; Silva and Martorell, 2018). It would also be useful to know if these results would remain the same in the long term, or, on the contrary, they would improve as they were a consequence of the implementation of SEL in the ordinary teaching practice. Regarding to school opinions and school absence, we did not find differences between the groups after the intervention. The lack of differences may be because these concepts were not directly worked on with the Toolkit, even when it was an expected result if socio-emotional competencies were to improve (Brackett et al., 2004). Although the intervention is based on a manual, as suggested by Weare and Nind (2011), the Toolkit allows for an open implementation in accordance with the necessities observed by the teacher. This may have

TABLE 3 | ANCOVA results variables.

	F	p	η^2 *partial*
Self-esteem	4.39	0.03*	0.03
SEC	2.15	0.14	0.01
Social awareness	0.23	0.63	0.00
Self-management	0.14	0.70	0.00
Relationship management	0.64	0.42	0.00
Responsible decision-making	5.17	0.02*	0.02

*SEC, Social Emotional Competence; *$p < 0.05$.*

TABLE 4 | Descriptive statistics for each group.

Variables	Control group			Experimental group		
	M	**SD**	**M adjusted**	**M**	**SD**	**M adjusted**
Self-esteem	24.83	4.66	24.86	26.25	4.75	26.12
SEC	114.44	15.94	115.89	120.60	16.52	124.75
Social awareness	21.33	5.08	21.69	22.46	6.20	22.06
Self-management	21.82	5.58	22.21	22.94	6.10	22.50
Relationship management	25.81	3.94	25.89	26.37	3.76	26.29
Responsible decision-making	20.19	3.3	20.36	21.48	2.84	21.30

SEC, Social Emotional Competence.

resulted in differences in the applied contents and the degree of implementation. Thus, despite main principles for social and emotional learning and practical techniques were provided, there was no specific instructions in the experimental group to follow the same activities, creating possible differences among teachers in their application in their classes. Additionally, the application of the Toolkit may have been influenced by characteristics of the schools such as the number of students in a room or the skill of the teachers, who could need a longer period of training, as is already the case for other related studies (Body et al., 2016; Mira-Galvañ and Gilar-Corbi, 2020). For this reason, it would be necessary to evaluate in depth the use of the Toolkit in further groups of teachers after they receive longer training (i.e., more than 20 h), knowing in advance whether the teachers have efficiently acquired the skills for a subsequent application in the room. In this regard, it would be advisable to assess when the Toolkit could be best implemented, since its application in critical moments of the academic course could influence in the final results, as it is mentioned in the Research Progress Report of the Learning to Be Project (Berg et al., 2020). In view of the above, it would be essential the teacher participation in the planning, implementation and evaluation of the SEL program in future studies (Zins et al., 2004). The L2B project was developed to improve and assess social behavior, emotional problems, and academic achievement. In this line, the present study has sought to verify if the implementation of the Toolkit developed in the Learning to Be project for students in primary education is effective in the improvement of the skills mentioned above.

In addition to the flaws discussed above, there are other limitations that should be taken into account. First, the quasi-experimental design could have introduced bias in the process of selection of schools and their involvement in the training and research. Second, some of the self-reported instruments were not validated against Spanish population and, although back-translation process was employed, the questionnaire may not yield to the different cultural expressions (Berg et al., 2020). Finally, working on social and emotional competencies may have interfered or added an extra load of work to the daily routine of teachers, affecting, thus, their teaching labor and indirectly the students' monitoring on the acquisition of competencies.

CONCLUSION

Even though the study has failed to achieve the expected results in all the studied variables, further research on the advantages of the project Learning to Be in the long term is necessary. Despite this

kind of programs can mean an opportunity for the achievement of a school climate with a positive impact, playing an important role in the development of SEL competencies in students (Cohen et al., 2009; Divecha and Brackett, 2020; Mira-Galvañ and Gilar-Corbi, 2020), including a formative assessment in SEL programs might need further development.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

This study was reviewed and approved by Ethical Board of the University of Helsinki and Ethical Board of the Universidad Loyola Andalucía. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

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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.2021.632617/full#supplementary-material

Supplementary Table 1 | The TIDieR checklist.

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Parent-Adolescent Communication and Early Adolescent Depressive Symptoms: The Roles of Gender and Adolescents' Age

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Positive parent-adolescent communication has been found to be negatively related to adolescent depressive symptoms; however, few studies have investigated the moderating effects of adolescent gender and age on this relationship, especially during early adolescence in China. The present study investigated the joint moderating effects of adolescent gender and age on the linkage of father-adolescent and mother-adolescent communication with adolescents' depressive symptoms. A total of 11,455 Chinese junior high school students (M_{age} = 14.15 years, SD = 1.22 years; 49.86% boys; N_{grade7} = 5712, N_{grade9} = 5743) completed *ad hoc* questionnaires of parent-adolescent communication and depressive symptoms. Multiple linear regression analyses were conducted. Results indicated that gender and age jointly moderated the association between parental communication and adolescent depressive symptoms. Specifically, for girls, the negative effects of both father-adolescent and mother-adolescent communication on depressive symptoms were stronger in 9th grade students than in 7th grade students, while for boys, the negative effects were not different between 7th grade students and 9th grade students. These findings suggest that in China, the protective effects of positive parent-adolescent communication on adolescents' depressive symptoms may be most salient among senior-grade girls in junior high school.

Keywords: father-adolescent communication, mother-adolescent communication, early adolescent depressive symptoms, gender, age

INTRODUCTION

Depression is a serious mental health problem that has a detrimental effect on adolescents' psychosocial functioning (Rawana and Morgan, 2014; Alaie et al., 2021). Depression in adolescents has been found to be associated with many negative outcomes, such as a higher risk of suicide (Weissman et al., 1999; Hovanesian et al., 2009), poorer academic performance (Verboom et al., 2013), and higher levels of substance abuse (Obando et al., 2004; Scholes-Balog et al., 2015). Early adolescents are vulnerable to depression (Cole et al., 2002; Solomon-Krakus et al., 2017), because early adolescence is an important transition period from childhood to adolescence during which adolescents face greater challenges and stressors from all the tasks of physical, psychological, and social development

(Cicchetti and Rogosch, 2002; Hammen, 2009). According to the 2017 National Survey on Drug Use and Health, 13.3% of adolescents aged between 12 and 17 suffered a major depressive episode in the United States in 2017 (National Institute of Mental Health, 2019). In particular, it has been reported that early adolescents in China experience more stress, such as increased learning burden, high expectations from parents, and a weakened parent-adolescent bond, than adolescents in Western countries (Sun et al., 2012). Recently, a meta-analysis indicated that the prevalence of depressive symptoms among adolescents in secondary schools in mainland China was 24.3% (Tang et al., 2019). As depressive symptoms have severe and adverse consequences on early adolescents' psychosocial adjustment in China, it is essential to identify protective factors to inform the development of intervention and prevention efforts. Cicchetti and Rogosch (2002) suggested that we should consider depressive symptoms among early adolescents in dynamic relation between individual and internal and external contexts.

Parent-Adolescent Communication and Adolescent Depressive Symptoms

Positive parent-adolescent communication is an important protective factor in preventing adolescents' depressive symptoms (Ioffe et al., 2020; Kapetanovic et al., 2020). The high quality of parent-adolescent communication can strengthen parental connectedness, intimacy, trust, family cohesion, and family adaptability (Barnes and Olson, 1985; Laursen and Collins, 2004; Cava et al., 2014) and provide emotional and instrumental support for children, which has been found to be associated with low levels of internalizing and externalizing problems in adolescents (Hamza and Willoughby, 2011; Garthe et al., 2015; Ioffe et al., 2020). On the contrary, low-quality parent-adolescent communication, such as parental rejection, parental criticism, adolescents' secrecy, and non-disclosure can contribute to the development of depressive symptoms (Hale et al., 2005; Frijns et al., 2010). Moreover, a meta-analysis of 164 articles demonstrated that poor parent-adolescent communication was the strongest among fifteen psychosocial risk factors for depressive symptoms among adolescents in secondary schools in mainland China (Tang et al., 2020).

Attachment theory provides us with a developmental perspective to understand the effect of parent-adolescent attachment on depressive symptoms during early adolescence (Duchesne and Ratelle, 2014). Bowlby (1982) suggested that the bidirectional interaction between infant and caregiver will develop an internal working model of social relationships, i.e., parental attachment, which is the foundation of child emotional and social development (Steinberg and Morris, 2001; Brumariu, 2015) and has been associated with psychological outcomes, such as depressive symptoms and externalizing behavior (Allen et al., 2007). Studies have shown that adolescents with insecure attachment had more depressive symptoms (Agerup et al., 2015; Rawatlal et al., 2015; Cortés-García et al., 2019). In addition, the relationship between insecure attachment and depression was mediated by cognitive-emotional factors, such as brooding rumination, self-criticism, and low self-compassion

(Cortés-García et al., 2020). Conversely, adolescents with secure attachment develop emotion regulation abilities in challenging situations through repeated positive interactions with their parents, who encourage adolescents to manage negative emotions and communicate openly about their emotional state to their parents so that they can provide timely support to their child (Parrigon et al., 2015; Allen and Tan, 2016). Further, securely attached adolescents were more likely to gain communication and perspective-taking skills to coordinate parent-adolescent discrepancies in autonomy and solve parental conflicts, so they were able to achieve success in gaining autonomy while maintaining relatedness with their parents (Allen et al., 2007). In contrast, insecurely attached adolescents reported more parental criticism (Anhalt and Morris, 2008) and resisted discussing negative events that may activate the attachment system due to poor parent-adolescent communication (Allen and Tan, 2016).

Some studies have investigated parent-adolescent communication in Chinese adolescents compared to that of Western adolescents. For example, Chinese adolescents reported lower quality parent-adolescent communication compared to Italian adolescents (Li et al., 2015). Chinese parents were less willing to express their verbal, non-verbal, and supportive affection to their children relative to parents in the United States (Zhang and Wills, 2016). Moreover, Chinese parents showed their love to children mainly through instrumental support, but not open communication, while American parents emphasized open communication to increase parental warmth (Wu and Chao, 2011). In Chinese culture, adolescents are expected to be obedient, exhibit self-control, and respect their parents, while parents as authoritarian figures are inclined to give guidance to their children on conduct and morality (Wu et al., 2002; Liu et al., 2005; Chuang and Su, 2009). When adolescents disagree with their parents, they are less likely to openly express their own conflicting ideas. In fact, parents' awareness of their children's information relies on adolescents' self-disclosure during adolescence (Keijsers et al., 2009). If parents know little information about their children, they cannot provide timely support; as a result, adolescents tend to develop depressive symptoms (Pantaleao and Ohannessian, 2019). Moreover, as good academic performance is valued highly in Chinese culture, Chinese adolescents face higher levels of academic stress compared with Western adolescents, especially for students in grade 9 who are facing the senior high school entrance examination (Sun et al., 2012). Studies have shown that when academic achievement was the core content of parent-adolescent communication, adolescents with poor academic performance were more likely to be depressed (Ma et al., 2018; Tang et al., 2020).

Different Effects of Father-Adolescent Communication and Mother-Adolescent Communication on Adolescents' Depressive Symptoms

Father-adolescent communication and mother-adolescent communication have different effects on adolescents' depressive symptoms (Ioffe et al., 2020). According to attachment

Moderating Effect of Adolescents' Age on the Relation Between Parent-Adolescent Communication and Adolescents' Depressive Symptoms

Age of the adolescent is another factor that could influence the relation between parent-adolescent communication and adolescents' depressive symptoms. With the development of autonomy and individuality, adolescents are more likely to keep secrets from their parents, which is associated with depressive symptoms, especially when adolescents consider parental solicitation as intrusion and control (Kakihara et al., 2010). Some empirical evidence has shown that the effect of parental communication on adolescent psychological outcomes changes with age. For example, Xu et al. (2016) found that, relative to Chinese adolescents in grade 7, Chinese adolescents in grade 9 developed more self-consciousness, idealized their parents less, and had reduced communication with their parents. As such, parents cannot provide social support because they have less information about their children, which increases the level of depressive symptoms. However, Hamza and Willoughby (2011) found that adolescent disclosure had a negative impact on depressive symptoms indirectly through parents' knowledge, but the effect did not change with age across high school years. Few studies have investigated the moderating effect of adolescents' age on the relationship between parent-adolescent communication and adolescents' depressive symptoms.

theory, children report greater *safe haven* support from mothers in times of distress as well as greater *secure base* support from fathers from which to explore, suggesting that mothers and fathers play different roles in children's secure attachment (Kerns et al., 2015). As mothers typically are in charge of daily care and emotional comfort for their children (Ho, 1987; Shek, 1999), they are inclined to communicate more actively, emotionally, and frequently with their children (Barnes and Olson, 1985; Shek, 2000). Relative to fathers, mothers may receive more information about their children's problems and provide timely support and care, which can relieve children's depressive symptoms (Darling et al., 2006; Pantaleao and Ohannessian, 2019). However, as the role of fathers in children's development has received increased research attention (Flouri and Buchanan, 2003; Dubeau et al., 2013; Paquette et al., 2013), father-adolescent communication has more recently become an area of investigation. For example, Ioffe et al. (2020) demonstrated that paternal communication had a greater impact on children's internalizing symptoms than maternal communication. Further, Lopez et al. (2005) found that negative father-adolescent communication increased the risk of victimization that is linked with depressive symptoms. Relative to mothers, fathers can provide more problem-solving strategies and autonomy support that are useful for their children (Lamb and Lewis, 2013; Huang et al., 2021).

Moderating Effect of Gender on the Relation Between Parent-Communication and Adolescents' Depressive Symptoms

Adolescents' gender could moderate the relationship between parent-adolescent communication and adolescents' depressive symptoms, with stronger associations observed for female adolescents (Finan et al., 2018; Pantaleao and Ohannessian, 2019). Studies have shown that female adolescents communicated more often with their mothers than male adolescents, and were more satisfied with communication with mothers than with fathers (Noller and Bagi, 1985; Noller and Callan, 1990). Moreover, girls tended to express greater closeness and shared more personal issues with their mothers than with their fathers (Collins and Russell, 1991; Van Lissa et al., 2019), and mothers provided various resources, such as emotional comfort and social support, to decrease the level of depressive symptoms (Katz and Hunter, 2007; Kenny et al., 2013). Thus, female adolescents may be more likely to be affected by maternal relationships than paternal relationships (Rueger et al., 2014). In addition, a previous study revealed that father-adolescent communication predicted depressive symptoms in boys, but not in girls (Pantaleao and Ohannessian, 2019). Relative to female adolescents, male adolescents perceived more positive communication with their fathers and may receive more support that can reduce their depressive symptoms (Jackson et al., 1998; Cornwell, 2003).

The Present Study

As early adolescence is a key developmental stage characterized by complex biological, social, and psychological changes as well as various stresses, it is necessary to understand the role of parent-adolescent communication as a critical dimension of parent-adolescent attachment in early adolescent mental health (Armsden and Greenberg, 1987; Allen and Tan, 2016). Although previous studies have found that father-adolescent and mother-adolescent communication influences adolescents' depressive symptoms, few studies have investigated the combined moderating effects of adolescents' age and gender on the relationship between father-adolescent or mother-adolescent communication and adolescents' depressive symptoms during early adolescence in China. Therefore, the current study aimed to answer three questions. First, do parent-adolescent communication and adolescents' depressive symptoms change during early adolescence in China? Second, does parent-adolescent communication influence Chinese early adolescents' depressive symptoms? Third, do adolescents' age and gender jointly moderate the effects of parent-adolescent communication on Chinese early adolescents' depressive symptoms? Based on the literature reviewed above, the present study proposed three hypotheses:

H1 Relative to 7th grade students, the quality of both father-adolescent communication and mother-adolescent communication would be lower, while

adolescents' depressive symptoms would be higher among 9th grade students.

H2 Both positive father-adolescent communication and mother-adolescent communication would have a negative effect on early adolescent depressive symptoms.

H3 Adolescents' age and gender would jointly moderate the effect of parent-adolescent communication on early adolescents' depressive symptoms. Specifically, positive father-adolescent or mother-adolescent communication would have a stronger effect on female adolescents' depressive symptoms in 9th grade students than in 7th grade students, while positive father-adolescent or mother-adolescent communication would have a weaker effect on male adolescents' depressive symptoms in 9th grade students than in 7th grade students.

MATERIALS AND METHODS

Participants and Procedure

The data used in this study were obtained from the China Education Panel Survey, which was conducted by the National Survey Research Center at Renmin University of China, using a multi-stage sampling method with probability proportional to size. First, they sampled 28 counties (districts) from all 2870 counties in China. Second, they sampled four schools from each selected county by using probability proportionate to size sampling. Third, in each selected school, they randomly sampled two classes from each of grades 7 and 9. Finally, all students in the selected classes participated in the survey. Between September 2013 and March 2014, a total of 19,487 students (including 10,279 in grade 7 and 9208 in grade 9) from 112 schools and 438 classes participated in the survey. Participants were asked to complete a self-report questionnaire in class at school under the guidance of trained investigators.

In the present study, given that we investigated the effects of both father- and mother-adolescent communication on adolescents' depressive symptoms, we selected participants whose fathers and mothers were both at home, and whose Hukou (a legal document that records the household population's basic information) was local. As a result, there were 12,018 participants. Among the 12,018 participants, 399 participants (3.3%) had no data on depressive symptoms. Additionally, given that skewness = 1.04 and kurtosis = 1.51 on depressive symptoms, we deleted 164 participants whose depressive symptoms score was the maximal value (151 participants scored 25 and 13 participants scored 24). Finally, there were 11,455 participants included in the data analysis (M_{age} = 14.15 years, SD = 1.22 years; N_{boys} = 5,711, N_{girls} = 5,744; N_{grade7} = 5,712, N_{grade9} = 5,743). Among these 11,455 participants, 670 participants (5.8%) had no data on father-adolescent communication and 257 participants (2.2%) had no data on mother-adolescent communication. Considering the low missing ratio and the random missing data pattern, we deleted the participants with missing data on relevant variables when conducting the data analysis.

Measures

Father-Adolescent and Mother-Adolescent Communication

According to the measurement of parental solicitation, as a main component of parent-driven communication (Stattin and Kerr, 2000; Kapetanovic et al., 2020), we used five items to measure father-adolescent communication. Participants were asked, "How often did your father have a discussion with you on the following issues?" The five response items were, "What happened at school," "Your relationship with your friends," "Your relationship with your teacher," "Your feelings," and "Your mind or troubles." We assessed mother-adolescent communication using the same five items, except they were asked, "How often did your mother have a discussion with you on the following issues?" The items were responded to using a three-point scale where 1 = "never," 2 = "once in a while," and 3 = "often." In this study, Cronbach's α for father-adolescent communication was 0.84, and for mother-adolescent communication α = 0.82.

Depressive Symptoms

According to the definition and measurement of depressive symptoms (Radloff, 1977; Saylor et al., 1984), we used five items to measure depressive symptoms. Participants were asked, "Have you had any of the following feelings in the past 7 days?" The five items were, "upset," "depressed," "unhappy," "life has no meaning," and "sad." The items were responded to using a five-point scale ranging from 1 = "almost never" to 5 = "almost always." Cronbach's α in this study was 0.86.

Demographics Variables

We collected demographic data on participants' gender, grade, family economic condition, and parents' education level. We used one item to measure the family's economic condition, namely, "What is your family's financial situation at present?" The item was responded to using a three-point scale ranging from 1 = "very poor," 2 = "middle income," and 3 = "very rich." Parents' education level was assessed by two items, "What is your mother's education level?" and "What is your father's education level?" Participants selected one from nine levels, including "No education whatsoever," "Primary school," "Junior high school," "Technical secondary school," "Vocational high school," "High school," "University college," "University degree," and "Postgraduate or above." Additionally, we collected data on two variables at the school level: school rank (three categories, including "Medium and below," "Above average," and "Best") and school location (three categories, including "Central urban area," "Urban-rural fringe area," and "Town and country").

Data Analysis Strategy

First, we examined whether the variables in the study were normally distributed by determining skewness and kurtosis. Second, we analyzed the means, standard deviations, and bivariate correlations of all variables. Third, we examined

TABLE 1 | Sample distribution of school rank, school location, family economic status, grade, gender, and father and mother education.

Variable	n	%	Variable	n	%
School rank			**Father education**		
Medium and below	1,852	16.2	No education whatsoever	46	0.4
Above average	6,646	58.0	Primary school	1,468	12.8
Best	2,957	25.8	Junior high school	4,780	41.7
School location			Technical secondary school	744	6.5
Central urban area	4,744	41.4	Vocational high school	258	2.3
Urban-rural fringe area	2,651	23.1	High school	2,021	17.6
Town and country	4,060	35.4	University college	838	7.3
Family economic status			University degree	1,090	9.5
Poor	2,114	18.5	Postgraduate or above	197	1.7
Middle income	8,581	74.9	Missing	13	0.1
Rich	738	6.4	**Mother education**		
Missing	22	0.2	No education whatsoever	320	2.8
Grade			Primary school	2,032	17.7
Grade 7	5,712	49.9	Junior high school	4,654	40.6
Grade 9	5,743	50.1	Technical secondary school	757	6.6
Gender			Vocational high school	248	2.2
Boys	5,711	49.9	High school	1,623	14.2
Girls	5,744	50.1	University college	771	6.7
			University degree	919	8.0
			Postgraduate or above	118	1.0
			Missing	13	0.1

$N = 11,455$.

TABLE 2 | Means and standard deviations of parent-adolescent communication and depressive symptoms according grade.

Variable	Grade 7	Grade 9	t	p	Cohen's d
Father communication	9.88 (2.86)	9.45 (2.88)	7.85	<0.001	0.15
Mother communication	11.06 (2.76)	10.75 (2.83)	5.86	<0.001	0.11
Depressive symptoms	9.59 (3.57)	10.48 (3.78)	−12.96	<0.001	−0.24

$N_{Grade7} = 5,712$, $N_{Grade9} = 5,743$.

TABLE 3 | Means and standard deviations of parent-adolescent communication and depressive symptoms according gender.

Variable	Boys	Girls	t	p	Cohen's d
Father communication	9.66 (2.88)	9.66 (2.88)	0.10	0.924	0.00
Mother communication	10.51 (2.77)	11.28 (2.79)	−14.72	<0.001	−0.28
Depressive symptoms	9.82 (3.76)	10.26 (3.63)	−6.49	<0.001	−0.12

$N_{Boys} = 5,711$, $N_{Girls} = 5,744$.

RESULTS

Normal Distribution Test and Sample Distribution of the Categorical Variables

The results of the test for the normal distribution of the variables were as follows: skewness = 0.68 and kurtosis = 0.30 for depressive symptoms, skewness = 0.08 and kurtosis = −0.82 for father-adolescent communication, and skewness = −0.23 and kurtosis = −0.79 for mother-adolescent communication. These results indicated that these variables were normally distributed. The results of the sample distribution on the categorical variables are displayed in **Table 1**.

Age and Gender Differences in Parent-Adolescent Communication and Depressive Symptoms

Results of the t-tests on age and gender differences are provided in **Tables 2–4**. In this study, age was represented by grade; generally, participants in Grade 9 were 2 years older than participants in Grade 7 (M_{age} = 13.14 years in Grade 7 vs. M_{age} = 15.15 years in Grade 9). Participants in Grade 9 had less father-adolescent communication (M_{grade9} = 9.45 vs. M_{grade7} = 9.88) and less mother-adolescent communication (M_{grade9} = 10.75 vs. M_{grade7} = 11.06), and had more depressive symptoms ($M_{grade\,9}$ = 10.48 vs. $M_{grade\,7}$ = 9.59) compared to those in Grade 7. Additionally, collapsed across grades, girls reported more mother-adolescent communication (M_{girls} = 11.28 vs. M_{boys} = 10.51) and more depressive symptoms (M_{girls} = 10.26 vs. M_{boys} = 9.82) than boys.

grade and gender differences in the average level of parent-adolescent communication and depressive symptoms using t-tests. Fourth, we used multiple regression to examine the effects of father-adolescent and mother-adolescent communication on adolescents' depressive symptoms in the total sample. Finally, we used multiple regression to investigate the moderating effect of adolescents' gender on the moderating effect of grade on the relationship between father-adolescent or mother-adolescent communication and adolescents' depressive symptoms. In the multiple regressions, we controlled for school rank, school location, family economic status, father's education level, and mother's education level. Although the data had a multilevel structure, we did not use multilevel regression analyses because the intra-class correlation coefficient (ICC) of the dependent variable was 0.040 [i.e., it did not reach 0.059 (Cohen, 1988)]. All analyses were performed using SPSS 21.0. In particular, data analysis for the moderating effect of adolescents' gender on the moderating effect of grade on the relationship were conducted using Model 3 in the Process macro for SPSS Statistics (Hayes, 2016).

TABLE 4 | Means and standard deviations of parent-adolescent communication and depressive symptoms according gender and grade.

Gender	Variable	Grade 7	Grade 9	t	p	Cohen's d
Boys	Father communication	9.87 (2.88)	9.45 (2.86)	5.32	<0.001	0.15
	Mother communication	10.69 (2.75)	10.32 (2.77)	5.00	<0.001	0.13
	Depressive symptoms	9.44 (3.61)	10.21 (3.86)	−7.73	<0.001	−0.21
Girls	Father communication	9.89 (2.85)	9.44 (2.90)	5.78	<0.001	0.16
	Mother communication	11.43 (2.73)	11.15 (2.83)	3.87	<0.001	0.10
	Depressive symptoms	9.75 (3.51)	10.74 (3.67)	−10.44	<0.001	−0.28

$N_{Boys,Grade7}$ = 2,921, $N_{Boys,Grade9}$ = 2,790, $N_{Girls,Grade7}$ = 2,791, $N_{Girls,Grade9}$ = 2,953.

TABLE 5 | Effect of father-adolescent and mother-adolescent communication on adolescents' depressive symptoms.

Variable	Depressive symptoms				
	B	SE	t	p	95% CI
School rank					
Above average	0.080	0.101	0.79	0.428	−0.118, 0.279
Best	−0.063	0.125	−0.50	0.614	−0.307, 0.181
School location					
Urban-rural fringe area	−0.026	0.097	−0.27	0.791	−0.217, 0.165
Central urban area	0.280	0.099	2.83	0.005	0.086, 0.473
Family economic status					
Middle income	−0.712	0.094	−7.55	<0.001	−0.896, −0.527
Rich	−0.697	0.164	−4.26	<0.001	−1.018, −0.376
Father education	0.051	0.024	2.11	0.035	0.004, 0.097
Mother education	−0.082	0.024	−3.38	0.001	−0.129, −0.034
Grade	0.811	0.069	11.68	<0.001	0.675, 0.947
Gender	−0.514	0.070	−7.32	<0.001	−0.651, −0.376
Father communication	−0.121	0.015	−7.98	<0.001	−0.150, −0.091
Mother communication	−0.138	0.016	−8.59	<0.001	−0.170, −0.107

CI, confidence interval. Grade: 0 = 7th grade, 1 = 9th grade. Gender: 0 = girl, 1 = boy. Reference group: Medium and below on School rank; town and country on School location; poor family on Family economic status.

Effect of Parent-Adolescent Communication on Adolescents' Depressive Symptoms

The results of the multiple regression analysis on the effect of parent-adolescent communication on depressive symptoms are provided in **Table 5**. Both father-adolescent communication and mother-adolescent communication had a significant negative effect on adolescents' depressive symptoms, $B = -0.121$, $SE = 0.015$, $t = -7.98$, $p < 0.001$, 95% CI = [−0.150, −0.091] and $B = -0.138$, $SE = 0.016$, $t = -8.59$, $p < 0.001$,

95% CI = [−0.170, −0.107], respectively. Additionally, results indicated that adolescents in a rich family or middle income family had less depressive symptoms compared to adolescents in a poor family.

Moderating Effects of Adolescents' Age and Gender
Father-Adolescent Communication and Adolescents' Depressive Symptoms

Table 6 displays the results of the multiple regression analysis on the moderating effects of age and gender in the relationship between father-adolescent communication and adolescents' depressive symptoms. The result for the father communication × grade (age) × gender interaction variable suggests a trend toward significance at the 0.05 level ($B = 0.075$, $SE = 0.048$, $t = 1.56$, $p = 0.119$, 95% CI = [−019, 0.170]). Further

TABLE 6 | Moderating effect of adolescents' grade and gender on the relation between father-adolescent communication and adolescents' depressive symptoms.

Variable	Depressive symptoms				
	B	SE	t	p	95% CI
School rank					
Above average	0.079	0.101	0.78	0.436	−0.120, 0.278
Best	−0.063	0.125	−0.50	0.615	−0.307, 0.181
School location					
Urban-rural fringe area	−0.024	0.097	−0.249	0.803	−0.215, 0.167
Central urban area	0.283	0.099	2.860	0.004	0.089, 0.476
Family economic status					
Middle income	−0.708	0.094	−7.51	<0.001	−0.893, −0.523
Rich	−0.693	0.164	−4.23	<0.001	−1.014, −0.372
Father education	0.050	0.024	2.10	0.036	0.003, 0.097
Mother education	−0.081	0.024	−3.33	0.001	−0.128, −0.033
Mother communication	−0.139	0.016	−8.66	<0.001	−0.171, −0.108
Father communication	−0.119	0.015	−7.88	<0.001	−0.149, −0.089
Grade	0.811	0.069	11.69	<0.001	0.675, 0.947
Gender	−0.506	0.070	−7.20	<0.001	−0.644, −0.369
Father communication × Grade	−0.039	0.024	−1.61	0.108	−0.088, 0.009
Father communication × Gender	0.031	0.024	1.30	0.195	−0.016, 0.079
Grade × Gender	−0.136	0.139	−0.98	0.327	−0.407, 0.136
Father communication × Grade × Gender	0.075	0.048	1.56	0.119	−0.019, 0.170

CI, confidence interval. Grade: 0 = 7th grade, 1 = 9th grade; Gender: 0 = girl, 1 = boy. Reference group: Medium and below on School rank; town and country on School location; poor family on Family economic status.

analysis indicated that the moderating effect of grade (age) was significant for girls ($B = -0.076$, $SE = 0.034$, $t = -2.241$, $p = 0.025$, 95% CI = [-0.142, -0.010]), while the moderating effect was not significant for boys ($B = 0.000$, $SE = 0.034$, $t = -0.014$, $p = 0.989$, 95% CI = [-0.068, 0.067]). Simple effect analysis indicated that, for girls in grade 7, the effect of father-adolescent communication on depressive symptoms was significant ($B = -0.096$, $SE = 0.026$, $t = -3.712$, $p < 0.001$, 95% CI = [-0.147, -0.045]), but this effect was stronger for girls in grade 9 ($B = -0.172$, $SE = 0.025$, $t = -6.906$, $p < 0.001$, 95% CI = [-0.221, -0.123]). For boys in grade 7, the effect of father-adolescent communication on depressive symptoms was significant ($B = -0.103$, $SE = 0.026$, $t = -3.975$, $p < 0.001$, 95% CI = [-0.154, -0.052]), and this effect was similar for boys in grade 9 ($B = -0.103$, $SE = 0.027$, $t = -3.892$, $p < 0.001$, 95% CI = [-0.155, -0.051]).

Mother-Adolescent Communication and Adolescents' Depressive Symptoms

Table 7 displays the results of the multiple regression analysis on the moderating effects of age and gender in the relationship between mother-adolescent communication and adolescents' depressive symptoms. The result for the mother communication $\times$ grade (age) $\times$ gender interaction variable was marginally significant ($B = 0.086$, $SE = 0.051$, $t = 1.69$,

TABLE 7 | Moderating effect of adolescents' grade and gender on the relation between mother-adolescent communication and adolescents' depressive symptoms.

Variable	Depressive symptoms				
	B	**SE**	**t**	**p**	**95% CI**
School rank					
Above average	0.077	0.101	0.76	0.445	−0.121, 0.276
Best	−0.067	0.125	−0.54	0.591	−0.311, 0.177
School location					
Urban-rural fringe area	−0.023	0.097	−0.23	0.816	−0.213, 0.168
Central urban area	0.284	0.099	2.88	0.004	0.090, 0.478
Family economic status					
Middle income	−0.705	0.094	−7.48	< 0.001	−0.890, −0.520
Rich	−0.691	0.164	−4.22	< 0.001	−1.012, −0.370
Father education	0.049	0.024	2.06	0.039	0.002, 0.096
Mother education	−0.081	0.024	−3.33	0.001	−0.128, −0.033
Father communication	−0.122	0.015	−8.08	< 0.001	−0.152, −0.093
Mother communication	−0.136	0.016	−8.46	< 0.001	−0.168, −0.105
Grade	0.828	0.070	11.83	< 0.001	0.691, 0.966
Gender	−0.506	0.070	−7.20	< 0.001	−0.643, −0.368
Mother communication × Grade	−0.032	0.025	−1.28	0.201	−0.082, 0.017
Mother communication × Gender	0.057	0.025	2.23	0.026	0.007, 0.106
Grade × Gender	−0.154	0.140	−1.10	0.271	−0.427, 0.120
Mother communication × Grade × Gender	0.086	0.051	1.69	0.090	−0.014, 0.185

CI, confidence interval. Grade: 0 = 7th grade, 1 = 9th grade; Gender: 0 = girl, 1 = boy. Reference group: Medium and below on School rank; town and country on School location; poor family on Family economic status.

$p = 0.090$, 95% CI = [-0.014, 0.185]). This result indicates that the moderating effect of adolescents' gender on the moderating effect of grade (age) on the relationship between mother-adolescent communication and adolescents' depressive symptoms was significant. Further analysis revealed that the moderating effect of grade (age) was significant for girls ($B = -0.075$, $SE = 0.035$, $t = -2.104$, $p = 0.035$, 95% CI = [-0.144, -0.005]), while it was not significant for boys ($B = 0.011$, $SE = 0.036$, $t = 0.310$, $p = 0.756$, 95% CI = [-0.060, 0.082]). Simple effect analysis indicated that, for girls in grade 7, the effect of mother-adolescent communication on depressive symptoms was significant ($B = -0.126$, $SE = 0.028$, $t = -4.593$, $p < 0.001$, 95% CI = [-0.180, -0.072]), but this effect was stronger for girls in grade 9 ($B = -0.201$, $SE = 0.026$, $t = -7.721$, $p < 0.001$, 95% CI = [-0.252, -0.150]). For boys in grade 7, the effect of mother-adolescent communication on depressive symptoms was significant ($B = -0.113$, $SE = 0.028$, $t = -4.096$, $p < 0.001$, 95% CI = [-0.167, -0.059]), and this effect was similar for boys in grade 9 ($B = -0.102$, $SE = 0.028$, $t = -3.658$, $p < 0.001$, 95% CI = [-0.156, -0.047]).

DISCUSSION

Our findings indicated that the quality of both father-adolescent and mother-adolescent communication was lower, while the level of adolescent depressive symptoms was higher among 9th grade students compared to 7th grade students. Moreover, the effects of both father-adolescent and mother-adolescent communication on adolescents' depressive symptoms among all students were significant. Furthermore, gender and age jointly moderated the association between parental communication and adolescent depressive symptoms. Specifically, for girls, the negative effects of both father-adolescent and mother-adolescent communication on depressive symptoms were stronger in 9th grade students than in 7th grade students, while for boys, the negative effects did not differ between 7th grade students and 9th grade students. These findings suggest that the protective effects of positive parent-adolescent communication on adolescents' depressive symptoms may be most salient among senior-grade girls in junior high school in China.

Age Differences in Parent-Adolescent Communication and Adolescent Depressive Symptoms

When comparing 7th grade students ($M_{age} = 13.14$ years) to 9th grade students ($M_{age} = 15.15$ years), the results indicated that the quality of both father-adolescent and mother-adolescent communication was lower, while the level of adolescent depressive symptoms was higher among 9th grade students. This result supports Hypothesis 1, which is consistent with previous studies. Finkenauer et al. (2002) found that children were less likely to share their thoughts, feelings, and secrets with their parents when they got older, which is not beneficial for connectedness and intimacy between parents and their children (Metzger et al., 2012). Lionetti et al. (2019) examined the change

in parent-adolescent communication using meta-analysis and found that parental control and adolescent disclosure decreased, but adolescents' secrecy increased. In addition, Newman et al. (2007) found that 9th grade adolescents reported more depressive symptoms than 8th grade adolescents, and Chen et al. (2012) found that depressive symptoms increased from 18.8% in grade 7–21.7% in grade 9, based on a sample of 2,239 students from rural areas in China.

The finding regarding the positive association between age and depressive symptoms may be explained in part by the increase in academic stress that adolescents experience from grade 7 to 9. Ciciolla et al. (2017) found that children with poor academic performance were more likely to be depressed; in particular, maternal emphasis on high grades accompanied by parental criticism may lead to psychological maladjustment. Relative to children in primary school, Chinese adolescents experience higher levels of academic stress linked with high school entrance examinations due to limited educational resources, especially in grade 9 in middle school (Sun et al., 2012). As academic performance is highly valued in Chinese culture, studies have found that adolescents with poor academic grades were likely to be monitored strictly by parents, leading to more parental conflicts that increase the risk of depressive symptoms (Chao, 2001; Ma et al., 2018). Moreover, when adolescents considered parental monitoring as impaired independence and an invasion of privacy, they were more inclined to disclose to best friends rather than their parents (Metzger et al., 2012; Solis et al., 2015).

Effects of Parent-Adolescent Communication on Adolescents' Depressive Symptoms

We found that both father-adolescent and mother-adolescent communication negatively predicted adolescents' depressive symptoms during junior high school, which supports Hypothesis 2. This result is consistent with previous findings showing that positive parental communication negatively related to adolescent depressive symptoms in Western cultures (Pinquart, 2017; Ioffe et al., 2020; Kapetanovic et al., 2020). Importantly, this result is consistent with a meta-analysis on risk factors associated with depressive symptoms among adolescents in mainland China (Tang et al., 2020) and highlights the protective effect of positive parent-adolescent communication on preventing depressive symptoms in adolescents in secondary schools in China.

Adolescents may face more stress from academic requirements and social relationships when entering middle school, which increases the risk of depressive symptoms (Verboom et al., 2013; Ma et al., 2018). However, according to Allen and Tan (2016), the attachment bond between adolescents and their parents could be maintained via positive parent-child communication, which, in turn, would help adolescents to deal with stress actively and make it less likely that they experience depressive symptoms. Studies have revealed that adolescents were more likely to communicate with parents who understand them well; as a result they get more guidance, involvement, and protection from their parents, which could prevent them from experiencing depressive symptoms (Kapetanovic et al., 2020; Hamza and Willoughby, 2011). However, if adolescents receive less support from parents by keeping secrets from them, they may experience more difficulty in relieving stress and reducing or alleviating depressive symptoms as a result (Flouri and Buchanan, 2003; Frijns et al., 2010). Ioffe et al. (2020) reported that positive parent-adolescent communication helped in developing problem-solving and adaptive coping skills to decrease the negative effects of stressful events in middle school students. Hill and Roberts (2019) suggested that positive parent-adolescent communication may increase self-efficacy and social skills that are helpful for academic success.

The Moderating Effects of Adolescents' Age and Gender

More importantly, we found that gender and age jointly moderated the association between parental communication and adolescent depressive symptoms. Specifically, for girls, the negative effects of both father-adolescent and mother-adolescent communication on depressive symptoms were stronger in 9th grade students than in 7th grade students, while for boys, the negative effects were similar among 9th grade students and 7th grade students. This finding was not consistent with Hypothesis 3. This result is also partially inconsistent with previous empirical evidence showing the protective effects of positive maternal communication on depressive symptoms for girls decreased during middle school but was not significant in boys (Ebbert et al., 2019). The different role expectations of fathers and mothers on boys and girls may explain these results. Chinese adolescents face more challenges in developing new interpersonal relationships and experience academic stress when they transition to middle school, which was found to be associated with depressive symptoms (Wang et al., 2016). Boys are expected to deal with these adjustment difficulties independently, whereas girls are expected to seek support from parents to solve them (Rosario et al., 1988; Cyranowski et al., 2000). Moreover, relative to boys, girls are more likely to express their emotional needs and share more information with their mothers (Collins and Russell, 1991; Kapetanovic et al., 2020). There is empirical evidence showing that girls received more problem-solving strategies and emotional support from parents than boys, which reduced the negative effects of depressive symptoms (Kenny et al., 2013; Van Lissa et al., 2019). When girls in the 9th grade experience more academic stress due to senior high school entrance examinations, they are more needed and likely to communicate with their parents for emotional and instrumental support than those in the 7th grade. Therefore, for girls, the effects of both father-adolescent and mother-adolescent communication on depressive symptoms may be stronger in the 9th grade relative to the 7th grade.

With regard to boys, those in the 9th grade require more autonomy and individuality than boys in the 7th grade, so

they may become more secretive when relating with their parents in order to avoid interference in their development of individuality and autonomy from early adolescence to mid-adolescence (Keijsers et al., 2009). Chinese parents treat their sons with stricter rules and more behavior control compared to their daughters (Chuang and Su, 2009). Research indicates boys experienced more negative feelings when communicating with their parents, leading to less communication with their parents in order to avoid punishment (Shek, 2000; Rueger et al., 2014). Therefore, for boys, the negative effects of father-adolescent or mother-adolescent communication on adolescent depressive symptoms may be similar in both the 9th and 7th grades.

Strengths and Limitations

This study makes important contributions to the literature by examining the combined moderating effects of adolescents' age and gender on the association between parent-adolescent communication and early adolescents' depressive symptoms. First, the present study replicated previous results that showed the protective effect of positive parent-adolescent communication on adolescent depressive symptoms (Tang et al., 2020) by using junior high school data from the China Education Panel Survey. Second, these findings contribute to acquiring knowledge in understanding the different protective effects of positive parent-adolescent communication on depressive symptoms among lower- and senior-grade female and male adolescents in junior high school in China.

However, the current study has several limitations. First, the present study was a cross-sectional survey. As such, causality between variables and the change of variables over time in this study could not be investigated. Second, self-report questionnaires were used to collect the data, which can influence the results due to response bias. Future studies should gather information from both parents and adolescents. Third, *ad hoc* questionnaires from the China Education Panel Survey were used, which may influence comparisons with other relevant research studies. Fourth, other possible moderators that might influence the association, e.g., parental stress, sensitivity, or mentalizing ability, were not controlled for. Finally, this study only investigated the effects of parent-driven communication, not child-driven communication, which might have different effects on adolescent depressive symptoms (Kapetanovic et al., 2020; Kapetanovic and Skoog, 2021). Further studies should examine the different roles of parent-driven and child-driven communication.

Implications for Clinical Practice

The current findings provide key information for designing prevention and intervention programs to heighten the quality of parental communication with the aim of preventing or alleviating depressive symptoms in middle school children. As the findings identified age and gender differences, policymakers should provide more guidance and resources to encourage parents to communicate actively with their children, and clinicians should consider age and gender differences to meet the specific needs of girls and boys.

Importantly, as the finding that positive parent-communication had a stronger protective effect on adolescent depressive symptoms among girls in the 9th grade relative to the 7th grade, parents should pay more attention to their daughters in the 9th grade and strengthen communication with them, which could effectively prevent or alleviate daughters' depressive symptoms.

CONCLUSION

Our study highlighted the importance of parent-adolescent communication in early adolescent depressive symptoms. We found a negative effect of both father-adolescent communication and mother-adolescent communication on girls' depressive symptoms, which was enhanced in 9th grade girls compared to 7th grade girls during junior high school. In contrast, the negative effect of both father-adolescent communication and mother-adolescent communication on boys' depressive symptoms did not differ between 7th grade and 9th grade during junior high school.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of Renmin University of China. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

YP and QZ were responsible for the design of the study, for describing the methods and results sections of the manuscript. QZ and HL were responsible for the introduction and discussion section of the manuscript. YP, QZ, and LZ were responsible for data analysis and revision of manuscript. All authors contributed with validating each other's responsibilities and to the writing of the manuscript in its current presentation.

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Maternal Psychological Control and Rural Left-Behind Children's Anxiety: The Moderating Role of Externalizing Problem Behavior and Teacher Support

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Based on the risk and protective factor framework and context-dependent theory, the present study investigated the association between maternal psychological control and anxiety among left-behind children in rural China as well as the moderating roles of externalizing problem behavior and teacher support in this association. A total of 149 children with two migrant parents, 306 children with only a migrant father, and 287 accompanied children aged 11–16 years (M = 13.85 years, SD = 0.50) in the rural areas of Shandong Province, Eastern China, participated in the study. Children reported their perceived levels of maternal psychological control, teacher support, externalizing problem behavior, and anxiety. The results provided evidence that a higher level of psychological control was associated with more anxiety symptoms in all three groups of children, and this association was stronger in children with two migrant parents than in accompanied children. Hierarchical regression analysis supported our hypotheses that the moderating effects of externalizing problem behavior and teacher support varied as a function of parents' migrant status, with externalizing problem behavior exacerbating the impact of psychological control on anxiety in accompanied children, and teacher support buffering the impact of psychological control on anxiety in children with a migrant father. These findings broaden our understanding of the factors and processes that contribute to anxiety problems in left-behind children in rural China.

Keywords: psychological control, externalizing problem behaviors, teacher support, anxiety, left-behind children, China

INTRODUCTION

Anxiety, generally defined as a negative emotional state of vigilant apprehension characterized by a narrowing of attention, a sense of dread, ruminative worry, a perception of vulnerability, an inhibition of behavior, and a heightened state of sympathetic arousal (American Psychiatric Association, 2000), is one of the most prevalent emotional disorders in childhood, with prevalence rates of approximately 5–13% in community children younger than 18 years old (Moreno et al., 2010) and 26.6% in rural children and adolescents aged 3–19 years (Abbo et al., 2013). Childhood anxiety disorders are associated with poor academic performance, depression, increased risk for substance abuse, and other externalizing disorders (Whiteside and Brown, 2008; Kendall et al., 2010). If left

untreated, such disorders may persist into adolescence and even adulthood (Broeren and Muris, 2008). All these findings highlight the importance of identifying factors that contribute to anxiety problems in childhood. In rural China, labor migration from rural to urban areas has been the most significant social change since the reform and opening policy was implemented in 1978. With labor migration, a large number of children aged 17 years or younger have been left behind in the original rural communities by one or both parent migrant in search of work in cities, which has led to dramatic changes in the traditional family structure (Cheng and Sun, 2014). Parent-migrant/other caregiver families and father-migrant/mother caregiver families have increasingly become two common patterns of migrant families in rural China (Zhao et al., 2015). Although migrant workers provide more economic resources for their children, most of the left-behind children actually live in a situation lacking parental or paternal care and nurture, which might lead to an increase in anxiety symptoms. Indeed, empirical studies (Li and Cai, 2012; Cheng and Sun, 2014) have found that left-behind children reported higher levels of anxiety than their age-matched peers from non-migrant families. However, of note, most of the prior research did not distinguish between types of migrant families. Extant research has demonstrated that family structures affect parenting and family communication patterns and, subsequently, affect children's adjustment (Bastaits and Mortelmans, 2016; Murry and Lippold, 2018). To the best of our knowledge, the only study that has examined the differences in children's levels of anxiety between types of migrant families found that children with two migrant parents displayed higher levels of anxiety than those with only a migrant father (Zhao and Li, 2017). Thus, one might wonder whether children with only a migrant father might display higher levels of anxiety than accompanied children in non-migrant families, considering that the loss of contact with fathers is an important risk factor for and has been shown to be associated with maladjustment among children (Carlson, 2006). Based on these findings, the present study examined differences in anxiety levels among two-migrant-parent children, only-a-migrant-father children, and accompanied children.

The Relationship Between Parental Psychological Control and Child Anxiety

Research on the etiology of anxiety often begins with an examination of parenting, due to the importance of the family microsystem in children's development. Control is considered one of the most influential dimensions of parenting. Prior research has focused on two types of control—psychological and behavioral—and documented their distinct effects on children's functioning (Pomerantz and Wang, 2009; Bebes et al., 2015). In contrast to behavioral control—i.e., control over children's activities and behaviors in the physical world, which benefits children's academic and behavioral adjustment (Wang et al., 2007)—a large body of research has shown that psychological control—i.e., control over children's thoughts and feelings in the psychological world, which intrudes upon children's sense of self (Wang et al., 2007)—is closely associated with children's

anxiety (Bebes et al., 2015; Stone et al., 2015; Zhao et al., 2018). Nevertheless, almost all of the studies in this area have been conducted in children of intact families; there is a lack of research on the association between psychological control and anxiety of left-behind children from families of different parental migrant statuses. Murry and Lippold (2018) proposed that changes in family structure, as a consequence of parental migration, affect the levels of parenting, including parental involvement, control, and warmth, which are likely to influence children's adjustment and well-being. Context-dependent theory suggests that chronic and cumulative stress (i.e., parental absence caused by different forms of family separation such as divorce, death of a parent, separation, and migration) may increase an individual's reactivity (i.e., behavioral or emotional arousal), and highly reactive individuals may be more susceptible to both negative (risk-promoting) and positive (development-promoting) environments (Ellis and Boyce, 2011; Steeger et al., 2017). Empirical support for this viewpoint has come from several studies on the associations between parenting or parent-child relation and children's well-being in diverse family structures. Specifically, a study by Bloch et al. (2007) found that children growing up in a household in which the parent is absent due to death or divorce are more prone to exposure to stressful life events than those in intact families. Zhao and Li (2017) found that the relationship between insecure attachment with fathers and adolescents' anxiety was stronger in families with two migrant parents ($r = 0.21$) than in families with only a migrant father ($r = 0.13$). Li and Liu (2013) reported that a high level of secure attachment with fathers directly increased subjective well-being among children with one or both migrant parents ($\beta = 0.34$) but not among accompanied children ($\beta = 0.06$). Based on these indirect evidences, the present study further examined the difference in the association between perceived psychological control parenting and children's anxiety among two-migrant-parent families, only-a-migrant-father families and non-migrant families to test whether the extent of the association between psychological control and children's anxiety depended on parents' migrant status.

The Moderating Effect of Externalizing Problem Behavior

Although higher levels of parental psychological control are associated with higher levels of child anxiety, some research has found that psychological control is not uniquely related to child anxiety (Caron et al., 2006; Gere et al., 2012), which to some extent suggests that the significant association between psychological control parenting and children's anxiety reported in prior research (Stone et al., 2015; Zhao et al., 2018) may be influenced by other potential confounding variables. Externalizing problem behavior refers to behavior problems that are manifested in children's outward behavior and reflect children's negative actions in the external environment, such as aggression and delinquency (Campbell et al., 2000). It has been documented that parental psychological control is related to children's externalizing problem behavior (Symeou and Georgiou, 2017; Pace et al., 2018). Given that children with

anxiety disorders often have cooccurring externalizing behavior disorders (Kendall et al., 2010), it is therefore crucial to consider behavioral problems when examining the relationship between parental psychological control and children's anxiety. To date, only a few studies have examined the role of child externalizing problem behavior in the association between parenting and children's anxiety or internalizing symptoms. In studies of community children from primary schools, it has been reported that the significant associations between psychological control (Caron et al., 2006) or parenting patterns (Pereira et al., 2009), and children's internalizing symptoms disappeared after controlling for cooccurring externalizing symptoms. Similarly, in a clinical sample of 190 children aged 7–13 years, Gere et al. (2012) found that the previous significant relationship between parental overprotection, often referred to as parental control, and children's anxiety became non-significant after controlling for children's externalizing symptoms. To some extent, these findings demonstrated that externalizing problem behavior may moderate the association between psychological control parenting and children's anxiety; that is, this association may be significant at a higher level of externalizing behavior, but it may become non-significant at a lower level of externalizing behavior. However, these studies have not specifically focused on the question of whether the role of externalizing problem behavior in the association between parental psychological control and children's anxiety changes across different family structures. In two-migrant-parent and only-a-migrant-father families in rural China, Wen and Lin (2012) argued that, irrespective of the level of other sources, parental or paternal absence has considerable emotional costs for left-behind children's development due to weakened parental support and guidance, and undermined parent–child bonding. Additionally, according to the opinion of context-dependent theory, long-term absence of parental or paternal support in migrant families may be an important source for children's high reactivity to negative environments that lead to maladaptive outcomes (Obradović et al., 2010; Steeger et al., 2017) regardless of the level of other risk factors. Considering left-behind children's high reactivity to negative environments, one might wonder whether psychological control parenting was always associated with left-behind children's anxiety regardless of the level of their externalizing problem behavior. In other words, one might wonder whether the absence of both parents or fathers make the influences of externalizing problem behavior on the association between psychological control and left-behind children's anxiety decrease or disappear. Therefore, the third aim of this study was to examine how the moderating effects of externalizing problem behavior on the association between psychological control and children's anxiety differed among two-migrant-parent, only-a-migrant-father, and non-migrant families.

The Moderating Effect of Teacher Support

To date, most research on anxiety has focused on the risk factors for family microsystems (e.g., negative parenting, parental anxiety; Eley et al., 2015; Möller et al., 2015) and individual characteristics (e.g., behavioral inhibition; Murray et al., 2008). There is a lack of research on protective

buffers against the negative impact of risk situations on child anxiety. According to the risk and protective factor framework, child development is the dynamic interplay between risk and protective factors whereby risk factors predispose children to negative developmental outcomes, and protective factors increase resilience and decrease the likelihood of negative outcomes (Masten, 2001; Wang et al., 2013). School is another important microsystem factor for child development, and teachers are the primary adult figures within this microsystem. Teacher support, often defined as "children's perceived or actual instrumental and/or expressive provisions supplied by the teacher" (Lin, 1986), as a direct, immediate, or proximal contextual factor, may act as a protective factor between risk situations (e.g., psychological control) and children's anxiety. Indeed, numerous studies on child resilience have provided evidence to suggest that teacher support or high-quality teacher–student relationships serve as a buffer in the association between negative parenting and child psychological adjustment. For instance, Wang et al. (2013) found that positive experiences with teachers buffered adolescents with negative family experiences from engaging in misconduct behaviors. A study of maltreated children by Lynch and Cicchetti (1997) suggested that positive relationships with teachers compensated for negative relationships with parents. In addition, a study by Costa et al. (2005) suggests that positive relationship with teachers was particularly beneficial to students who do not have secure relationships with their parents. However, these studies mainly focused on children from intact families, and few studies have examined how the moderating effects of teacher support on the association between psychological control and anxiety differ among children left behind by both parents or children left behind by fathers only in rural areas. Because the potential therapeutic functions of social support in the context of adversity were underscored in the theory of interpersonal relationships by Sullivan (1953), when compared to accompanied children, teacher support may have a stronger protective effect against negative parenting on left-behind children's adjustment. Thus, the last aim of this study was to compare the moderating effect of teacher support on the association between parental psychological control and children's anxiety among families with different parents' migrant statuses.

The Current Study

To extend our understanding of the risk and protective factors for children's anxiety beyond the results of previous research mostly conducted in intact families, the present study investigated the association between psychological control and children's anxiety in families with different parent migrant statuses in rural China as well as potential moderating mechanisms. Because psychological control was more likely to be used by parents as a means to make their children emotionally and psychologically dependent on them as children enter middle school—a time during which children's separation and independence increase (Soenens et al., 2010)—we focused on children who were at this stage of development. Given that mothers tend to be more involved than fathers in children's parenting (Wen and Lin, 2012), this study primarily focused on maternal psychological

control. Based on the extant direct and indirect evidence, first, we expected that children with two migrant parents would report the highest levels of anxiety, followed by those with a migrant father and then accompanied children. Second, it was expected that maternal psychological control would be most closely associated with the increase of children's anxiety in two-parent-migrant families, followed by those in only-a-migrant-father families and then non-migrant families. Given the relative paucity of previous research on the moderating role of externalizing problem behavior in the association between psychological control and children's anxiety, we did not propose strong hypotheses on this issue. Finally, we anticipated that teacher support would be more likely to buffer the impact of maternal psychological control on left-behind children's anxiety (especially for the two-migrant-parent children) than that of accompanied children.

MATERIALS AND METHODS

Participants

A total of 771 Chinese children aged 11–16 years enrolled in grade 7 were recruited from three junior high schools in three counties of Linyi, located in Shandong Province of Eastern China, which is a region that has a large labor migration population. According to the criterion employed by Zhao et al. (2012), a threshold of < 90% response rate was used to remove unsatisfactory cases. Twenty-nine students were excluded from the initial 771 participants. The final sample therefore consisted of 742 children, including 149 children in families with two migrant parents (M = 13.91 years, SD = 0.57; 100 boys and 49 girls), 306 children in families with only a migrant father (M = 13.84 years, SD = 0.43; 154 boys and 152 girls), and 287 accompanied children in non-migrant families (M = 13.83 years, SD = 0.52; 153 boys and 134 girls). Among children with two migrant parents, 85.7% of fathers and 96.7% of mothers had an educational level of junior high school or below, and the others had educational levels ranging from senior high school to junior college. Among children with only a migrant father, 87.3% of fathers and 98.1% of mothers had an educational level of junior high school or below, and the others had an educational level of senior high school or high. Among accompanied children, 84.7% of fathers and 94.3% of mothers had an educational level of junior high school or below, and the others had educational levels ranging from senior high school to junior college. Most of the fathers were unskilled workers (e.g., building workers, stevedores), and most mothers were farmers. The percentage of families in income per month per capita exceeding ¥1,000 was 71.6, 65, and 67.6% for families with two migrant parents, families with a migrant father, and non-migrant families, respectively.

Procedure

We sought the help of the elementary school institutions for access to the participants of this study. Prior to data collection, approval to administer questionnaires was obtained from the school principals, and the students were assured of the voluntary and confidential nature of this research. The questionnaires were administrated to groups of students by a trained research assistant in separate classrooms. Students independently completed the Psychological Control Scale (Wang et al., 2007), Youth Self-Report List (Achenbach, 1991), Teacher (Significant Other) Support Subscale of the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1990), and Spence Children's Anxiety Scale (Zhao et al., 2012) during classroom hours or immediately after school. All procedures were approved by the Institutional Review Board at the Institute of Psychology, Chinese Academy of Sciences.

Measures

Psychological Control

Maternal psychological control was assessed with an 18-item Chinese version developed by Wang et al. (2007). Ten items assessed *guilt induction* (e.g., "My mother tells me of all the sacrifices she has made for me."), five assessed *love withdrawal* (e.g., "My mother avoids looking at me when I have disappointed her."), and three assessed *authority assertion* (e.g., "My mother says, when I grow up, I will appreciate all the decisions she make for me."). Child indicated how true each item was of his or her mother (1 = not at all true; 5 = very true). The mean score of the 18 items was taken, with higher scores indicating greater psychological control. The scale has been shown to have acceptable reliability and validity in Chinese middle school students (Wang et al., 2007). In the current sample, the alpha coefficient was 0.89 for the scale.

Externalizing Problem Behavior

Children's externalizing problem behavior was assessed with the Youth Self-Report List for ages 11–18 (YSR/11–18; Achenbach, 1991). The 30-item YSR externalizing scale comprises two subscales (aggressive behavior and delinquent behavior). Children rated each item (e.g., "I get into many fights.") on a 3-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). The responses for the 30 items were averaged, with higher scores indicating greater externalizing problem behavior. The Chinese version of the YSR has already been validated in Chinese children and adolescents and demonstrated adequate reliability and validity (Gershoff et al., 2010; Xing et al., 2011). The internal reliability of the scale was 0.87 in the current sample.

Teacher Support

The teacher (Significant Other) Support Subscale of the MSPSS (Zimet et al., 1990) was used to assess the children's perception of support from their teachers. On a scale ranging from 1 (never) to 5 (always), children completed four items, such as "There is a teacher who is around when I am in need." The mean of the four items was taken, with a higher score representing greater teacher support. As a commonly used instrument for assessing children's perception of social support, the Teacher Support Subscale of the MSPSS has been validated in China and demonstrated adequate reliability and validity (Zhao et al., 2018). The alpha coefficient of the subscale was 0.81 in the current sample.

Children's Anxiety

The Chinese version of the Spence Children's Anxiety Scale (SCAS; Zhao et al., 2012) was employed to assess children's

anxiety. The SCAS contains 44 items (e.g., "I worry about being away from my parents"), 38 of which can be grouped into six subscales: separation anxiety disorder (6 items), social phobia (6 items), physical injury fears (5 items), panic disorder and agoraphobia (9 items), obsessive-compulsive disorder (6 items), and generalized anxiety disorder (6 items). The remaining six statements are positively worded filler items. Children rated how often they experienced each symptom on a 4-point scale ranging from 0 (never) to 3 (always). The mean was taken, with higher scores indicating greater anxiety. The alpha coefficient of the scale was 0.93 in the present study.

RESULTS

Descriptive Statistics and Correlations

A multivariate analysis of variance (MANOVA) was conducted to examine the group differences of the key variables (i.e., psychological control, externalizing problem behavior, teacher support, and anxiety), with parents' migrant status and children's gender as the between-group factors. The results of the MANOVA indicated that the combined dependent variables were significantly affected by children's gender [$F_{(4,733)} = 24.91$, $p < 0.001$, $\eta^2 = 0.12$] and parental migrant status [$F_{(4,734)} = 2.97$, $p < 0.05$, $\eta^2 = 0.02$]. As shown in **Table 1**, compared with girls, boys reported higher scores on maternal psychological control and externalizing problem behavior and lower scores on anxiety. *Post-hoc* tests revealed that, compared with accompanied children and children with a migrant father, children with two migrant parents had higher scores on psychological control and anxiety, and no significant difference in the two variables was found between children with a migrant father and accompanied children. The interaction between parents' migrant status and gender was not significant [$F_{(4,734)} = 1.92$, $p > 0.05$, $\eta^2 = 0.01$]. Given that children's gender was associated with most variables of the current study, it was therefore included in subsequent analyses as a control variable.

The partial correlations among all the key variables separated by parent migrant status and adjusted for children's gender are reported in **Table 2**. As shown, for the three groups, maternal psychological control was positively associated with children's anxiety. The online resource provided by Lowry (1998) was used to test the significance of the difference between two independent correlation coefficients. It was found that this association was stronger for children with two migrant parents than for accompanied children ($Z = 2.36$, $p < 0.05$). No significant differences in this association were found between children with two migrant parents and those with only a migrant father ($Z = 1.52$, $p > 0.05$) or between children with a migrant father and accompanied children ($Z = 1.05$, $p > 0.05$). Externalizing problem behavior was negatively associated with children's anxiety among the three groups. Teacher support was negatively associated with anxiety in children with two migrant parents and accompanied children but not in children with only a migrant father.

Hierarchical Regression Analyses

To test whether the relationship between psychological control and children's anxiety was moderated by children's externalizing

problem behavior and teacher support, and whether the specific moderating mechanisms depended on parents' migrant status, we conducted six hierarchical regression analyses. Regression analyses were performed separately for each type of family and each moderator. Gender was entered in the first step as a controlling variable, and the main effects of psychological control and the moderator were entered in the second step. The interaction term (psychological control × moderator) was entered in the third step. The online resource provided by Preacher et al. (2003) was used to estimate the simple slope. The values at 1 SD above and below the mean of the moderators were used to calculate the simple slopes of the association between psychological control and children's anxiety. Prior to conducting the regression analyses, all predictors were mean centered to reduce multicollinearity. **Table 3** shows the results of six regression analyses.

Three regression models testing the moderating role of externalizing problem behavior were computed first. The results showed that the regression models were all significant, explaining 40, 23, and 29% of the variance in anxiety for children with two migrant parents, children with a migrant father and accompanied children, respectively. Specifically, both the main and interaction effects of psychological control and externalizing behavior were statistically significant for accompanied children, suggesting that externalizing problem behavior moderated the association between maternal psychological control and accompanied children's anxiety (see **Table 3**). The results of the follow-up simple slope analyses revealed a pattern consistent with an exacerbating process. As indicated in **Figure 1**, maternal psychological control was positively associated with anxiety for accompanied children with higher levels of externalizing behavior but not for those with lower levels of externalizing behavior. Although the main effects of psychological control and externalizing behavior were statistically significant, the predicted interaction effects failed to reach significance for children with two migrant parents and with only a migrant father, suggesting that externalizing problem behavior did not moderate the association between psychological control and anxiety in left-behind children populations (see **Table 3**).

The results from the other three regression models testing the moderating role of teacher support showed that the regression models were statistically significant, explaining 27, 13, and 15% of the variance in anxiety for children with two migrant parents, children with a migrant father, and accompanied children, respectively. Both the main effect of psychological control and its interaction with teacher support were significant for children with a migrant father, suggesting that teacher support moderated the association between psychological control and anxiety in children with a migrant father (see **Table 3**). The results of the follow-up simple slope analyses demonstrated a pattern consistent with a buffering process. As illustrated in **Figure 2**, maternal psychological control was positively associated with anxiety for children with a migrant father at lower levels of teacher support, but this association became non-significant for those at higher levels of teacher support. Although the main effects of psychological control and teacher support were statistically significant, the predicted interaction effects failed to reach significance, suggesting that teacher support did not

TABLE 1 | Comparisons of the key variables between parents' migrant status groups/children's gender groups (mean ± standard deviation).

	Total by parents' migrant status				Total by children's gender		
	Cmp	Cmf	AC	Partial η^2	Boys	Girls	Cohen's d
Psychological control	2.15 ± 0.58	2.03 ± 0.52	2.04 ± 0.55	0.01	2.14 ± 0.56	1.99 ± 0.52	0.28
Externalizing behavior	0.28 ± 0.24	0.25 ± 0.21	0.25 ± 0.19	0.00	0.28 ± 0.22	0.22 ± 0.18	0.30
Teacher support	1.19 ± 0.62	1.20 ± 0.64	1.19 ± 0.61	0.00	1.21 ± 0.65	1.18 ± 0.60	0.05
Anxiety	0.96 ± 0.54	0.87 ± 0.46	0.85 ± 0.48	0.01	0.83 ± 0.42	1.02 ± 0.49	−0.42

Cmp, children with two migrant parents; Cmf, children with only a migrant father; AC, accompanied children.

TABLE 2 | Correlations among variables separately for two-migrant-parent children, only-a migrant-father children, and accompanied children.

	1	2	3	4
1. Psychological control	–	0.36***	0.01	0.24***
2. Externalizing behavior	0.35*** (0.35***)	–	−0.16**	0.43**
3. Teacher support	0.10 (−0.03)	−0.09 (−0.15)	–	−0.22***
4. Anxiety	0.32*** (0.45***)	0.43** (0.54***)	−0.05 (−0.22**)	–

Coefficients in parentheses below the diagonal are the correlations between variables for children with two migrant parents, and coefficients outside parentheses refer to children with a migrant father. Coefficients above the diagonal are the correlations between variables for accompanied children. **p < 0.01; ***p < 0.001.

moderate the association between psychological control and anxiety for children with two migrant parents and accompanied children (see **Table 3**).

DISCUSSION

Previous research indicates that parental psychological control is associated with children's anxiety (Bebes et al., 2015; Stone et al., 2015; Zhao et al., 2018). The present study extended such findings to left-behind children in rural China. Moreover, this study went beyond prior research by simultaneously examining this association in different families of parents' migrant status and further exploring whether the moderating roles of externalizing problem behavior and teacher support varied as a function of parents' migrant status. The results largely supported our hypotheses, as discussed below.

As anticipated, our analyses of different families of parents' migrant status revealed that children with two migrant parents reported higher levels of anxiety than children with only a migrant father and accompanied children, and no significant difference was found between children with only a migrant father and accompanied children. Attachment theory suggests that loss of the attachment figure (e.g., physical separation) may increase children's vulnerability to anxiety (Brumariu and Kerns, 2010). Thus, this disadvantages experienced by children with two migrant parents may partly be attributable to the lack of secure attachment with their parents. Specifically, although migrant fathers and mothers provide their children with more economic resources, the secure attachment bond between child and parents may be interrupted due to the reduced sensitivity and availability of parental response and the weakened parent–child bonding and communication (Cheng and Sun, 2014), thus contributing to the elevated level of anxiety symptoms.
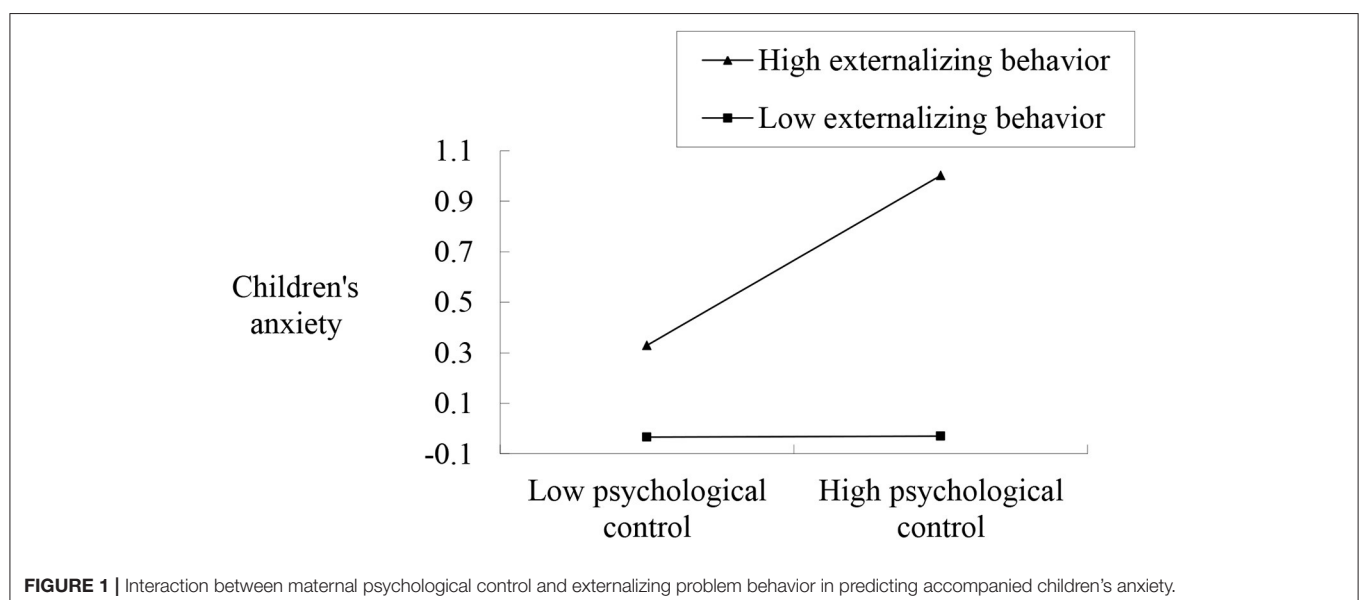
However, children with a migrant father may not only enjoy better financial conditions as a result of their father's earnings but also benefit from their accompanied mother (Zhao et al., 2015), considering that mothers are typically the most dedicated caregivers in the family and that children tend to feel closer to mothers. The company of left-behind mothers is perhaps the primary reason why there was no significant difference in levels of anxiety between children with a migrant father and accompanied children.

By simultaneously investigating the associations between maternal psychological control and children's anxiety in three types of families, the present study found evidence that a higher level of perceived maternal psychological control was associated with more anxiety symptoms in all types of families. This finding is in line with the results of studies across a broad range of samples (Stone et al., 2015; Salaam and Mounts, 2016; Zhao et al., 2018). It has been suggested that parental psychological control thwarts children's autonomy and identity development (Bebes et al., 2015) and is therefore hypothesized to represent a threat to children's emerging sense of self (Stone et al., 2015). Stress-process theory asserts that life events and chronic stress are more likely to result in distress or anxiety when they function to diminish the self (Frazer and Fite, 2016), which may partly explain the negative impact of maternal psychological control on children's anxiety. In addition, the present study also found that children with two migrant parents had a stronger association between maternal psychological control and their anxiety than accompanied children. This finding was basically consistent with our hypothesis and indicated that the association between a negative parenting environment and offspring's maladaptive outcomes was stronger for disadvantaged children with two migrant parents than for accompanied children. This result was also in line with context-dependent theory, which suggests that chronic and cumulative stress may be a source

TABLE 3 | Summary of hierarchical regression analyses for the relationship between psychological control and anxiety with externalizing problem behavior/teacher support included as a moderator.

Variables	Children with 2 migrant parents		Children with a migrant father		Accompanied children	
	β	SE	β	SE	β	SE
EPB as a moderator						
Step 1						
Gender	0.23**	0.09	0.16**	0.05	0.24***	0.05
Step 2						
Gender	0.32***	0.07	0.24***	0.05	0.28***	0.05
PC	0.29***	0.06	0.19***	0.05	0.26*	0.05
EPB	0.43***	0.08	0.36***	0.07	0.38***	0.07
Step 3						
Gender	0.31***	0.07	0.25***	0.05	0.28***	0.05
PC	0.31***	0.06	0.19***	0.05	0.26***	0.05
EPB	0.50***	0.09	0.39***	0.09	0.36***	0.07
PC × EPB	0.12	0.11	0.07	0.10	0.13*	0.09
TS as a moderator						
Step 1						
Gender	0.23**	0.09	0.16**	0.05	0.24***	0.05
Step 2						
Gender	0.24**	0.07	0.18**	0.05	0.28***	0.05
PC	0.43***	0.06	0.33***	0.05	0.24***	0.05
TS	−0.20**	0.06	−0.09	0.04	−0.22***	0.04
Step 3						
Gender	0.24**	0.07	0.19**	0.05	0.28***	0.05
PC	0.44***	0.06	0.33***	0.05	0.24***	0.05
TS	−0.21**	0.06	−0.08	0.04	−0.21**	0.04
PC × TS	−0.07	0.09	−0.13*	0.06	−0.05	0.07

*PC, psychological control; EPB, externalizing problem behavior; TS, teacher support. Gender was coded 0 for boys and 1 for girls. *p < 0.05; **p < 0.01; ***p < 0.001.*

FIGURE 1 | Interaction between maternal psychological control and externalizing problem behavior in predicting accompanied children's anxiety.

for children's high reactivity to negative environments that lead to their maladaptation (Obradović et al., 2010; Steeger et al., 2017). Specifically, compared with accompanied children, children with two migrant parents may face more challenges and experience more pressure. For instance, they not only suffer

from separation from their parents but also experience difficulties in independently solving problems in life and study. Chronic stress may contribute to their emotional arousal, which may make them more sensitive to maternal psychological control. Further research needs to explore the possible mechanism of
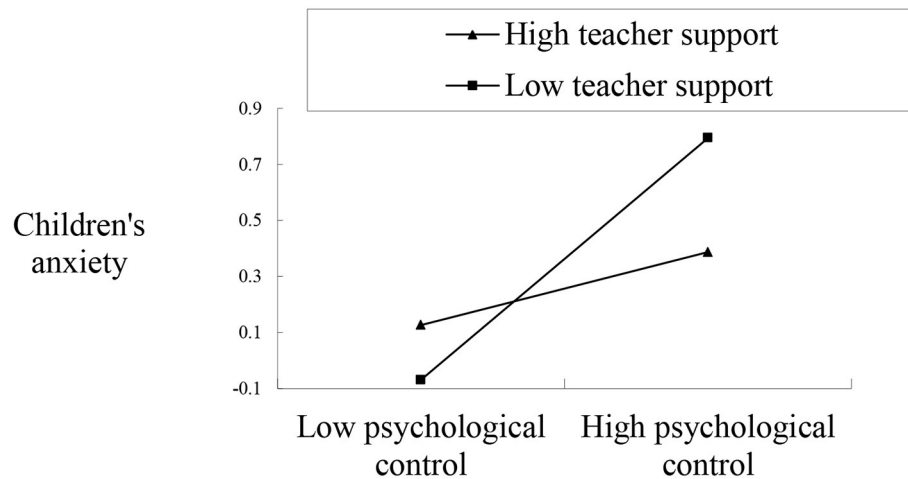
FIGURE 2 | Interaction between maternal psychological control and teacher support in predicting anxiety in children with only a migrant father.

emotional arousal underlying this association in left-behind children's populations.

This study found that the moderating effect of externalizing problem behavior on the association between maternal psychological control and child anxiety varied as a function of parents' migrant status. Among accompanied children, externalizing problem behavior exacerbated the association between maternal psychological control and their anxiety. This finding was basically in line with those of prior research in intact families (Caron et al., 2006; Pereira et al., 2009; Gere et al., 2012), indicating that psychological control parenting may not be uniquely related to children's anxiety and that the significant association between psychological control and child anxiety may be influenced partly by cooccurring externalizing problem behavior in the same children. Based on this finding, special attention must be paid to helping parents in non-migrant families regulate what their children do, such as guidance, monitoring, and rule setting (Pomerantz and Wang, 2009), to buffer the negative impact of maternal psychological control on their children's anxiety by decreasing the level of children's externalizing problem behavior. However, of note, among two-migrant-parent and only-a-migrant-father children, maternal psychological control was always associated with their anxiety regardless of the level of their externalizing problem behavior. This finding was in line with our anticipation and the viewpoint of context-dependent theory, which suggests that increasing emotional arousal resulting from parental absence may strengthen the negative impact of maternal psychological control on left-behind children's anxiety (Steeger et al., 2017), even though the other risk factors were at a lower level (Wen and Lin, 2012). Based on this finding, it is possible that a fundamental strategy to relieve anxiety or cultivate the well-being of left-behind children was to decrease their parents' migration from rural to urban areas so that more children live in a situation of parental care and nurturance. However, with the rapidly increasing number of children left by both parents or father only in their original

rural community, there is still a long way to go in solving the problem of left-behind children's well-being (Luo et al., 2009). Thus, more research is necessary to explore protective buffers against vulnerable situations of parental absence in the future, which may be helpful for developing an effective intervention program to improve the well-being of left-behind children (Zhao et al., 2015).

To better understand the protective factor that benefits left-behind children's adjustment, the present study further explored the moderating role of teacher support in the association between maternal psychological control and children's anxiety in different families of parents' migrant status. It was found that the moderating roles of teacher support varied across parents' migrant status. Among children with only a migrant father, teacher support buffered the impact of maternal psychological control on children's anxiety. This finding was consistent with prior research that demonstrated social support buffering against the vulnerable situations of parental absence (Zhao et al., 2015, 2018). This finding was also consistent with social provisional theory, which suggests that parents and significant others are both important providers of social support and that the relationship with significant others may become increasingly important provisional resources when the parent-child relationship is lacking in social provisions (Furman and Buhrmester, 1985). Thus, it is possible that the teacher becomes an important source of social support serving to protect against anxiety problems for children lacking fathers' care and nurturance. It is noteworthy, however, that the moderating roles of teacher support in the association between psychological control and anxiety were not found among accompanied children and those with two migrant parents, although the main effects of teacher support on the decrease in anxiety were significant in the two groups. Considering that family support matters more than the support of significant others in childhood and adolescence (Runtz and Schallow, 1997), support from fathers may effectively counterweigh the protective role of teacher support in the impact of maternal

psychological control on accompanied children's anxiety. In families with two migrant parents, children have the lowest level of family support and are most disadvantaged in terms of anxiety or other health problems; thus, the support of significant others (e.g., teachers) may not sufficiently buffer the negative impact of maternal psychological control on their anxiety. However, special attention is still needed to institutionalize teacher support by training, evaluation, and regulation, given the beneficial roles of teacher support in decreasing the anxiety of two-migrant-parent children and accompanied children and buffering the negative impact of maternal psychological control on the anxiety of only-a migrant-father children. This finding is very encouraging: it is presumably easier to promote the quality of teacher support via school training than to improve the quality of family support (Wen and Lin, 2012), which is hard to influence in migrant families in rural China.

LIMITATIONS

This study suffers from several methodological limitations. First, this study used a cross-sectional design; thus, it is difficult to make causal inferences. Future longitudinal studies need to firmly establish causal associations between variables. Second, the data of this study were solely based on children's reports, which may introduce systematic biases in estimates of associations among the key variables. Third, this study only recruited samples from the Linyi area of China. It remains unknown whether our findings can be generalized to left-behind children in other rural areas of China. Further research needs to recruit representative samples from different regions of rural China to replicate these findings.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board at the Institute of Psychology, Chinese Academy of Sciences. The participants' legal guardian provided written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed in this study made a substantial, direct and intellectual contribution to the work, and approved it for publication. ND: data curation, formal analysis, methodology, and writing—original draft. HB: data curation, formal analysis, and writing—review. JZ: project administration, conceptualization, writing—review and editing, and supervision.

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School Adjustment and Socio-Family Risk as Predictors of Adolescents' Peer Preference

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This work analyzes peer preferences at the beginning of adolescence. For this purpose, each adolescent's sociometric status was studied in their classroom group, and attempts were made to identify indicators of academic, personal, and socio-family adjustment related to that status. Participants were 831 adolescents studying 1st grade of Compulsory Secondary Education (CSE), in 31 classrooms from 10 schools. The 31 tutors of these students also participated. Sample selection was intentional. A quantitative research approach was used. Sociometric data were collected using the nomination method. Teachers provided information about these youths' adjustment and family risk variables. Descriptive analyses and bivariate correlations were calculated as a preliminary analysis of the study. Chi-square tests or ANOVAs examined the similarities and differences between status based on personal, socio-family, and school adjustment variables. Lastly, linear regression analysis and a Structural Equation Model (SEM) were performed. These latter analyses revealed that good performance and academic adjustment are important predictors of successful social relations. Also, the data show that the presence of personal and socio-family risk variables makes it difficult for adolescents to be accepted by their peers. The results suggest the need for school and family support to promote peer acceptance. Working on both aspects can help improve classroom coexistence. Intervention techniques are recommended for the entire group to intervene on attitudes, interpretations, and behaviors that enrich individual tools and the collective climate.

Keywords: adolescents, social preference, sociometric status, school adjustment, socio-family risk

INTRODUCTION

Peer relationships in the school context represent a unique experience of socialization during adolescence. These relationships are more egalitarian and transient than family relationships and include a wide range of phenomena, such as behaviors, affects, thoughts, motivation, and relationships (Rubin et al., 2015). Maintaining adequate relationships with peers has multiple benefits for individuals' cognitive, affective, and social development (Becker and Luthar, 2002; Buhs et al., 2006).

Many researchers have analyzed the concept of peer preference (or social preference among peers) and have tried to determine its correlates during adolescence. Peer preference in the classroom has been widely assessed using sociometric techniques. Sociometric nomination

expresses the position or social status that the student presents in their classroom, according to their peers' opinion (Aparisi et al., 2015). The nomination method is one of the most common procedures for measuring sociometric status (García-Bacete, 2006; Muñoz et al., 2008). Each student names the classmates they like to be with and those they do not like to be with. It is thus possible to prepare for each student a social preference index (the number of positive choices minus the number of negative choices) and a social impact index (the amount of positive and negative choices) (Coie et al., 1982; Coie and Dodge, 1983). These indices allow classification of the students into different sociometric statuses: popular (positive social preference and high impact), rejected (negative social preference and high impact), neglected (low social preference), controversial (average social preference and high social impact), or, finally, the rest of adolescents as average. Being popular is even a primary goal of many adolescents to gain greater social security (Igbo and Nwaka, 2013). In contrast, experiences of social rejection can affect adolescent well-being, even promoting the onset of psychiatric disorders (Schneider et al., 2016). The quality of relationships and the degree of acceptance/rejection experienced by adolescents are key aspects of psychosocial adjustment at this life stage (Estévez et al., 2009).

According to Bronfenbrenner (1979) ecological model of human development, what happens in the peer microsystem is not alien to the experiences in other systems (such as family and school) that are significant for the developing individual. This study focuses on the links between adolescents' acceptance by peers and variables from the school microsystem and the family microsystem.

Researchers have tried to identify the characteristics of boys and girls of each sociometric status. There is considerable empirical evidence regarding the involvement of variables from the school microsystem. School adjustment, understood as the adaptation to the demands and characteristics of the school system as well as the degree to which adolescents feel comfortable in this setting, and which we analyze in this work, is one of the variables that differentiate the students (Rodríguez-Fernández et al., 2012). Recent studies have confirmed the association between peer acceptance and academic performance (Gallardo and Barrasa, 2016; Rambaran et al., 2016; Wentzel et al., 2020). Academic difficulties and school failure are generally higher among rejected students. Students nominated negatively by their peers are more likely to attribute academic failure to internal causes such as ability and effort than positively nominated students (Inglés et al., 2017). This greater school failure is due to different factors (Cava and Musitu, 2000). On the one hand, social acceptance influences motivation for academic achievement and participation in learning tasks. Second, some personal skills are involved both in socially competent behavior and academic adjustment. These skills include, for example, self-regulation, impulse control, helping and cooperative behaviors, or self-confidence. And finally, as the evaluations made by teachers and peers usually coincide (Ahn and Rodkin, 2014), the same children who are evaluated more negatively are habitually the ones who receive less support, both by teachers and peers.

There is less evidence about the role of socio-family variables in peer preferences during adolescence. As indicated in a review on sociometric status and adolescence (Martínez et al., 2012), parents' support enhances the social competence of their children by increasing their ability to form positive social relationships. This support influences peer acceptance or rejection, with rejected adolescents feeling less supported by their parents, while the accepted children positively value the support and communication with their parents (Estévez et al., 2006). Also, the quality of family relationships is closely related to the behavior that children will develop in social interaction with others in the future (Helsen et al., 2000; Musitu and Cava, 2001; Musitu and García, 2004). Rejected children perceive their families as less cohesive, more conflictive, with less positive communication and achievement orientation, and planning and participation in cultural activities (García-Bacete et al., 1990). Other current researches have shown a different analysis. Studies such as those of Estévez et al. (2014) highlighted the results obtained in their work with adolescents, where they indicated that the emotional and family adjustment levels of aggressive popular students were as negative as those of aggressive rejected students.

The links between social risk and peer preferences are not clear. Van de Schoot et al. (2010) showed that, when sociometric status is analyzed among adolescents at psychosocial risk, there are some differences, and some boys with antisocial behaviors are among the most preferred in the classroom. In our particular study, we will analyze the influence of the accumulation of socio-family risk variables on peer preference among adolescents. According to the cumulative risk theory, when risks accumulate, their effects on well-being increase. The concept of cumulative risk explains that exposure to multiple risk factors predicts more adverse developmental consequences compared to singular risk factor exposure (Evans et al., 2013). As Rodríguez Rodríguez and Guzmán Rosquete (2019) confirmed, the accumulation of at least two risk factors, such as parents' emotional maladjustment, economic problems in the family, low educational level, and high conflict in family relationships, increase the likelihood of school failure. In the same line, authors such as Garcés-Delgado et al. (2020) have referred to adolescents born and growing up in low-education and low-economic families, with few social support networks, belonging to socially excluded minority cultures and unstructured families as "minors at risk of social exclusion." The accumulation of potential family risk factors may compromise youth adjustment (Buehler and Gerard, 2013), but the relationship between this variable and peer preference has received less attention.

It is also interesting to know the role of other personal variables. In terms of gender, for example, the percentage of boys rejected by their peers is higher than that of girls (Van de Schoot et al., 2010). The differences between boys and girls remain constant throughout schooling (Martín, 2016). In other research with adolescents, girls perceived higher peer acceptance than boys (Tamm et al., 2014). In line with these data, a recent study on the influence of gender in peer acceptance or rejection at recess has shown that girls and boys both mainly reject boys, in first and second place. The reasons are related to the personality of the rejected classmate, affective characteristics, and differences in the type of game (Luis Rico et al., 2020). Results from other studies have emphasized boys' poorer development of social skills (Mikas and Szirovitza, 2017). As sociometric status is usually analyzed

in peer groups with very similar ages, the age variable has hardly been studied in relation to possible interstatus differences. Despite the little evidence about this variable, we believe it is necessary to analyze possible differences between statuses. When some children are older than their peers in the same grade, it is usually because they have repeated one or more courses. One might wonder whether being older can be considered a risk factor concerning peer preference in the class group. When applying the cumulative risk theory, the presence of multiple personal risk factors (gender, age), together with socio-family risk factors, could lead to more adverse results.

In the present study, we sought to extend our current understanding of the link between peer preference during adolescence and academic functioning, and personal and family variables in students of the first grade of Compulsory Secondary Education (CSE) in Spain. The relationships of academic adjustment with social status among peers have been preferably studied during childhood and, to a lesser extent, during adolescence (Prinstein, 2007). Similarly, little is known about the concrete contributions of family and social contexts of origin to acceptance in the peer group. This work aims to provide new data to research, also replicating the results obtained in other studies in other contexts. Based on the previous findings reviewed, we hypothesized that (1) individual academic adjustment will be positively related to higher peer preference and 2) some personal (being a boy) and family variables (less family involvement and socio-family risk) will hinder adolescents' preference by their peers.

MATERIALS AND METHODS

Participants

The sample consisted of 831 adolescents enrolled in the 1st grade of CSE in Spain. Data were collected from 31 classrooms of 10 different schools. The 31 tutors of these students also participated. The selection of the sample was done through intentional sampling, taking into account the following parameters: (a) ownership of the school (public schools/private-concerted schools), (b) size of the population (large, more than 90,000 inhabitants/medium, less than 90,000 inhabitants), and c) socioeconomic level of the families (medium/medium-low). To respect the percentages of students in public and private schools in the province of residence, we maintained similar proportions when selecting the schools participating in the sample (75.9% public schools and 24.1% private schools).

All the classes of 1st grade of CSE of the selected schools participated. All the participants who did not have any missing value on the completed scales were selected. Of these participants, 53.5% were boys and 46.5% were girls, the mean age was 12.45 years (SD = 0.706). According to the information of the tutors, 4.7% of students belonged to ethnic minority groups, 11.3% had learning difficulties, 7.2% belonged to unstructured families, 5.3% were described by teachers as having significant economic needs, and at least 1.6% had a member with some substance addiction.

Measurements

Sociometric Status

Following the procedure of Coie and Dodge (1983), sociometric status was calculated following the next steps. To assess *peer liking* (positive nominations), we asked adolescents to nominate three classmates with whom they would like to share experiences and personal needs (e.g., "If you're worried or have a problem, which classmates would you tell it to and ask for advice?"), to play or spend free time (e.g., "Which classmate do you like to be with the most in your free time [to go out with, at recess,...]?") and to study with or do homework together (e.g., "Which classmate would you choose to do homework together?"). To assess *peer disliking* (negative nominations), we asked them to nominate three classmates with whom they would not like to do the above-mentioned activities. These nominations were standardized within each classroom. Four scores were calculated for each participant: (1) *standardized* score of the *sum of positive nominations* received, (2) *standardized* score of the *sum of negative nominations* received, (3) *Social Preference Index* (SP), by subtracting the negative nominations from the positive nominations received, and (4) *Social Impact Index* (SI), by adding the positive and negative nominations. Based on these scores, each participant was assigned to one of five sociometric status categories: popular, average, rejected, controversial, and neglected. For this purpose, the following formulas were applied: Popular (Z SP > 1, Z positive nominations > 0, Z negative nominations < 0), Rejected (Z SP < −1, Z positive nominations < 0, Z negative nominations > 0), Neglected (Z SI < −1, Z positive nominations < 0, Z negative nominations < 0), Controversial (Z SI > 1, Z positive nominations > 0, Z negative nominations > 0), and Average (rest of the group). As Cava et al. (2010b) indicate, the internal consistency index (Cronbach's α) for this measure is rarely used due to theoretical difficulties when conceptualizing sociometric measurement within a classical psychometric framework (Terry, 2000).

School Adjustment

Completed by the teacher in the classroom, the Scale of Teacher's Perception of School Adjustment (EA-P; Cava and Musitu, 1999) is made up of eight items about the teachers' perceptions of each one of their students in four areas or subscales: Social Adjustment (e.g., "The student's degree of social adjustment in the classroom"), Academic Performance (e.g., "Current approximate academic performance"), Family Involvement (e.g., "Degree of family implication in the child's school performance"), and Teacher–Student Relationship (e.g., "His/her relationship with this student"). The response scale ranges from 1 to 10 (1 = *poor/very bad* and 10 = *high/very good*). The reliability of the global scale in this study was α = 0.91, and it was higher than α = 0.85 in the four subscales. These indices are very similar to those used in previous studies, which obtained α = 0.91 or higher (Cava and Musitu, 1999; Cava et al., 2010a).

Socio-Family Risk

With the information provided by the teachers on different family variables, the Cumulative Socio-Family Risk Index was

generated. The cumulative risks exposure (range 0–4) was calculated by adding the four single risk indicators (0 = *Absence* and 1 = *Presence*): Addictions in the immediate family members, Significant economic needs (serious economic difficulties that impair meeting the basic needs), Very unstructured families or problem families (family group lacking a structure in terms of education, limits, schedules, coexistence, affectivity, and/or families that are in constant conflict), and Ethnicity different from the majority. This kind of score has been used previously to calculate a cumulative socio-family risk index (Rodríguez Rodríguez and Guzmán Rosquete, 2019) and with other psychological constructs, such as adverse childhood experiences (McCrory et al., 2015; Deschênes et al., 2018).

Procedure

After receiving the consent of the school directors and families, we visited the classrooms. The research project was accepted by the Doctoral Committee of the University of Cádiz (Spain). Permission was obtained from the local educational authorities and the School Council at each school. We obtained informed consent from all individual participants included in the study. Student participation was voluntary. We administered the questionnaires in whole class groups. Tutors were provided with the forms to be completed by them about each of their students.

Data Analysis

Data analysis was carried out using the Statistical Program for the Social Sciences PASW Statistics for Windows (version 21) and EQS 6.2. We present descriptive results and the relationships between the variables from the bivariate correlation analyses. Based on the standardized Social Preference (SP) and Social Impact (SI) indices, the sociometric status of each participant was calculated. Chi-square tests and ANOVAs were used to analyze the differences and similarities between sociometric status as a function of personal variables (sex and age), socio-family risk variables, and school adjustment variables. The analyses were completed with post hoc group comparisons. Cohen's d was used to calculate the magnitude of the group differences (effect size). The magnitude could be small ($d = 0.2$), medium ($d = 0.5$), or large ($d = 0.8$) (Cohen, 1988).

For the second group of analyses (regression model and Structural Equation Model), the standardized Social Preference score was used as a criterion variable. A regression analysis model was performed to explore the degree to which students' social preference could be predicted from personal, socio-family variables, and school adjustment variables. Finally, we calculated a Structural Equation Model (SEM) to study the influence of these variables and the degree to which they determine variations in social preference among adolescents.

RESULTS

Table 1 shows the descriptive statistics of the variables of the study. The results of the Pearson correlation analysis revealed statistically significant correlations between them ($p < 0.05$). Age and the Cumulative Socio-Family Risk Index (CSR) showed

a significant negative correlation with the Social Preference Index and the Teacher's Perception of School Adjustment (and its four subscales: academic performance, social adjustment, teacher–student relationship, and family involvement). Social preference correlated positively with the Teacher's Perception of School Adjustment.

Sociometric Status

Taking into account the positive and negative preferences received by each boy and girl from their classmates, the standardized Social Preference and Social Impact indices of each student were calculated. With these data, each of the 831 participants was classified in one of the five sociometric statuses. Descriptive data of the five groups are shown in **Table 2**.

Sociometric Status and Personal and Family Characteristics

The distribution by gender among the different statuses showed significant differences, $\chi^2(4) = 21.084$, $p < 0.001$ (**Table 3**). The proportion of boys in the rejected and neglected status was much higher than expected, and that of girls was higher in the average and popular status (adjusted standardized residuals > 2).

Regarding age, some differences were close to statistical significance, $F(4, 826) = 2.34$, $p = 0.054$. The popular adolescents were younger on average, closely followed by the neglected ones. The average and the controversial adolescents were in an intermediate position, with the rejected ones being the oldest.

The presence of certain family variables (addictions, economic needs, unstructured family, and a different ethnic group) was analyzed among the students of each of the sociometric statuses. Although their presence was always greater in the group of rejected boys, the group differences were only significant in unstructured families, $\chi^2(4) = 16.38$, $p < 0.01$. The percentage of rejected adolescents living in unstructured families was higher than in the other groups (adjusted standardized residuals > 2). The neglected and popular students lived in unstructured families to a lesser extent.

When comparing the mean scores of the Cumulative Socio-Family Risk Index, the ANOVA yielded significant differences between the scores of the different groups, $F(4, 826) = 3.71$, $p < 0.01$. The highest Socio-Family Risk Index was found among the students in the rejected group, followed by the controversial group. The lowest Socio-Family Risk Index was observed in the neglected and popular groups. It was observed that the rejected group scored significantly higher than the neglected ($d = 0.27$) and popular groups ($d = 0.27$) on the Cumulative Socio-Family Risk Index, with small effect sizes.

Sociometric Status and Teacher's Perception of School Adjustment

The school adjustment of each student was evaluated through their tutors. On a scale of 1 to 10, the total mean score of the Teacher's Perception of School Adjustment Scale was 6.49 (SD = 1.69). There were clear differences in the school adjustment of adolescents of the different sociometric statuses, $F(4, 826) = 16.72$, $p < 0.001$. The best school adjustment was

Variables	1	2	3	4	5	6	7	8
1. Age	1							
2. CSR	0.21**	1						
3. Social Preference	−0.13**	−0.13**	1					
4. Academic Performance	−0.37**	−0.30**	0.33**	1				
5. Family Involvement	−0.28**	−0.28**	0.20**	0.71**	1			
6. Social Adjustment	−0.22**	−0.26**	0.37**	0.60**	0.48**	1		
7. Teacher–student relationship	−0.16**	−0.20**	0.28**	0.60**	0.59**	0.65**	1	
8. EA-P	−0.32**	−0.32**	0.35**	0.88**	0.85**	0.79**	0.82**	1
M	12.45	0.18	0.00	5.64	6.53	6.71	7.13	6.49
SD	0.70	0.50	0.98	2.24	2.35	1.77	1.64	1.69

CSR, Cumulative Socio-Family Risk Index; EA-P, Scale of Teacher's Perception of School Adjustment.
$**p < 0.01$.

	Rejected	Controversial	Neglected	Average	Popular	Total
Frequency	73	32	55	594	77	831
Percentage	8.8	3.9	6.6	71.5	9.3	
Preference						
Mean	−2.22	−0.81	−0.03	0.15	1.35	0.00
SD	(1.08)	(1.27)	(0.18)	(0.45)	(0.37)	(0.98)
Impact						
Mean	1.78	1.92	−1.25	−0.24	0.50	0.01
SD	(1.41)	(0.88)	(0.19)	(0.43)	(0.50)	(0.98)

		Rejected	Controversial	Neglected	Average	Popular	Total
Gender	Male	68.5% (2.7)	65.6% (1.4)	70.9% (2.7)	51.0% (−2.3)	41.6% (−2.2)	53.5%
	Female	31.5% (−2.7)	34.4% (−1.4)	29.1% (−2.7)	49.0% (2.3)	58.4% (2.2)	46.5%
Age	Mean (SD)	12.63 (0.80)	12.50 (0.76)	12.36 (0.64)	12.46 (0.70)	12.30 (0.58)	12.45 (0.70)
CSR	Mean (SD)	0.35 (0.69)	0.21 (0.49)	0.07 (0.26)	0.19 (0.51)	0.07 (0.26)	0.18 (0.50)

CSR, Cumulative Socio-Family Risk Index. Below the percentages, in parentheses, are the Adjusted Standardized Residuals.

presented by students of the popular status ($M = 7.65$, SD = 1.24). Bonferroni's *post hoc* tests indicated that this score was higher than that of the students in the rest of the groups ($p < 0.05$).

Regarding the subscales of the Teacher's Perception of School Adjustment Scale, Academic Performance, $F_{(4, 825)} = 15.72$, $p < 0.001$, Social Adjustment, $F_{(4, 826)} = 16.57$, $p < 0.001$, Relations with Teachers, $F_{(4, 825)} = 10.19$, $p < 0.001$, and Family Involvement, $F_{(4, 803)} = 8.07$, $p < 0.001$ were significantly different among the five sociometric statuses. The highest scores of the popular adolescents and the lowest scores of the rejected adolescents stand out (**Figure 1**). **Table 4** shows the magnitude of the comparisons.

Predictive Capacity of Personal, Socio-Family, and School Adjustment Variables for the Social Preference Index

A linear regression analysis was performed to study the effect of personal and socio-family variables and the Teacher's Perception

of School Adjustment on social preference. To confirm the validity of the model, we analyzed the independence of the residuals. The Durbin-Watson statistic obtained a value of $D = 2.073$, confirming the absence of positive (values close to 0) and negative (values close to 4) autocorrelations. The absence of collinearity was also assumed and, thus, the stability of the estimates when obtaining high tolerance values and low Variance Inflation Factors (VIF).

In the first step, gender (coded as boy = 1, girl = 0), age, and CSR index were entered and, in the second step, three subscales of the Teacher's Perception of School Adjustment were introduced (Academic Performance, Teacher–Student Relationship, and Family Involvement).

The regression model was significant and predicted 14.5% of the variance of social preference (**Table 5**). The slope of the preference among classmates decreased in boys, older students, and students with higher CSR as the values of academic performance, relationship with teachers, and family involvement decreased.
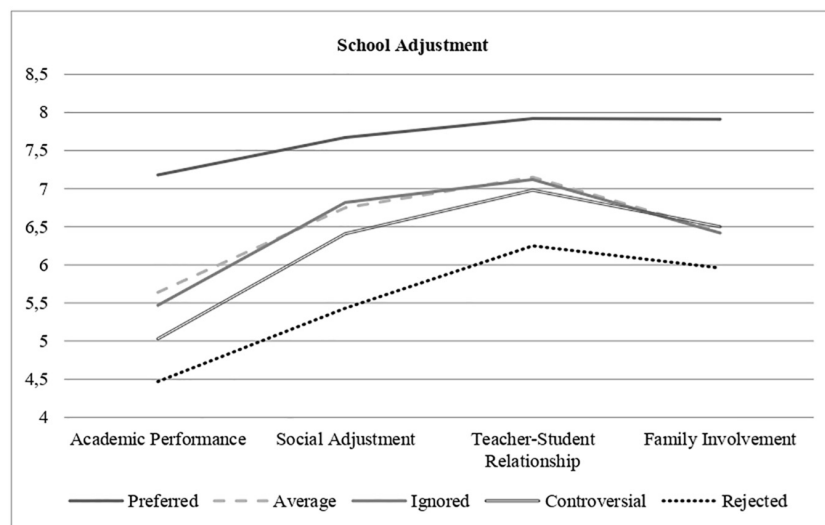
FIGURE 1 | School adjustment and Sociometric status.

TABLE 4 | Cohen's *d* value for *post hoc* contrasts between sociometric groups on EA-P dimensions.

R vs C	R vs N	R vs A	R vs P	C vs N	C vs A	C vs P	N vs A	N vs P	A vs P
EA-P	0.55	0.57	1.27			0.84		0.71	0.69
AP		0.52	1.20			0.68		0.75	0.68
FI			0.82			0.59		0.63	0.62
SA	0.78	0.74	1.25			0.71			0.51
TSR	0.52	0.54	1.01					0.48	0.46

R, rejected; C, controversial; N, neglected; A, average; P, popular; EA-P, Scale of Teacher's Perception of School Adjustment; AP, academic performance; FI, family involvement; SA, social adjustment; TSR, teacher–student relationship.

TABLE 5 | Regression analysis to predict Social Preference Index based on personal, socio-family, and school adaptation variables.

Variables	*R*	*R*^{2}	Adjusted *R*^{2}	SE	β	Collinearity statistics	
						Tolerance	VIF
Gender	0.173	0.030	0.029	0.977	−0.119**	0.972	1.029
CSR	0.216	0.047	0.044	0.970	−0.043*	0.842	1.187
Age	0.236	0.056	0.049	0.966	−0.015	0.917	1.090
Academic achievement	0.356	0.127	0.122	0.929	0.268**	0.404	2.476
Student-teacher relationship	0.374	0.140	0.134	0.923	0.175**	0.572	1.747
Family involvement	0.381	0.145	0.139	0.920	0.111*	0.440	2.273

CSR, Cumulative Socio-Family Risk Index; VIF, Variance Inflation Factor.
*p < 0.05. **p < 0.001.

Predictive Model of the Social Preference Index

We used an SEM to provide an overview of interrelationships and influences of the variables (personal, socio-family risk, and school adjustment variables) that better explain adolescents' social preferences. First, the normality of the data, skewness and kurtosis, and the multivariate kurtosis Mardia coefficient were analyzed. In our structural analysis, the Mardia coefficient was 23.31, and the normalized estimate was 29.50, exceeding by far the limit value of 5 established to be considered a multivariate normal distribution (Bentler, 2005). Therefore, the Robust Maximum Likelihood method was used.

The relationship between the variables showed the importance of the variables included in the model, whose standardized regression coefficients revealed their influence in the dependent latent variable. Given the sensitivity of the chi-square statistic to sample size, additional measures of model fit were used: the root mean square error of approximation (RMSEA), the Bentler comparative fit index (CFI), the Bentler-Bonett non-normed fit index (NNFI), Bollen's fit index (IFI), and McDonald's fit index

(MFI). All estimates were statistically significant, and the model fit adequately, as all the values of the global fit indices of the model met the criterion of being greater than or equal to 0.95, and the value of RMSEA was less than or equal to 0.08 (Ferrando and Anguiano-Carrasco, 2010; Ruiz et al., 2010). The fit indices obtained were: χ^2 = 9.0830, df = 8, p = 0.335, RMSEA = 0.013, NNFI = 0.997, CFI = 0.999, IFI = 0.999, and MFI = 0.999.

Figure 2 shows the variables included in the model and the standardized factorial coefficients. The indicators presented adequate factor loadings, ranging between 0.17 and 0.89. Personal and Socio-Family Risk characteristics, as well as School Adjustment (although to a lesser extent) had a direct relationship with social preference. These relationships accounted for 21% of the total variance of social preference. The model also revealed the existence of the interaction between the factors of personal and socio-family risk characteristics and academic adjustment.

DISCUSSION

The objective of this work was to identify personal, socio-family, and academic indicators related to the peer preference of Spanish adolescents in their classroom. Previous research has contributed to the knowledge of behavioral differences shown by children of different statuses. Less is known about the role of school adjustment and other personal and social characteristics of those involved. This work aimed to contribute in this regard. In this study, the sociometric technique was used to analyze social relationships in the classroom due to its easy application and empirical validity. The extensive sample of participants has allowed us to identify different statuses in each classroom, and discriminate some more prototypical personal, family, and school characteristics of each sociometric typology.

The results support the first hypothesis proposed in this work and coincide with those of other works (García-Bacete et al., 2010): Academic adjustment is positively related to a higher social preference among peers. The preferred adolescents receive a more positive academic evaluation by their teachers. They stand out for their better performance and school effort, presenting much higher scores than the other groups. They are also the youngest in the group, which denotes that they have seldom had to repeat a course. As Aparisi et al. (2015) pointed out, the children who are accepted the most by their peers are more interested in acquiring knowledge, as well as achieving good academic results, and advancing in their studies. Kingery et al. (2011), in a study with adolescents, also emphasized that those who get along the best with their classmates and are more accepted by their peers perform better in school. Good relationships with peers may be serving as a secure basis for exploration in the school setting (Meeus et al., 2002). At the opposite end, our results showed that rejected boys not only have difficulties at the social level but also present worse academic adjustment. This has been demonstrated in other studies where rejected adolescents are negatively valued by their teachers in variables such as acceptance, adaptation, effort, collaboration, participation, behavior, maturity, performance, intelligence, and

success (García-Bacete et al., 1990). Also, these youngsters are somewhat older than the rest, probably because there is a higher proportion of children who have had to repeat some course. In the same line, other authors (Rodríguez et al., 2012) indicated that rejected adolescents report greater academic difficulties, more school failure, and less motivation towards studies than accepted adolescents. A review conducted by Wentzel et al. (2010) showed that adolescents who do not perceive their relationships with their classmates as being based on providing attention and support tend to present academic and behavioral problems.

Regression analysis and SEM confirm the strong relationships between children's academic adjustment and social adjustment at the beginning of secondary education. These are probably two areas of personal adjustment where children are more or less successful in applying personal skills and knowledge. For both tasks, skills such as self-control, reflection, perspective-taking, or interpretation of rules are necessary. These skills may be poorly developed among children with worse social acceptance, who also fail to apply them to academic tasks. Deficits in information processing among rejected students have been reported by other researchers (Estévez et al., 2009). Systematic work on these competencies can therefore be useful to improve both the classroom climate and academic achievement.

Additionally, the results of this research highlight the two most opposing statuses, the children who received the most negative nominations (the rejected ones) and those who received the most positive nominations (the preferred ones), with the latter being the ones with the most differentiated profiles. Rejected children suffer the worst peer acceptance, and their tutors also describe their relationships with them as less positive. Our data show high correlations between teachers' perception of children's social adjustment and peer evaluation. Both tend to evaluate the same students negatively. The SEM corroborates this. As Cava and Musitu (2000) emphasized, the degree of coincidence between the perception of students and that of the teacher is usually high. Coinciding with other studies (Helsen et al., 2000; Cemalcilar, 2010), students who have non-conflictive relationships with the teacher are generally more accepted by their peers and are better adapted to school, unlike rejected children (García-Bacete and Monjas, 2009).

As the second hypothesis suggested, some personal and socio-family variables can act as risk factors for peer preference. The gender variable has shown significant differences in Social Preference, which is higher among girls. For example, there are more rejected boys than rejected girls. In both the Regression Analysis and the SEM, being a boy contributed to a lower peer preference. In this sense, Van de Schoot et al. (2010) also found more rejected (69.6 vs. 30.4%) and neglected boys (67 vs. 33%) compared to girls. Other previous studies also showed more favorable data for girls (Cava et al., 2010b; Tamm et al., 2014), which could be related to different patterns of socialization and different capacities for empathy in boys and girls (Mestre et al., 2009). Thus, for example, it has now been shown that adolescent girls need relationships with high emotional content earlier than boys (Naranjo Pou et al., 2020).

And finally, supporting Bronfenbrenner's ecological model, some variables of the specific socio-family microsystem of

FIGURE 2 | Model of structural equations social preference. *$p < 0.05$.
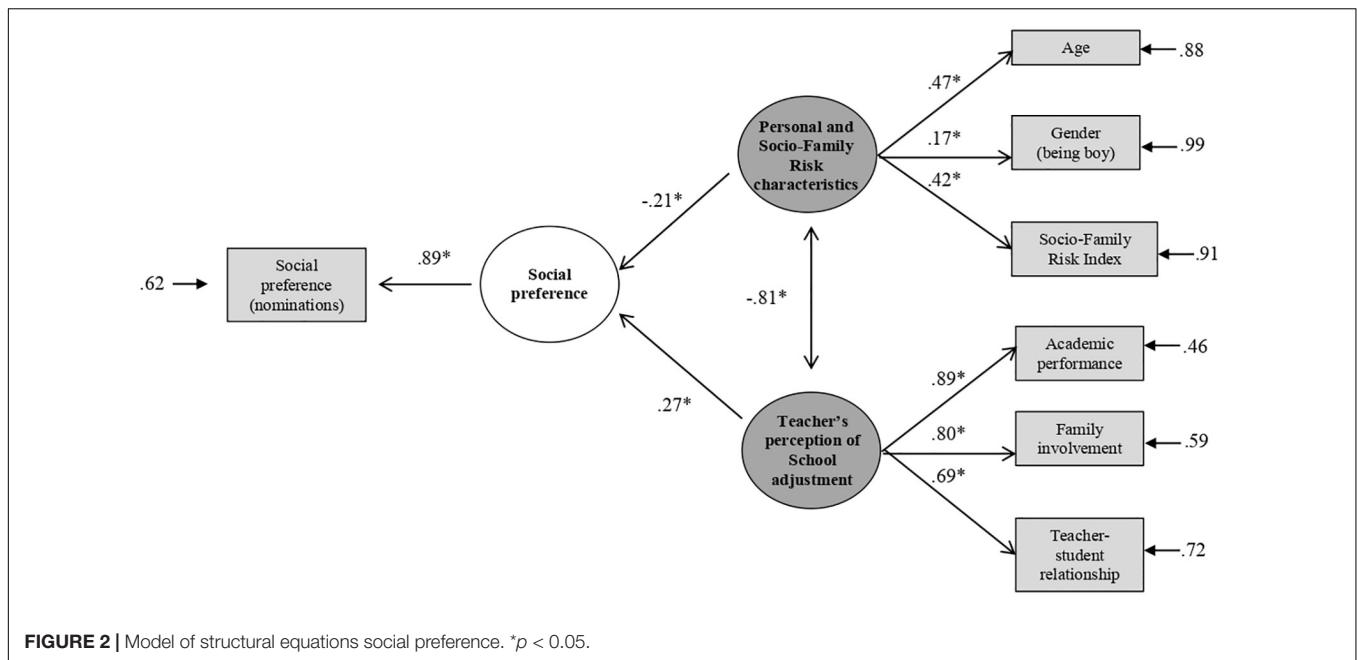
adolescents appear to be related to peer preference. The social and family conditions of peer-rejected children seem to be more complicated, as indicated by the higher socio-family risk rate presented on average by this group. Drawing on the accumulated risk theory (Evans et al., 2013), the accumulation of stressors in these families, a lack of supports, and the practice of maladaptive educational patterns may be hindering the learning and development of socioemotional skills needed to establish and maintain adaptive peer relationships (Dishion, 1990; Evans and English, 2002). Studies with adolescents from at-risk families have precisely shown the implication of these family variables in the manifestation of externalizing and internalizing problems (Lorence et al., 2013), problems also closely related to peers' greater or lesser preference. In this same line, the results of work carried out with other family variables (Tamm et al., 2014) have indicated that only the quality of the mother–child relationship was related to acceptance by adolescent peers. In this last study also, boys and girls who had more siblings, lived in a mono-maternal family, and had anxious attachment reported less acceptance by peers. Our results are in line with these other studies that show the link between risk variables from the family microsystem and the dynamics within peer groups.

The results of the subscale about parents' participation in their children's school life show that the families of adolescents with higher peer preference seem to be more involved in the school setting. There is less family involvement among the rejected children. In line with results obtained in other research, when tutors provide information about rejected adolescents, the teachers perceive their families as less participatory and less involved in the teaching and the educational community, with a lower degree of communication-agreement with the teachers and a lower cultural level. Some research has shown that this rejection profile may be

determined by inappropriate relational styles learned within the family (Díaz-Aguado and Martínez, 2006; Estévez et al., 2007). As has been shown, and as other authors have been defending (Helsen et al., 2000), parent–child relationships have a great influence on adolescents' behavior in other significant scenarios such as interaction with peers. According to the review of Martínez et al. (2012), parental support enhances children's social competence by promoting their ability to develop positive social relationships, and this affects peer acceptance/rejection.

In conclusion, the data in this study support the hypotheses proposed at the beginning of the work. School adjustment is an important predictor of the success of social relationships among adolescent peers. Moreover, the presence of personal and socio-family risk variables makes it difficult for adolescents to be accepted by their peers, as formulated in the second hypothesis. We emphasize the need for school and family support to promote peer acceptance. Working on both aspects can help improve classroom coexistence. Given that the peer group does not always respond as expected to the rejected children's change in behavior (Cava and Musitu, 2003), intervention techniques are recommended for the entire group, to intervene in attitudes, interpretations, and behaviors that enrich individual tools and the collective climate.

As a limitation to our work, we would like to point out that precisely the involvement of families in the academic monitoring of their children, as well as socio-family risk variables, were measured exclusively by the information provided by the tutors. Unlike teachers in early childhood education or primary education, secondary education tutors may not have sufficient information about these aspects. It would have been desirable to complete this information by other means. This lack of teachers'

knowledge of students' family aspects may be indicating the importance of a mesosystem variable, such as the knowledge that teachers have of children's family context of origin. As future lines of research, we aim to incorporate the direct evaluation of measures of relationship and involvement of the family context. It would also be interesting to know the expectations of teachers about their students in different fields (academic, personal, economic, and family well-being), which, in addition to conditioning the behavior of the students and affecting their academic evolution, could influence the parents' perception of these students. Likewise, parents' expectations about their children's future are a key aspect to study for their adaptation and adjustment (Sánchez-Sandoval et al., 2019).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité Doctorado de la Universidad de Cádiz. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

Both authors designed the study, collected and analyzed the data, and wrote the manuscript. Both authors contributed to the article and approved the submitted version.

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Chinese International Students in the United States: The Interplay of Students' Acculturative Stress, Academic Standing, and Quality of Life

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Background: Acculturation could cause grave health consequences in international students. However, there is a shortage of research into how acculturative stress might affect international students' quality of life in light of their academic standing and experience. The lack of research is particularly pronounced among Chinese international students, representing the largest body of international students studying in the United States (U.S.). Thus, to bridge the research gap, this study aims to examine the interplay between international students' acculturative stress, academic standing, and quality of life among a nationally representative sample of Chinese international students studying in the United States.

Methods: An online survey that gauges Chinese international students' levels of acculturative stress, academic standing, and quality of life was developed. Over 350 higher education institutions across the United States were approached, including public universities, private universities, and community colleges, among which approximately 220 institutions responded positively and supported survey distribution. A total of 751 students completed the survey. Multiple regression analyses were carried out to examine the associations between students' acculturative stress, academic standing, and quality of life.

Results: Findings reveal that acculturative stress negatively affects all four domains of Chinese international students' quality of life, irrespective of their academic standing. Data analyses also show that compared to master's and doctoral students, undergraduates experience the highest levels of acculturative stress. Furthermore,

a significant difference emerged among undergraduate and doctoral international students' acculturative stress levels, but not among undergraduate and master's students, or master's and doctoral students.

Conclusion: Our study found that, compared to master's and doctoral students, undergraduates had more significant acculturative stress associated with lower levels of quality of life. This finding highlights the potentially positive role of academic experience – while acculturative stress deteriorates international students' quality of life, students' academic standing and experience could be the protective factor in the equation. Future research could further examine how universities and colleges can capitalize on their academic apparatuses and resources to improve international students' academic performance and students' acculturation experience and quality of life.

Keywords: acculturative stress, international students, school classification, quality of life, acculturation

BACKGROUND

Acculturative stress could be understood as the "reduction in the health status of the individuals who have to struggle to adjust to a new culture psychologically and socially" (Berry et al., 1987). Acculturative stress is unique because it occurs as a direct result of acculturation – the process and experience of people from differing cultural and/or social backgrounds interact with each other (Berry, 1980). While several studies suggest that the acculturation process has the potential to promote personal growth (e.g., multiculturalism) (Pedersen, 1991; Berry, 2005), for international students, due to the lack of adequate systematic support, acculturation often results in more harm than good concerning their physical and psychological health (Cho, 2003; Ye, 2006; Poyrazli and Lopez, 2007; Zhang and Goodson, 2011; Servaty-Seib et al., 2016). Existing literature on the impacts of acculturative stress on international students' wellbeing, for instance, shows that students who experience acculturative stress encounter considerable adjustment issues, such as diminished sense of social belonging and pronounced levels of anxiety (Brunsting et al., 2018). Furthermore, research also shows that international students with high acculturative stress often exhibit severe psychological health issues, ranging from depression symptoms to suicidal ideation (Cho, 2003; Ye, 2006; Servaty-Seib et al., 2016).

However, while useful insights are available, little is known about how acculturative stress affects international students' quality of life or how students' academic standing and experience might be a protective factor against their acculturative stress. Quality of life refers to an "individuals' perceptions of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns" (The WHOQOL, 1995). Compared to health outcomes like stress, depression, and suicidal ideation, quality of life is a more comprehensive concept that represents individuals' overall sense of well-being (Bowling, 1991; Brazier et al., 1992; Nussbaum and Sen, 1993; Felce and Perry, 1995; The WHOQOL, 1995), which could provide a more balanced, connected, and complete picture of international students' acculturation experiences.

It is also important to understand that academic standing and experience could play an essential role in shaping international students' perception of acculturative stress. For instance, in a comparative study, researchers found that newly arrived international students have greater difficulty adjusting to living and academic environments than returning students (Poyrazli and Grahame, 2007). Compared with undergraduates, findings also show that graduate students generally have greater academic exposure and academic experience, and in turn, might be more skillful in coping with stressful situations, such as collaborating with students from diverse cultural backgrounds (Oswalt and Wyatt, 2014; Zvauya et al., 2017; Yusufov et al., 2019). However, due to a lack of research, little is known about how academic standing might shape the relationship between acculturative stress and quality of life among international students. To bridge the research gap, this study aims to examine the interplay between international students' acculturative stress, academic standing, and quality of life in a nationally representative sample of Chinese international students studying in the United States. Chinese international students are used as a research sample as they are the largest body of international students in America. Specifically, we set out to address the following research questions:

- How does acculturative stress affect Chinese international students' quality of life in light of their academic standing?
- How does academic standing influence the relationship between Chinese international students' acculturative stress and quality of life?

MATERIALS AND METHODS

Participants and Procedure

Chinese international students studying in the United States were invited to participate in this research from February to April, 2015. Participation requests were sent to International Student Offices and Chinese Students and Scholars Associations first, which were requested to help distribute the survey to their Chinese international students. Potential universities were selected via two approaches: (1) Based on Chinese

Students and Scholars Associations that were present in the United States at the time (Immigration Road, 2015), which consisted mostly medium to large institutions arranged by states, and (2) purposeful and manually contacting universities and (community) colleges (e.g., U.S. News, 2021) that have enrolled Chinese international students but did not have a Chinese Students and Scholars Association and/or International Student Office presence. While over 350 institutions across the United States were approached, only approximately 220 universities' International student offices and Chinese Students and Scholars Associations helped distribute the survey.

The authors' university Institutional Review Board granted ethical approval for carrying out this research (IRB protocol number: 2014-12-0027). Students received an email explaining the purpose of the study and indicated that the completion and submission of the survey implied consent to participate. As an incentive, participants were entered into a draw for a $50 Amazon gift. In terms of eligibility, only participants who self-identified as Chinese international students enrolled in a higher education institution in the United States were invited to participate. Respondents were informed that they could withdraw from the study without penalty at any stage of the study. No force response mechanisms were employed as a measure to reduce potential psychological discomfort participants might experience.

Study Measures
Sociodemographic Variables
Respondents provide information about their gender, age, marital status, academic standing, length of stay in the United States, and self-rated English proficiency. Length of stay and English proficiency were included in the study as previous research shows that they are significant predictors of international student acculturation experience (Williams and Berry, 1991; Lee et al., 2004; Smith and Khawaja, 2011; Lopez and Bui, 2014).

Acculturative Stress
Acculturative stress for international students was measured using a 36-item scale developed by Sandhu and Asrabadi (1994). An example item is, "people show hatred toward me non-verbally" (Sandhu and Asrabadi, 1994). Items were scored on a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). The total score for acculturative stress ranged from 36 to 180, with higher scores indicating greater acculturative stress. In this study, the Cronbach alpha for the total acculturative stress score was 0.96. Here, Cronbach alpha measures the score's reliability ranging from 0 to 1, where a higher value means greater reliability.

Quality of Life
Quality of life was evaluated based on a four-domain structure derived from the World Health Organization (The WHOQOL Group, 1998a,b). The 26-item World Health Organization Quality of Life (WHOQOL) instrument uses a Likert scale and produces four quality-of-life scores: (a) physical health (e.g., "To what extent do you feel that physical pain prevents you from doing what you need to do?"), (b) psychological

health (e.g., "To what extent do you feel your life to be meaningful?"), (c) social relationships (e.g., "How satisfied are you with the support you get from your friends?"), and (d) environment (e.g., "How safe do you feel in your daily life?"). With the current sample, the WHOQOL generated the following Cronbach's alpha scores: physical health (0.75), psychological health (0.80), social relationships (0.73), and environment (0.81).

Data Analysis
Responses downloaded from Qualtrics were entered into a database hosted by the IBM SPSS Statistics for Macintosh, version 24 (IBM Corp., Version 24.0; Armonk, NY, United States). Categorical variables were presented as absolute and relative frequencies (i.e., gender, marital status, academic standing, self-rated English proficiency), while continuous variables were represented by means and standard deviations (i.e., age, length of stay, acculturative stress, quality of life). An analysis of variance (ANOVA) assessed the differences between the means of acculturative stress among the three groups of Chinese international students (undergraduate, master's, and doctoral students). Spearman correlations were calculated as an exploratory analysis to examine bivariate associations between variables. Controlling for sociodemographic variables, linear regression analyses were carried out to explore the associations between acculturative stress and each of the four domains of quality of life. The level of significance was set at 0.05. We deleted data that missed 70% or above of the variable (Scheffer, 2002). Drawing insights from the literature, the multiple imputation method was used to replace values that had less than 60% of the data missing (Blankers et al., 2010).

RESULTS

Participant Characteristics
In total, 751 participants completed the survey among the 2,321 who received it. No differences were found between students who completed the survey and those who did not. The sample (M_{age} = 24.39, SD = 4.18) consisted of 380 women (50.7%), 271 (36.1%) undergraduate students, 213 (28.4%) master's students, and 267 (35.6%) doctoral students. Most participants were single (n = 535, 71.2%). The average length of stay in the United States was 31.85 months (SD = 26.87). Regarding English proficiency, 334 students (44.5%) self-rated it as either average or below average, 412 (54.9%) reported it as good or very good, and 5 (0.6%) did not indicate their proficiency level (see **Table 1**).

Correlations of Key Research Variables
Spearman correlations revealed significant correlations between students' acculturative stress and physical health (r_s = −0.42, p < 0.001), psychological health (r_s = −0.39, p < 0.001), social relationships (r_s = −0.29, p < 0.001), and environment (r_s = −0.36, p < 0.001). All four quality-of-life domains were significantly intercorrelated, with r_s ranging from 0.55 to 0.67, p < 0.001 (please refer to **Figure 1**).

Variables	
Gender, *n* (%)	
Female	380 (50.7)
Male	370 (49.3)
Age in years, *M* (*SD*)	24.39 (4.18)
Marital status, *n* (%)	
Single	535 (71.2)
Non-single	216 (28.8)
Academic standing, *n* (%)	
College	271 (36.1)
Master's program	213 (28.4)
Ph.D. program	267 (35.6)
Length of stay in months, *M* (*SD*)	31.85 (26.87)
English proficiency, *n* (%)	
Average or below average	334 (44.5)
Good or very good	412 (54.9)
Did not state	5 (0.6)
Acculturative stress, *M* (*SD*)	85.71 (23.13)
Quality of life, *M* (*SD*)	
Physical health	14.57 (2.34)
Psychological health	14.14 (2.31)
Social relationships	13.87 (3.02)
Environment	14.06 (2.17)

Regression Analyses of Key Research Variables

Four multiple regression analyses were conducted to examine the variance in students' quality of life (i.e., physical health, psychological health, social relationships, and environment) explained by demographics, length of stay in the United States,

self-rated English proficiency, and acculturative stress. Findings showed that all four multiple regression analyses were significant (please see **Table 2**). In all analyses, self-rated English proficiency was a positive predictor of students' physical health ($\beta = 0.20$, $p < 0.001$), psychological health ($\beta = 0.19$, $p < 0.001$), social relationships ($\beta = 0.13$, $p < 0.01$), and environment ($\beta = 0.17$, $p < 0.001$). Acculturative stress was a negative predictor of physical health ($\beta = -0.34$, $p < 0.001$), psychological health ($\beta = -0.28$, $p < 0.001$), social relationships ($\beta = -0.23$, $p < 0.001$), and environment ($\beta = -0.28$, $p < 0.001$).

Results indicated that among the three student groups, undergraduates had the highest acculturative stress mean score of 88.70 ($SD = 24.36$), followed by master's students ($M = 85.82$, $SD = 21.85$); doctoral students had the lowest score of 82.88 ($SD = 22.58$). An ANOVA addressed the second aim (i.e., whether significant differences manifested in acculturative stress between the three groups). We observed significant differences between groups [$F(2,688) = 3.934$, $p = 0.020$]. A *post hoc* test using Tukey's HSD revealed a significant difference in acculturative stress scores between undergraduate students and doctoral students ($p = 0.014$); however, no significant difference emerged between undergraduate and master's students ($p = 0.392$) or between master's and doctoral students ($p = 0.370$).

DISCUSSION

Acculturative stress negatively shapes the physical and psychological health and well-being of international students (Al-Krenawi et al., 2020; Dorevitch et al., 2020; Jenkins and Boyd, 2020; Liu et al., 2020; Minutillo et al., 2020), a phenomenon that could be further exacerbated by global crises such as international trade wars and the COVID-19 pandemic (Ma and Miller, 2020; Su et al., 2020; Zhai and Du, 2020; Zheng et al., 2020).
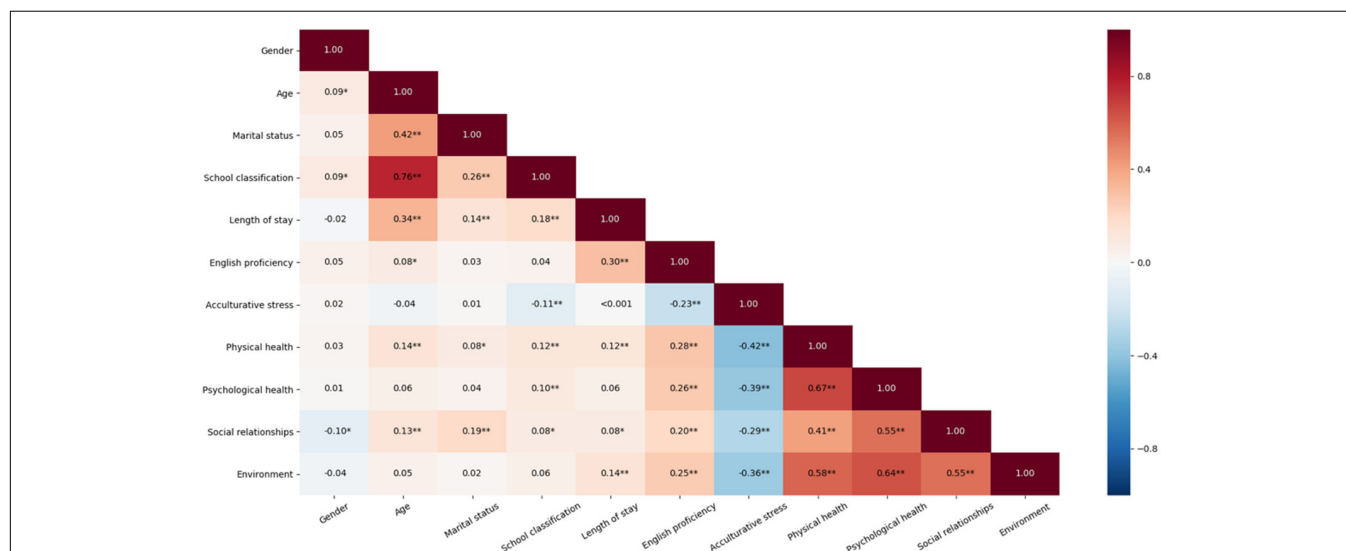
FIGURE 1 | Correlations of key study variables (*N* = 751). *Red colors represent positive correlations, while blue colors denote negative correlations. The darker or more saturated the color, the stronger the relationship. Two asterisks (i.e., **) are used to highlight *p*-values that are less than 0.05, whereas one asterisk (i.e., *) is used to refer to less than 0.1 *p*-values.

TABLE 2 | Multiple regression analyses of key research variables (*N* = 751).

Predictor variables	*B*	*SE B*	*β*	*t*	*p*	Adj. R²
Dependent variable: Physical health QoL						
Gender	0.17	0.18	0.04	0.96	0.34	
Age	0.07	0.03	0.12	1.93	0.05	
Marital status	0.02	0.22	0.004	0.10	0.92	
Academic standing	0.02	0.15	0.01	0.14	0.89	
Length of stay	−0.001	0.004	−0.01	−0.15	0.88	
Self-rated English proficiency	0.94	0.19	0.20	4.90	< 0.001	
Acculturative stress	−0.03	0.004	−0.34	−8.59	< 0.001	0.20
Dependent variable: Psychological health QoL						
Gender	−0.004	0.19	−0.001	−0.02	0.98	
Age	−0.01	0.04	−0.02	−0.27	0.79	
Marital status	0.11	0.23	0.02	0.49	0.63	
Academic standing	0.22	0.15	0.08	1.47	0.14	
Length of stay	−0.003	0.004	−0.03	−0.64	0.52	
Self-rated English proficiency	0.86	0.20	0.19	4.28	< 0.001	
Acculturative stress	−0.03	0.004	−0.28	−6.76	< 0.001	0.14
Dependent variable: Social relationship QoL						
Gender	−0.77	0.25	−0.13	−3.10	0.002	
Age	0.05	0.05	0.07	1.12	0.26	
Marital status	0.90	0.31	0.13	2.88	0.004	
Academic standing	−0.02	0.20	−0.004	−0.08	0.94	
Length of stay	−0.001	0.01	−0.01	−0.18	0.86	
Self-rated English proficiency	0.81	0.27	0.13	3.02	0.003	
Acculturative stress	−0.03	0.01	−0.23	−5.47	< 0.001	0.12
Dependent variable: Environmental QoL						
Gender	−0.11	0.18	−0.03	−0.60	0.55	
Age	−0.004	0.03	−0.01	−0.11	0.92	
Marital status	0.03	0.22	0.01	0.16	0.88	
Academic standing	−0.01	0.14	−0.004	−0.06	0.95	
Length of stay	0.01	0.004	0.07	1.46	0.15	
Self-rated English proficiency	0.73	0.19	0.17	3.86	< 0.001	
Acculturative stress	−0.03	0.004	−0.28	−6.63	< 0.001	0.13

Adj., adjusted; QoL, quality of life.

However, there is a lack of research that sheds light on the intensity, impacts, and consequences of acculturative stress on international students' health and well-being, particularly those of Chinese origin. During the 2019–2020 academic year alone, international students studying in the United States, have collectively contributed $44 billion to the economy and supported approximately 458,290 jobs during their stay – over a third (34.6%) of this student body are Chinese international students – the most significant international student group in the country (Institute of International Education, 2020). What is also worth noting is that many contributions international students made to the United States society, such as improving America's intellectual prowess, innovative power, and cultural diversity (Chellaraj et al., 2005; No and Walsh, 2010; Ghosh et al., 2014; Sato et al., 2019), might be too invaluable to put a price tag on. In other words, research on investigating and addressing international students' health challenges is not only urgently needed from a humanitarian perspective, but also indispensable out of social and economic concerns and considerations.

Addressing this research gap, this study investigates the interplay between international students' academic standing, acculturative stress, and quality of life. To our knowledge, this is the first study that examined the aforementioned relationship in a large geographically representative sample of Chinese international students studying in the United States. Our first research question aims to evaluate the impact of acculturative stress on Chinese international students' quality of life. Findings show that acculturative stress negatively affects students' quality of life regardless of their academic standing. Data analyses further reveal that the negative impact of acculturative stress is permeated through all aspects of international students' quality of life, ranging from physical and psychological health to social relationships.

The second research question aims to study the role of academic standing in shaping the relationship between international students' acculturative stress and quality of life. The results show that, compared to graduate students, undergraduates shoulder greater acculturative stress, and in turn, experienced poorer quality of life. Interestingly, the relationship is only significant between doctoral and undergraduate students. In other words, statistically significant differences only emerged between undergraduate and doctoral students' acculturative stress and quality of life, but not among undergraduate and master's students or master's and doctoral students. One way to shed light on these within-group differences is through a nuanced understanding of the relationship – it is possible that the differences in academic standing and experience, and by extension, students' abilities to cope with their acculturation processes, between doctoral and undergraduate students are meaningfully more pronounced than those of doctoral and master's students or master's and undergraduate students. In other words, compared to undergraduates, doctoral students might have markedly advanced skills and knowledge needed to cope with American culture as well as the United States higher education system (Institute of International Education, 2020), capabilities that master's students may not sufficiently possess. A key takeaway of this finding is that, considering that the academic experience is an adjustable variable, universities and colleges can employ their existing academic apparatus and resources to boost international students' academic performance and lessen students' acculturative stress and improve their quality of life.

In line with previous research (Smith and Khawaja, 2011; Lopez and Bui, 2014), self-rated English proficiency was a significant predictor of international students' acculturation experience. Different from some studies, which suggest that length of stay in the United States significantly shape international students' acculturative stress levels (Koo et al., 2021), the current findings indicate that the relationship was insignificant. One way to shed light on this finding is via gaining a deeper understanding of the scales studied. It is important to note that different from the length of stay, which is primarily an objective measure, self-rated English proficiency is subjective. In other words, rather

than a true reflection of the students' English proficiency, such as (most recent) English language test scores, self-rated English proficiency is more likely to reflect students' confidence with their English capabilities, and by extension, their confidence in interacting with their cultural, social, and academic environments. To further explore these relationships, future research could investigate objective English proficiency measures (e.g. TOEFL or GRE scores), subjective English proficiency scales, length of stay, as well as acculturative stress among international students in the same research context to tease out the nuanced differences in these variables and how these variations might influence international students' acculturation experience.

Another critical area of research that could help explain the differences in undergraduate, master's, and doctoral international students' experiences of acculturative stress centers on the role of perfectionism. Perfectionism could be best understood as the degree to which individuals have high goals and aspirations for themselves (Flett et al., 1989). Mounting evidence indicates that maladaptive perfectionism (i.e., discrepancies between individuals' expectations and performance) is common among college students (Aparicio-Flores et al., 2020a,b; Vicent et al., 2020), especially international students (Huang and Mussap, 2018; Dorevitch et al., 2020; Lee et al., 2020). Research shows that international students' acculturative stress is significantly associated with their levels of perfectionism and years in the host country (Wei et al., 2007).

However, there is a lack of research investigating the role of academic standing in this particular population. Compared to their master's and doctoral counterparts, undergraduates might have a high level of maladaptive perfectionism which could result in greater degrees of acculturative stress. Furthering the role of perfectionism in international students' acculturative stress, future research could examine how perfectionism dimensions might shape international students' acculturative stress and quality of life. In addition, many other potential confounders that might affect international students' acculturative stress, such as the students' socioeconomic background, health, and even the characteristics of the programs they are in, should also be further investigated to gain a more in-depth understanding of international students' acculturative stress and possible intervention strategies.

Limitations

While this study fills critical gaps in the literature, it is not without limitations. First, the study survey was self-administered, which means that findings may be susceptible to social desirability and recall biases. A raffle of a $50 Amazon gift card was offered to show gratitude to students' input and incentivize participation. It is possible that the incentive might result in possible unintended selection bias (e.g., students who are less interested in financial incentives might have chosen to not participate in the survey). Second, the cross-sectional nature of this work means that limited causal conclusions can be drawn from the data. It is also important to note

that one item in the WHOQOL questionnaire was accidentally excluded from the survey design. While the error was addressed with the multiple computation method for missing values (Scheffer, 2002), it is a mistake, albeit unintentional, needs to be acknowledged.

There are many ways to classify academic standing, but we only looked at degree level; future research could address this limitation by investigating other aspects of international students' academic standing and experience. To establish researcher-participant rapport, no force response or quality control measures was deployed in the survey. Though in hindsight, both measures should have been integrated into the questionnaire to boost survey robustness. Aiming to partially address these flaws as well as to gauge international students' acculturative stress amid the coronavirus 2019 (COVID-19) pandemic, the researchers are working on developing a follow-up study that will employ both force response and quality control mechanisms in the survey design.

CONCLUSION

This study is the first to explore the associations between international students' academic standing, acculturative stress, and quality of life in a nationally representative sample of Chinese international students studying in the United States. Our study found that, compared to master's and doctoral students, undergraduates had greater acculturative stress, which was associated with lower levels of quality of life. This finding highlights the potentially positive role of academic experience – while acculturative stress deteriorates international students' quality of life, students' academic standing and experience could be the protective factor in the equation. Future research could further examine how universities and colleges can capitalize on their academic apparatuses and resources to improve international students' academic performance and students' acculturation experience and quality of life.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the IRB protocol number: 2014-12-0027, issued by The University of Texas at Austin's Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

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Socio-Emotional Competencies and School Performance in Adolescence: What Role for School Adjustment?

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There is growing evidence in the literature of positive relationships between socio-emotional competencies and school performance. Several hypotheses have been used to explain how these variables may be related to school performance. In this paper, we explored the role of various school adjustment variables in the relationship between interpersonal socio-emotional competencies and school grades, using a weighted network approach. This network approach allowed us to analyze the structure of interrelations between each variable, pointing to both central and mediatory school and socio-emotional variables within the network. Self-reported data from around 3,400 French vocational high school students were examined. This data included a set of interpersonal socio-emotional competencies (cognitive and affective empathy, socio-emotional behaviors and collective orientation), school adjustment measures (adaptation to the institution, school anxiety, self-regulation at school, and self-perceived competence at school) as well as grades in mathematics and French language. The results showed that self-regulation at school weighted the most strongly on the whole network, and was the most important mediatory pathway. More specifically, self-regulation mediated the relationships between interpersonal socio-emotional competencies and school grades.

Keywords: socio-emotional competence, school adjustment, school performance, network analysis, self-regulation

INTRODUCTION

Interest in socio-emotional competencies in education has grown considerably over the last few decades (Oberle et al., 2016) and there is now a large amount of research showing their positive and adaptive role at school (Durlak et al., 2011; Domitrovich et al., 2017).

A number of studies have shown that better socio-emotional competencies are associated with better school grades (Durlak et al., 2011; Taylor et al., 2017; MacCann et al., 2020).

Several hypotheses attempting to explain the positive relationships between socio-emotional competencies and school achievement have been suggested in the literature, but this issue is not clearly understood. Yet, while educational decision-makers in most western countries are beginning to consider the importance of socio-emotional competencies of pupils, a better understanding of the relationships between these competencies and school achievement may help to build strategies favoring their co-development. One hypothesis that comes from intervention studies assumes that better socio-emotional competencies would allow the pupils to better adapt to school and place them in conditions that are conducive to learning (Corcoran et al., 2018). School adjustment is believed to play a key role in the relationship between socio-emotional competencies and academic achievement. In this paper, we explored the role of several variables of school adjustment in the relationships between socio-emotional competencies and grades in French vocational high school students, using a weighted network approach. This approach is particularly interesting as it allowed us to visualize the structure and strength of interrelations between variables, and to identify direct and indirect mediatory pathways (Epskamp et al., 2012, 2018).

Socio-Emotional Competencies at School

Socio-emotional competencies at school have been mainly explored in the framework of social and emotional learning (SEL), which organizes social and emotional competencies around five types of competence: self and social awareness, self-management, relationship skills and responsible decision-making (Greenberg et al., 2003; Jones and Doolittle, 2017). Programs targeting these competencies have been associated with positive development of a set of school adjustment variables, including decreased anxiety, better adaptation to the institution, more positive attitudes toward oneself, others and school, enhanced relationship quality, fewer disruptive behaviors, and improved self-regulation (McClelland et al., 2007; Durlak et al., 2011; Mega et al., 2014; Taylor et al., 2017). In addition, there is increasing evidence that these programs have a positive effect on school grades (Durlak et al., 2011; Taylor et al., 2017). A deeper exploration of the relationships between socio-emotional competencies and school grades highlighted the specific role of emotion understanding and emotion management (MacCann et al., 2020). These two competencies play a key role in interpersonal processes, which according to MacCann et al. (2020) are one of the main drivers of the relationships

between socio-emotional competencies and school performance. In the present study, we focused on three interpersonal socio-emotional competencies: socio-emotional behaviors, empathy, and collective orientation.

Socio-emotional behaviors are at the root of adaptive social interactions. They encompass knowledge and respect of social rules, listening to and accepting others' opinions, controlling negative emotions, and demonstrating positive behaviors in social situations, such as resolving conflicts or giving a positive image of friends. These overlap with the social awareness and relationship skills which are SEL concepts. Appropriate socio-emotional behaviors at school are required to develop good quality relationships with friends and teachers, and to comply with the school rules and systems. As mentioned above, programs designed to foster students' social awareness and relationship skills, among the five SEL competencies, have shown to positively influence school achievement and that these effects last over several years (Durlak et al., 2011; Taylor et al., 2017). Socio-emotional behaviors have been related to school performance in various cultures (Chen et al., 2004).

Empathy is defined as the ability to understand and share others' emotions. It comprises both cognitive and affective components. Cognitive empathy refers to the ability to adopt the perspective of others, also termed perspective-taking, and is a key process to understand and predict the intentions and emotions of others. It enables effective communication and interaction with others (Decety, 2005; Singer and Lamm, 2009). Affective empathy reflects the ability to share others' emotions and to respond appropriately to others' distress. This ability is believed to be at the root of pro-social behaviors, driving protection and help behaviors (Niezink et al., 2012). Both components of empathy are essential for social interactions, and have been put forward in the social awareness competence of SEL (Jones and Doolittle, 2017). At school, empathy is a foundation for healthy relationships with teachers and peers thus favoring a good adaptation to the institution. It may also contribute to positive learning experiences in collaborative settings (López-Mondéjar and Pastor, 2017).

Collective orientation refers to a team-oriented mindset that facilitates coordination and communication in group work (Driskell et al., 2010). It has been shown to predict performance on various tasks, including decision-making, negotiation and execution tasks (Driskell et al., 2010; Hagemann, 2017). This mindset is essential for successful collaborative learning. Research has shown that collaborative learning is effective if students have enough social skills to engage and interact in group work (Buchs and Butera, 2015). Collective orientation, as an index of a positive attitude toward group work, has been repeatedly shown to have benefits for social and cognitive outcomes, including better school performance (Johnson and Johnson, 2009; Stump et al., 2011).

The Mediating Role of School Adjustment

Conceptual models of socio-emotional learning assume that socio-emotional competencies provide a foundation for better school adjustment, more positive attitudes toward school and

one's self, a more supportive learning environment and less school-related anxiety, which in turn lead to enhanced academic skills (Corcoran et al., 2018). This study focuses on a set of school adjustment variables, including adaptation to the institution, self-perceived school competence, school anxiety and self-regulation at school.

Adaptation to the institution refers to students' abilities and their satisfaction with personal, social and emotional aspects of their integration into the school (Feldt et al., 2011; Credé and Niehorster, 2012). A good adaptation to the institution has been related to positive attitudes toward it and higher self-perceived competence (Martin et al., 1999), as well as to better socio-emotional competencies, such as emotion management abilities in university students (Nightingale et al., 2013). Meta-analytic results indicate that adaptation to the institution is also predictive of school performance (Credé and Niehorster, 2012).

Self-perceived school competence is also an important index of school adjustment. It has been associated with social adjustment, such as peer acceptance, and with socio-emotional competencies which are the ability to manage ones' own emotion and to utilize emotions in social contexts (Harter and Leahy, 2001; Cicei et al., 2012). In addition, it has been found that self-perceived school competence is strongly related to academic performance (Chen et al., 2004; Valentine et al., 2004; Urdan and Schoenfelder, 2006; Chiu and Klassen, 2010; Huang, 2011). Some research has shown that self-perceived school competence and academic performance contribute to each other in a reciprocal manner (Muijs, 1997). In other words, students' confidence in their abilities to achieve success influences and is affected by school performance. Some authors proposed that this reciprocal interaction is driven by behaviors that promote learning goals, such as self-regulation (Schunk and Zimmerman, 2012).

Self-regulation, or self-regulated learning, refers to "learning that results from students' self-generated thoughts and behaviors that are systematically oriented toward the attainment of their learning goals" and a major factor of school adjustment (Schunk and Zimmerman, 2012, p59). Numerous studies have shown that students who adopt self-regulated strategies perform better at school (Weinstein and Acee, 2013). Self-regulation is an effortful process that implies executive control in the social, emotional and cognitive spheres, and individual differences in self-regulatory skills have been related to different empathy levels (Blair and Diamond, 2008; Eisenberg, 2010; Eisenberg et al., 2010). Although not all domains of self-regulation are related to learning (Sitzmann and Ely, 2011), we may hypothesize that self-regulatory processes needed for self-management in social and school contexts share common bases, and that part of the relationships between socio-emotional competencies and school achievement is explained by this common mechanism. Research has shown that self-regulated learning mediates the effects of emotions on academic achievement in undergraduate students (Mega et al., 2014). It is therefore likely that self-regulation at school will be linked to socio-emotional competencies in the network of positive competencies which lead to good school adaptation.

Lastly, school anxiety is a substantial indicator of school non-adjustment, reflecting a lack of emotional wellbeing. Different forms of anxiety including test anxiety, separation anxiety or social anxiety, may occur at school and give rise to general symptoms of anxiety. These symptoms are characterized by negative thoughts (e.g., hopelessness, worry, and fear), physiological reactions (e.g., sweating, upset stomach, and tremors) and/or inappropriate behaviors such as avoidance or procrastination, which may affect the socio-emotional life at school, academic strategies and performance (McDonald, 2001; Wren and Benson, 2004; Chapell et al., 2005; Pascoe et al., 2020). In a recent review, Pascoe et al. (2020) reported consistent adverse effects of school anxiety on academic performance, socio-emotional life at school, and self-regulated learning. Test anxiety has also been shown to be negatively related to self-perceived school competence (Raufelder and Ringeisen, 2016).

Overall, the literature supports reciprocal interrelations between interpersonal socio-emotional competencies, school adjustment and academic performance. However, most studies used methods that do not facilitate the visualization of the structure or a study of the strength of these interrelations. A weighted network approach overcomes these limitations.

The Network Approach in Psychology

The network approach is being increasingly used to visualize and analyze psychological data. This approach considers abilities, personality traits, symptoms and behaviors as directly affecting each other. For example, the network approach has been used in the field of psychopathology (Borsboom and Cramer, 2013; Fried et al., 2017), personality (Costantini et al., 2019) and health psychology (Nudelman et al., 2019) to give a descriptive view of the patterns of co-occurrence of symptoms and health behaviors. Unlike traditional analyses exploring multiple associations, this approach allows the researcher to identify how central constructs are linked in a given network. Centrality is of fundamental interest as it reveals the degree of connectedness with the entire network: a node with a high degree of centrality will act as a hub connecting the whole network and will therefore have an influence on the entire network (Bringmann et al., 2019). Some indexes of centrality also identify nodes that act as mediators between different variables or between a subnetwork of variables, by taking into consideration the frequency with which a given node lies in the shortest path between two other nodes. This approach is therefore useful to explore (1) weighted interrelations between socio-emotional competencies, school adjustment and school grades and (2) the role of various potential mediators between socio-emotional competencies and school grades. Furthermore, the network approach allows the researcher to better understand the weighted role of each variable within the network, thus avoiding the aggregation of data that often masks a finer granularity of how each competence, characteristic or performance interrelate.

Objectives

In this paper, we used a network approach to gain a deeper understanding of the nature and structure of the interrelationships between interpersonal socio-emotional competencies school adjustment and school performance. We analyzed data from a large study of French vocational high

school students (ProFan). Vocational high schools are part of the French education system enabling pupils to learn a trade by gradually moving from the school environment to the world of work often through dual training courses alternating between the workplace and school. Vocational high school students constitute a heterogeneous population mainly from low to average income socio-economic backgrounds, and whose socio-emotional and school functioning is largely under-explored. In this study, we assessed: (1) three interpersonal socio-emotional competencies–socio-emotional behaviors, empathy and collective orientation; (2) four school adjustment measures–adaptation to the institution, self-perceived school competence, self-regulation at school, and school anxiety; and (3) grades in French language and mathematics. We expected all the variables to be directly or indirectly interrelated, as they are all linked to school adjustment.

MATERIALS AND METHODS

Participants

The sample is drawn from the ProFan project, a large research project launched in 2017 by the French Ministry of Education, which tested the impact of collaborative learning on several major outcomes, such as socio-emotional functioning, academic performance, or school adaptation. Two cohorts of students from 109 French vocational high schools participated in this longitudinal research project. Their vocational studies were business, health services, and electricity. The high schools included in the study were chosen by the French Ministry of Education, on a voluntary basis. The classes were selected randomly in these schools, and the study was part of the curriculum, so that the students were obliged to participate. This analysis focuses on data from the initial baseline of the second cohort, which was collected in October-December 2018 from 4342 students (57% females, mean age 16.41 years).

Procedure

The data were collected during school hours in the schools' computer rooms. The students had to fill out an online questionnaire containing 251 items. This questionnaire included items relating to socio-emotional competencies, school adjustment, and academic performance. Other items related to beliefs and attitudes concerning school or learning, and items relating to students' functioning in class were also part of the questionnaire, but were not used in this analysis (see **Supplementary Appendix D**). The questionnaire was presented online using a specially designed internet platform.

Measures of Socio-Emotional Competencies
Socio-emotional behaviors
We used a scale developed by Lippman et al. (2014) to assess the extent to which the participant uses a set of positive skills necessary to get along well with others and function constructively in groups. These skills include expressing respect and appreciation for others, working efficiently with others, presenting ideas and listening to others' ideas, regulating

emotions, behaving according to social norms, and using conflict resolving skills. The scale had eight items (e.g., "I control my anger when I have a disagreement with a friend"), for which the participants had to indicate if the statement was "exactly like [them]" to "not at all like [them]" on a five point Likert scale (Cronbach alpha = 0.69).

Empathy
The Interpersonal Reactivity Index (IRI) (Gilet et al., 2013) was used to assess both cognitive and affective empathy: (1) cognitive empathy: the ability to adopt another person's point of view (subscale: perspective-taking), (2) affective empathy: the tendency to experience compassion for others (subscale: empathic concern). Each subscale contained four items, for which the participants had to indicate whether they agreed with the statements (e.g., "Before criticizing somebody, I try to imagine how I would feel if I were in their place.") on a 7 point Likert scale from "strongly agree" to "strongly disagree" (Cronbach alpha = 0.76 for empathic concern and 0.64 for perspective-taking).

Affiliation
An eight-item subscale of the Collective Orientation Scale was used to assess the ability and tendency to value working with others as opposed to working alone (Driskell et al., 2010). For each item, the participants had to indicate if they agreed with a statement (e.g., "I can usually perform better when I work on my own") on a five point Likert scale from "totally agree" to "totally disagree" (Cronbach alpha = 0.76).

Measures of School Adjustment
Self-perceived competence at school
It was assessed using the French version of the five-item perceived school competence subscale (Bariaud, 2006) from the Self-Perception Profile for Adolescents (Harter, 2012). Each item presented a description of two groups of students with opposite characteristics. Participants were asked to select the group that best described them and assess how true that assertion was for them ("really true for me" or "sort of true for me"). Each item had a score from one to four, and the responses were averaged to obtain a subscale score. A high score indicated a high self-perceived competence at school. The internal consistency was moderate, but acceptable (Cronbach alpha = 0.67).

Self-regulation at school
Nine items adapted from the Motivated Strategies for Learning Questionnaire (Pintrich, 1991) were used to assess self-regulated behaviors at school, including the ability to concentrate and motivate oneself (e.g., "I am able to work on my own at home and at school") or to work independently (e.g., " I prepare myself before an exam"). For each item, the participants had to answer using a seven point Likert scale from "totally disagree" to "totally agree" (Cronbach alpha = 0.86).

Adaptation to institution
We used the Student Adaptation to College Questionnaire (SACQ) (Dahmus et al., 1992) to asses general adaptation to the school environment. This questionnaire had sixteen items

which assessed three dimensions: social adaptation (e.g., "If I feel depressed, my friends will help me to get better"), attachment to institution (e.g., "sometimes, I would like to give up everything"), emotional and personal adaptation (e.g., "I can't get used to my life here"). A global score of general adaptation to the institution was computed from the 16 items using a seven point Likert scale ranging from "totally disagree" to "totally agree" (Cronbach alpha = 0.84).

School anxiety

We used a questionnaire adapted from the State-Trait Anxiety Inventory for Children (STAIc) (Turgeon and Chartrand, 2003), in order to assess school anxiety. The French version adapted by Pouille (2016) contains (e.g., "when I go to school, my heart beats fast"), for which participants had to indicate the frequency with which they experienced the symptoms on a four point Likert scale from "never" to "always" (Cronbach alpha = 0.85).

Measures of School Performance

The participants were asked to provide their grades in mathematics and French language obtained the year preceding the data collection. Self-reported grades have been shown to be reliable, especially for children from grades 9 to 11 (Sticca et al., 2017). Grades in the French education system are based on a 20-point scale. We collected self-reported grades on a five-point scale (1 = 0–4.9; 2 = 5–8.9; 3 = 9–12.9; 4 = 13–15.9; and 4 = 16–20) to avoid over or under reports.

Socio-Demographic Measures

The students' socio-economic status (SES) was coded according to the parents' occupational status from 1 (low SES) to 4 (high SES). The highest occupational status in the family was selected for the analysis. The majority had a low SES (40% = 1; 27% = 2; 25% = 3; and 8% = 4).

Data Preparation

To remove invalid data, we computed a variability score for each scale and each participant, using an intraindividual standard deviation (iSD) coefficient. We chose to remove data from each participant showing no variation (iSD = 0) in scales using reversed items, which suggested that they had systematically responded with the same pattern of responses, independently of the meaning of the items. Around 20% of the data were thus removed, leading to a final sample of 3,385 participants aged 15–20 years (60% female, mean age 16.35 years).

Analysis

Network Construction[1]

Partial correlation networks were computed using the R package qgraph (Epskamp et al., 2012; Epskamp and Fried, 2018). The full R code for these analyses can be

[1] Although we did not have any hypothesis concerning any gender effect in the structure and strength of interrelations in the network. We ran two exploratory analyses to compute different networks for girls and boys. It is indeed not possible to include both binary and non-binary variables in the network to control for or explore the effect of gender (Van Borkulo et al., 2014). The networks can be viewed in the **Supplementary Appendix B**. The networks show similar structures and central variables for boys and girls.

found in the **Supplementary Appendix B**. We performed a lasso regularization of the networks using EBIC selection (hyperparameter λ = 0.5) to optimize the network (i.e., aiming to include as few false positives as possible, or not estimating connections that were not true in the network) (Epskamp et al., 2012). All variables were then input into the analysis. The edges were estimated to be above 0.10, meaning that the measures had substantial connections to each other (Cohen, 1988). In the networks, partial correlation coefficients were close to multiple regression coefficients (Epskamp and Fried, 2018). In addition, this model may display potential mediating variables (e.g., A → B → C would show that B mediated the relationships between A and C).
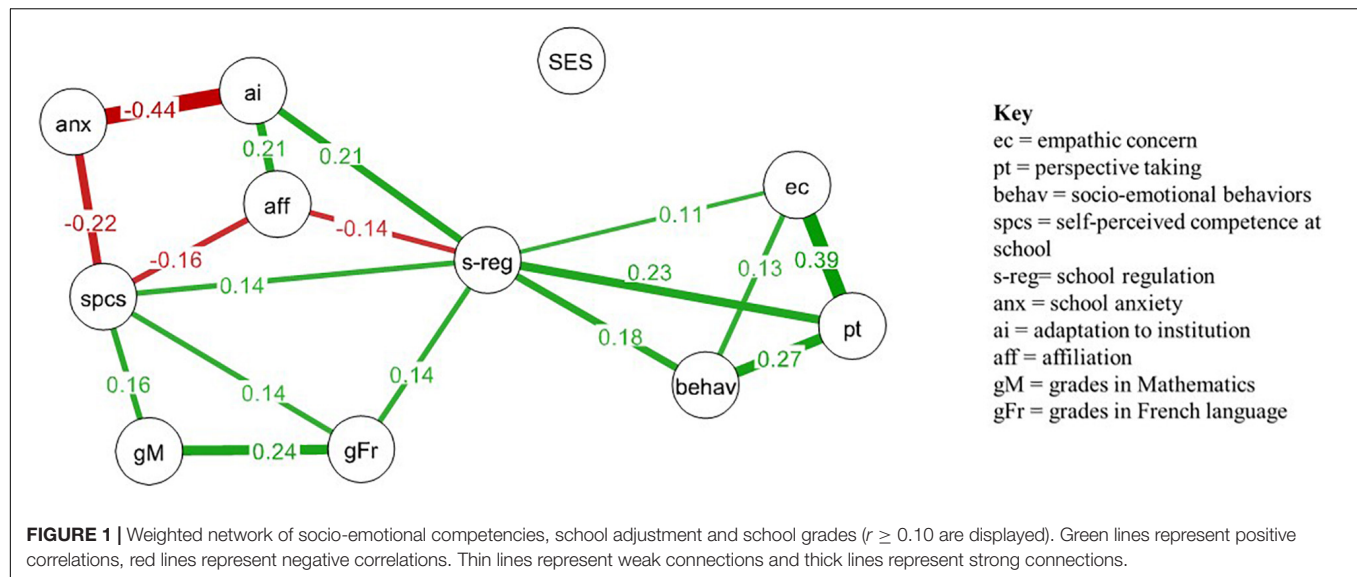
Centrality

Two centrality indexes were computed: Strength and Betweenness. Strength is the sum of weighted values of its connections with other nodes in the network. It provides information on the importance of the node in the network and therefore its potential influence over the entire network (Bringmann et al., 2019). Betweenness reflects the frequency with which a given node lies in the shortest path between two other nodes. It is an indicator of indirect connections and provides information on the mediatory paths between several nodes of the network. These centrality indexes were assessed using the R package *qgraph* (Epskamp et al., 2012). A central node (high strength) with high betweenness will rapidly affect the whole network and reciprocally (Epskamp et al., 2018).

RESULTS

The network concerning socio-emotional competencies is displayed in **Figure 1**, and the centrality nodes of this network are shown in **Table 1**.

A descriptive analysis of the global structure of the network shows that this network is dense, as most of the nodes are weakly to moderately interconnected. Two distinct parts emerge from visual inspection of the network: both affective and cognitive empathy and socio-emotional behaviors are strongly and positively interrelated, and separated from the rest of the network by self-regulation. As expected, grades in mathematics and French language show no direct relationships with socio-emotional competencies, but indirect connections through self-regulation.

Self-regulation shows the highest score of betweenness centrality (**Table 1**)–more than double the second betweenness centrality variable–indicating that this variable has the most indirect connections with other nodes in the network. In addition, self-regulation displays the highest strength centrality, suggesting that this variable is not only an important mediatory variable, but it also weighs heavily on other network variables. It shows direct connections with all socio-emotional competencies and with grades in French language, adaptation to institution and self-perceived competence at school. Conversely, it only shows an indirect connection with grades in math and school anxiety. In other words, it

FIGURE 1 | Weighted network of socio-emotional competencies, school adjustment and school grades ($r \geq 0.10$ are displayed). Green lines represent positive correlations, red lines represent negative correlations. Thin lines represent weak connections and thick lines represent strong connections.

has both strong direct and indirect connections with the whole network.

Unexpectedly, collective orientation (affiliation) is not related to other socio-emotional competencies. It is negatively related to self-regulation and self-perceived school competence, but positively to adaptation to institution. In addition, it is negatively linked to school grades via indirect connections.

School grades are only positively related to self-perceived competence at school for French language and mathematics and self-regulation in French language. All the other network variables only show indirect connections with school grades.

As expected, school anxiety has negative connections with self-perceived competence at school. This is also the case for adaptation to the institution, which is the strongest connection in the entire network.

TABLE 1 | Nodes centralities for each variable of the network.

Variables	Betweenness	Strength
s-reg	**19**	**1.155**
pt	8	0.886
ai	5	0.859
spcs	5	0.813
anx	2	0.656
ec	0	0.631
behav	0	0.590
gFr	4	0.520
aff	0	0.513
gM	0	0.404
SES	0	0.000

cont = emotional contagion; ec = empathic concern; pt = perspective-taking; behav = Socio-emotional behaviors; psc = perceived socio-emotional competence; spcs = self-perceived competence at school; s-reg = school regulation; anx = school anxiety; ai = adaptation to institution; aff = affiliation; gM = grades in Mathematics; gFr = grades in French language; SES = socio-economic status. Nodes with the highest centrality values are in bold.

Lastly, parental SES was not related to any variable of the network, indicating that the structure of the interrelations between interpersonal socio-emotional competencies, school adjustment and grades is similar whichever the SES.

DISCUSSION

Considering socio-emotional functioning, school adjustment and school performance from a functional network perspective allowed us to explore the strength and structure of their interrelations, and to investigate variables that are central within the network and their mediatory paths. Our results showed that (1) socio-emotional competencies, school adjustment and school performance are highly interconnected, (2) self-regulation is a central variable in these functional network, both in terms of strength and as mediatory variables between socio-emotional competencies and school performance.

A Highly Interconnected Network

As expected, variables assessing socio-emotional competencies, school adjustment and school grades were highly interconnected, and form a network of positive functioning at school, adaptive variables being positively related to other adaptive variables, and school anxiety showing negative relationships with adaptation and self-perceived competence at school.

The Central Role of Self-Regulation at School

Academic self-regulation is the most central variable of the network, both in terms of strength and of betweenness. It has connections with virtually all the network variables and mediates the relationships between socio-emotional functioning and other school adjustment variables and school grades. The relationship between self-regulatory abilities and academic performance has been extensively studied, school self-regulation being one of the

strongest predictors of school performance (Zimmerman and Schunk, 2001; Komarraju and Nadler, 2013; Gestsdottir et al., 2014). The relationship between self-regulation at school and socio-emotional competencies has been less explored. Our results showed that self-regulated abilities were related to cognitive empathy, affective empathy and to socio-emotional behaviors. Cognitive empathy, referring to perspective-taking abilities, and the regulation of social behaviors both strongly rely on the cognitive aspects of socio-emotional processing and one may hypothesize that the relationships between school self-regulation and socio-emotional competencies depend on the ability to deploy effective strategies. This supports the idea that the same overarching socio-emotional cognitive factors are important for the regulation of academic work and socio-emotional adaptation (Patrick, 1997). It echoes the recent hypothesis that the regulation of academic emotions is an important mechanism by which socio-emotional competencies influence school grades (MacCann et al., 2020). Furthermore, affective empathy has a weaker connection with self-regulation ($r = 0.11$) than cognitive empathy ($r = 0.23$).

Self-regulation was also positively related to adaptation to institution and to self-perceived competence at school, indicating that students with good self-regulated learning strategies have a more positive view of their scholastic abilities and feel a stronger sense of belonging in their school, and *vice versa*. These interrelations may be explained by a dynamic interaction between positive representations of the self, of others and the school, and the use of effective learning strategies, which could be driven by a general feeling of self-management control (Isen, 2000). Earlier studies have shown that self-perceived competence at school, social behaviors and school grades are consistently related in adolescents from different cultures (Chen et al., 2004). Our results point to the essential role of self-regulation in these relationships.

As our study was conducted among high school adolescents, there may be a different pattern with younger children. Late adolescence is indeed a critical period during which self-regulation is directly related to mental and physical health, social relationships and psychological adjustment (Park et al., 2012; Farley and Kim-Spoon, 2014). Research has shown that self-regulatory abilities increase steadily from pre-adolescence to young adulthood, and that adolescence is a key period for a reorganization and development of regulatory systems (Steinberg, 2005; Steinberg et al., 2018). Although these abilities have a significant impact on diverse outcomes in early childhood, such as better school performance, it is likely that self-regulation gradually becomes a more central process in adolescents' school adaptation. Future studies could explore this subject with younger children.

Variables Connected to School Grades

Grades in mathematics and French language were not central network variables, and showed very low indexes of betweenness and strength centrality. As stated before, school grades were not directly related to socio-emotional competencies, but indirectly *via* self-regulation. Grades in math were only related to self-perceived competence at school, while grades in French language were related to self-perceived competence at school as well as

self-regulation. self-perceived competence at school was therefore the most consistent factor associated with school performance. Numerous studies have pointed to a strong and persistent relationship between self-perception of academic abilities and academic performance (Purkey, 1970; Huang, 2011).

Maladjustment Variables in the Network

As mentioned above, collective orientation showed unexpected connections with other network variables. It was negatively related to both self-perceived competence at school and school self-regulation, and therefore indirectly negatively related to school performance. This observation suggests that group work may be more beneficial to vulnerable students, i.e., those showing lower levels of school adjustment. Alternatively, this negative relationship might be the reflection of poor adjustment of learning and evaluative systems to the group work itself. However, collective orientation showed a positive relationship with adaptation to institution, which may be explained by a common positive disposition toward social environments. Thus, affiliation tendencies could enable students to get along with other classmates in group work situations while also reinforcing social adaptation to the school environment. Conversely, school anxiety was related to lower levels of adaptation to institution and to self-perceived competence at school. Research exploring relationships between internalized problems, school grades and self-perception has shown that self-perception mediated the pervasive effect of school grades on internalized problems (Metsäpelto et al., 2020). Other studies have shown that test anxiety is more strongly related to self-perceived competence at school than to actual school performance (Meece et al., 1990). Consistent with these findings, our results suggest that emotionally vulnerable adolescents have a lower self-perception of their academic competence and/or that a low perception of academic competence generates school anxiety, and that self-perception of competence mediates the relationships between anxiety and grades.

Limitations

The first limitation of our study is the restricted number of socio-emotional competencies taken into account in this analysis. Additional emotional and social skills, such as emotion regulation and emotion recognition, would have provided more information about the architecture of socio-emotional functioning and how it relates to school adjustment. As the network approach depends on the variables used in the analysis, extending our results to a wider socio-emotional network would be necessary to consolidate our findings. This limitation also applies to the potential mediatory variables in the network. The literature highlights several school environment factors and individual characteristics that can also influence school achievement. For example, McCormick et al. (2015) have shown that the positive impact of a socio-emotional learning program on reading abilities was mediated by improved classroom organization. Better socio-emotional competencies might indeed facilitate class climate and organization. Other authors have put forward factors linked to personality and intelligence (e.g., MacCann et al., 2020). As our analysis focused on the benefits of a network approach, future

research could extend its application to a broader analysis of socio-emotional competencies and school adjustment. Another limitation is the use of self-reported grades, which according to some studies, could be less reliable than objective grades (Kuncel et al., 2005). Due to the strict data privacy rules enforced within the French education system, we were unable to access students' grades ourselves.

CONCLUSION AND PERSPECTIVES

The use of a network approach helped us to better understand the architecture relating to socio-emotional competencies and school adjustment, giving a new perspective of their relationships with each other. Analyzing the structure of this network allowed us to make two major advances: (1) adopting an exploratory approach to determine the mediatory variables relating socio-emotional competencies to school performance, and (2) identifying variables that are the most central in the positive network of school adaptation. Our results reveal that, at adolescence, good self-regulation abilities at school are central to both social and affective aspects of adaptation to school and school achievement. This result may have significant implications for education. One application of our results could be the implementation of teaching programs designed to develop students' self-regulation abilities, i.e., organizational, self-management skills, to strengthen school adaptation. For example, some aspects of professional time management training courses could be used in these teaching programs. Our results also suggested that more cognitive socio-emotional competencies, such as perspective taking skills, have a stronger weight on the network of school adaptation than other socio-emotional variables. Keeping in mind the limitation due to the restricted number of socio-emotional competencies in our study, a potential application would be to include perspective taking as a major component of socio-emotional programs at school.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

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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.2021.640661/full#supplementary-material

Supplementary Appendix A | Correlations between all variables of the network.

Supplementary Appendix B | Weighted networks for boys and girls separately.

Supplementary Appendix C | R code for the network analysis.

Supplementary Appendix D | List of other indicators assessed in the PROFAN study.

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