HOMEWORK, LEARNING AND ACADEMIC SUCCESS: THE ROLE OF FAMILY AND CONTEXTUAL VARIABLES

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HOMEWORK, LEARNING AND ACADEMIC SUCCESS: THE ROLE OF FAMILY AND CONTEXTUAL VARIABLES

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The main purpose of this Research Topic is to analyze and identify the main family and contextual variables that are involved in the process of carrying out homework. This will require studying the role played by teachers, students, and families in order to ensure that schoolwork is a useful learning tool. Although the role of the student is, obviously, crucial in homework, research has focused on the cumulative time spent by the student carrying out homework. However, the time spent on homework is not in itself evidence of the student's involvement nor is time spent indicative of quality time. Indeed, an excess of time can sometimes denote low competence in a field of knowledge, while spending less time on homework could be indicative of high competence. It is more likely that a high dedication of time spent on homework reflects high motivation, or comprehension deficits, rather than commitment to learning or academic motivation.

In tandem with the role of the student, teachers, as responsible for prescribing homework assignments for students, also become central players in the process of completing homework assignments. The decisions that teachers make about homework prescriptions, and the amount and type of tasks they set, will determine, to a large extent, the quality of the homework process including the student's motivation and the student's level of engagement with homework. Furthermore, the fact that homework is useful, interesting and motivating for students, will depend on how the teacher prescribes those tasks and the connection established with classroom learning. Teacher feedback also acquires particular relevance for this point by helping the students to accurately estimate the quality of their progress and overcome the difficulties they may have encountered in carrying out their homework. Lastly, the effectiveness of teacher feedback depends on its contribution to the student's educational progress and how that student will perform in the future.

In addition to the student who performs the task and the teacher who prescribes and corrects it, we must not lose sight of parents' role. Although there are discrepancies regarding the role that parents play in relation to homework, it is evident that their implication has important consequences not only on the final result of those tasks but also on the very process of carrying them out. Everything seems to indicate that the family environment and, more specifically, the support and feedback provided by parents is a factor that can determine the involvement of students in school duties. In this way, providing emotional support encouraging children to get involved can contribute positively to improving their motivation and interest in the performance of homework.

The objective of this Research Topic is to provide researchers and professionals in psychology and education settings with some of the most recent empirical evidence regarding the homework process, its prescription and correction. Overall, we aim to cease making homework a source of conflict and controversy at the socio-educational level in order to provide useful instruments for improving the quality of student learning.

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Table of Contents

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Reciprocal Effects Among Parental Homework Support, Effort, and Achievement? An Empirical Investigation

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The present study investigates reciprocal influences of parental homework support, effort, and math achievement, using two waves of data from 336 9th-graders. Results revealed that higher prior autonomy-oriented support and homework effort resulted in higher subsequent achievement. Higher prior content-oriented support led to higher subsequent effort, but lower subsequent achievement. Additionally, higher prior effort led to higher subsequent autonomy-oriented support. Furthermore, our results supported the structural path invariance over gender. The current investigation advances extant research, by differentiating two forms of parental homework support (autonomy- and content-oriented support), and by showing their respective influences on subsequent homework effort and math achievement.

Keywords: achievement, autonomy, effort, parental homework support, parent involvement

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INTRODUCTION

Parent involvement in homework has garnered much attention from educators and policy makers (Patall et al., 2008; Moroni et al., 2015), as there are generally consistent findings that homework has a positive effect on student achievement (Cooper et al., 2006; Fan et al., 2017), and as homework has everyday importance for teachers, parents, and students (Cooper et al., 2006). Thus, it is not surprising that parental homework involvement is viewed as an important strategy to promote student achievement (Hoover-Dempsey et al., 2001; Patall et al., 2008; Dumont et al., 2012) and desirable attributes (e.g., effort and self-regulation; Xu and Corno, 1998; Ramdass and Zimmerman, 2011).

Research on parental homework involvement, however, has yielded inconsistent findings for several reasons (Pomerantz et al., 2007; Patall et al., 2008; Hill and Tyson, 2009; Moroni et al., 2015). First, although parental homework involvement takes different forms (e.g., parental control and direct aid; Patall et al., 2008), previous research has not paid adequate attention to "multidimensional measures in order to come to consistent conclusions about the effectiveness of parental involvement in homework" (Moroni et al., 2015, p. 418). Second, recent literature taps into one promising form of parent involvement – parental support in homework (Dumont et al., 2014; Moroni et al., 2015; Silinskas and Kikas, 2017). However, it has not differentiated two forms of parental support in homework: (a) autonomy-oriented support (i.e., paying attention to children's ideas and encouraging their homework initiatives), and (b) content-oriented support (i.e., offering direct help on homework assignments). Finally, except for several exceptions

(e.g., Dumont et al., 2014; Moroni et al., 2015), previous research relied on cross-sectional data, thereby unable to disentangle the direction of relation between parent involvement and student outcome.

To address these limitations in prior research, we examine the temporal ordering of parental homework support (including both autonomy- and content-oriented support), effort, and achievement, using two waves of data from 9th-graders.

Theoretical Framework

One framework pertaining to parental homework involvement is self-determination theory (Deci and Ryan, 2008; Ryan et al., 2016). Self-determination theory postulates that the needs for autonomy, competence, and relatedness are "essential for facilitating optimal functioning of the natural propensities for growth and integration, as well as for constructive social development and personal well-being" (Ryan and Deci, 2000, p. 68). The need for autonomy concerns the feelings of volition that accompanies an activity (e.g., having the freedom to act, feel, or think for themselves). The need for competence concerns experiences of mastery in carrying out an activity (e.g., having a sense of proficiency). The need for relatedness concerns having trustful and warm relationships (e.g., feeling connected with important others). As "contexts supportive of autonomy, competence, and relatedness were found to foster greater internalization and integration than contexts that thwart satisfaction of these needs," Ryan and Deci (2000) argued, it was of "great significance for individuals who wish to motivate others in a way that engenders commitment, effort, and high-quality performance" (p. 76). Specifically, autonomy support from significant others (e.g., parents) can foster children's need satisfaction, by nurturing their volitional functioning, by taking an active interest in their frame of reference, and by encouraging them to take personal initiative (Ryan et al., 2016).

Closely related to self-determination theory, Grolnick and Slowiaczek (1994) conceptualized two models concerning the effects of parent involvement: a direct effect and an indirect effect. The direct effect model posits that parent involvement affects students' schooling through directly teaching them relevant academic skills (e.g., providing direct assistance on homework assignments). The indirect effect model posits that parent involvement affects students' schooling through indirectly fostering their motivation to do well in school (e.g., providing autonomy support and encouraging children to put forth effort in homework assignments). Based on their review of related studies concerning these two models, Raftery et al. (2012) found that "parent involvement may likely have its largest effects by facilitating the attitudes and values children need to put forth effort in school" (p. 348).

Grolnick and Slowiaczek (1994) further hypothesized that associations between parent involvement and student achievement may be reciprocal: "While the parent-to-child effects model may be plausible, equally plausible is the model whereby parent involvement follows student competencies" (p. 240). Based on recent studies relating to parental autonomy support and assistance (Pomerantz and Eaton, 2001; Bronstein et al., 2005), Raftery et al. (2012) similarly posited that associations between parent involvement and student outcome "may represent a bidirectional effect" (p. 348) – "parents may have higher expectations for their high-performing students" (p. 348) and "autonomy support affects motivation, motivation results in engagement, and engagement feeds back to motivational processes and parenting" (p. 352).

Parental Homework Support, Effort, and Achievement

Several studies has investigated relations between several forms of parental homework involvement and achievement (Dumont et al., 2014; Moroni et al., 2015; Xu et al., 2017). Moroni et al. (2015) examined the impacts of parental homework involvement on reading achievement, based on 1,685 6th graders from Switzerland. Parent involvement was assessed in two forms: (a) involvement perceived as supportive, and (b) involvement perceived as intrusive. Results revealed that student achievement was positively associated with supportive involvement, but negatively related to intrusive involvement. As supportive involvement was positively associated with student achievement (after controlling prior achievement and family background), it would be important to pay more close attention to the construct of parental homework support. A close look at the 5-item scale on supportive involvement in Moroni et al. (2015) revealed that several items measured content support (e.g., "I can ask my parents any time if I don't understand my German homework"), relating to Grolnick and Slowiaczek (1994) direct effect model. Meanwhile, other items measured autonomy support (e.g., "When my parents help me with my homework, they always encourage me first to find the correct answers for myself"), relating to Grolnick and Slowiaczek (1994) indirect effect model.

Similarly, Dumont et al. (2014) used a 4-item scale labeled as perceived parental responsiveness, in which some items assessed content support (e.g., "When I'm doing my homework, I can ask my parents for help at any time"), while others assessed autonomy support (e.g., "When I'm doing my homework, my parents carefully listen to how I would solve a problem instead of telling me what to do").

To examine whether autonomy- and content-oriented support are empirically distinguishable, Xu et al. (2017) validated the Parental Homework Support Scale (PHSS) based on 796 8th graders in China. Both EFA and CFA results revealed that the PHSS included two subscales: Autonomy-oriented Support (4-item; $\alpha = 0.91$) and Content-oriented Support (4-item; $\alpha = 0.88$). Additionally, in line with theoretical expectations, the PHSS was positively associated with motivational beliefs, homework completion, and homework grade. Meanwhile, math achievement was positively associated with autonomy-oriented support, yet unrelated to content-oriented support. These findings imply the need to differentiate autonomy support from content support in research on parental homework support.

In addition to student achievement, it is important to incorporate student effort in research on parent involvement, as self-determination theory emphasizes "the great significance" to motivate individuals "in a way that engenders commitment,

effort, and high-quality performance" (Ryan and Deci, 2000, p. 76). As one important goal of homework is to promote children' ability to take responsibility for their own learning (Ramdass and Zimmerman, 2011; Dumont et al., 2014), homework effort has been conceptualized as an important construct and outcome variable (Trautwein et al., 2006; Dumont et al., 2014). Using 1,501 8th graders in Swiss in the domain of French as a foreign language, Trautwein et al. (2006) linked homework effort to two forms of involvement: (a) parental provision of help (e.g., "My parents help me with French if I ask them."), and (b) unwanted parental help (e.g., "My parents sometimes help me with French even when I don't need any help at all."). Their study found that homework effort was positively related to parental provision of help, yet unrelated to unwanted parental help.

Using 2,820 German students in grade 5 and grade 7, Dumont et al. (2014) investigated reciprocal relations among parental homework involvement, reading achievement, and academic functioning (reading effort and homework procrastination). Parental homework involvement was conceptualized in three forms: (a) perceived parental control (e.g., "My parents help me with my homework even when I don't need any help."), (b) perceived parental responsiveness (e.g., "My parents help me with my homework if I ask them to."), and (c) perceived parental structure (e.g., "My parents make sure that I have enough time and space to do my homework."). Prior parental structure positively influenced subsequent reading effort, while prior reading effort positively influenced parental control and parental structure. Additionally, prior reaching achievement negatively influenced subsequent parental control. Yet, prior parental homework involvement (control, responsiveness, and structure) did not influence subsequent reading achievement.

In summary, this body of literature suggests possible associations among parental homework involvement, effort, and achievement. It points to the importance of focusing on parental homework support (instead of parental homework involvement in general), as there is more conclusive evidence in prior studies that one dimension of parental homework involvement was negatively related to effort and achievement, whether labeled as intrusive involvement (Moroni et al., 2015), parental control (Silinskas and Kikas, 2017; Dumont et al., 2014), or unwanted parental help (Trautwein et al., 2006). Additionally, it points to the importance of differentiating autonomy-oriented support from content-oriented support, as items for autonomy- and content-oriented support were often combined in one scale in prior studies, whether labeled as supportive involvement (Moroni et al., 2015), perceived parental responsiveness (Dumont et al., 2014), or perceived parental support (Silinskas and Kikas, 2017).

The Current Investigation

The goal of our current investigation is to examine reciprocal effects among autonomy- and content-oriented support, effort, and math achievement. Specifically, it employs models of reciprocal effects, along with invariance tests across gender. This line of research is important, as parents' behavior (e.g., homework support) may influence the child's behavior, and as the characteristics of the child (e.g., prior achievement and effort) may also affect parents' behavior (e.g., homework support; Grolnick and Slowiaczek, 1994; Raftery et al., 2012; Dumont et al., 2014; Kikas and Silinskas, 2016). Compared with cross-sectional models, reciprocal effects models are especially useful for examining relationships among variables over time (e.g., regarding theorized directions of influences; Little, 2013; Newsom, 2015).

Our reason for examining parental support in math homework is that parental homework involvement may differ based on subject matter, yet prior research tends to examine parental homework involvement in general (Silinskas and Kikas, 2017). In addition, students often invest significant time on math homework (e.g., 20–40% of homework time; Xu, 2017). Moreover, doing math homework often presents a significant challenge for many children and their parents (Else-Quest et al., 2008).

The reason for testing invariance across gender is that the forms of parent involvement may be different for boys and girls (e.g., parental support; Grolnick and Slowiaczek, 1994; Dumont et al., 2012; Silinskas and Kikas, 2017). Additionally, prior research on gender differences in math has yielded inconsistent results (Halpern et al., 2007; Dumont et al., 2012; Silinskas and Kikas, 2017). Furthermore, prior studies have shown mixed findings concerning gender differences in the relations between parent involvement and student achievement (Pomerantz et al., 2007; Silinskas et al., 2013). Thus, it is important to study whether relations among parental homework support, effort, and math achievement vary by gender.

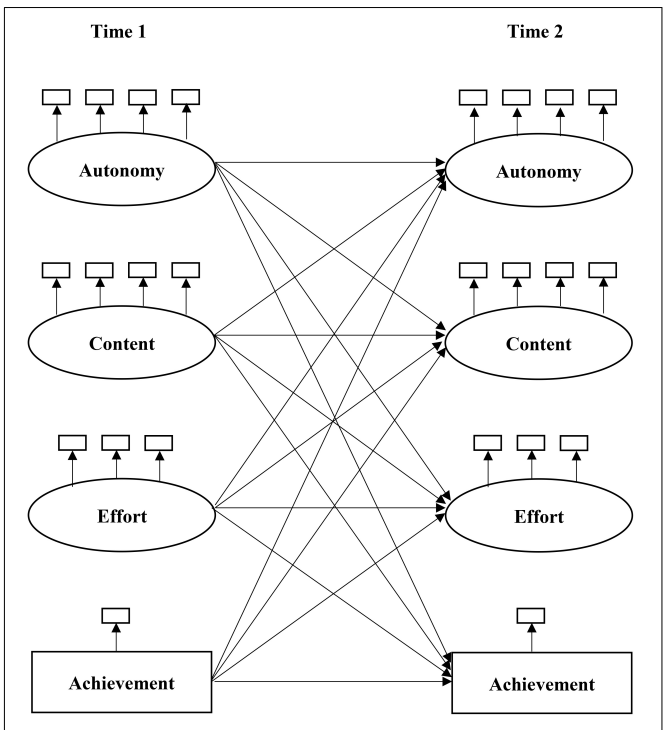

FIGURE 1 | The model of reciprocal effects among autonomy-oriented support, content-oriented support, effort, and achievement.

Hypotheses

Hypothesis 1 (Path Coefficients)

Models of reciprocal effects are used to investigate relationships among parental homework support, effort, and achievement (see **Figure 1**).

Hypothesis 1a: Parental homework support and achievement

Consistent with related literature (Ryan and Deci, 2000; Deci and Ryan, 2008), we hypothesize that parental autonomy support and achievement would be reciprocally related. As there is little research relating to the association between content-oriented support and achievement, we leave it as a research question.

Hypothesis 1b: Effort and achievement

Consistent with the finding from the previous study (Marsh et al., 2016), it is hypothesized that effort would not be reciprocally associated with achievement.

Hypothesis 1c: Parental homework support and effort

Consistent with related literature (Dumont et al., 2014; Kikas and Silinskas, 2016), it is hypothesized that autonomy-oriented support would be reciprocally associated with effort. Similarly, as there is little research relating to the association between content-oriented support and effort, we leave it as a research question.

Hypothesis 2 (Robustness of Path Coefficients Over Gender)

Consistent with related literature concerning student effort and academic achievement (Deci and Ryan, 2008; Patall et al., 2008; Marsh et al., 2016), it is hypothesized that the pattern of findings concerning H_{1b} would be similar across gender. Meanwhile, given mixed results in prior research on relations between parental homework involvement and student achievement (Grolnick and Slowiaczek, 1994; Pomerantz et al., 2007; Dumont et al., 2012; Silinskas and Kikas, 2017), we do not have any hypotheses on whether H_{1a} and H_{1c} would vary across gender.

MATERIALS AND METHODS

Participants

Participants were 336 9th graders (Mean age = 15.18 ± 0.72; 47.9% boys) from two schools in southeastern China. They were assessed two points: (a) Time 1 (October); and (b) Time 2 (June). Education level was 10.40 years (*SD* = 3.20) for father, and 9.59 years (*SD* = 3.21) for mother.

The percentages of students who did math assignments four or more days weekly were 69.7% at Time 1 and 68.2% at Time 2. The amount of time they spent on math assignments were 36.3 min (*SD* = 28.3) at Time 1 and 45.3 min (*SD* = 34.8) at

TABLE 1 | Autonomy-oriented support, content-oriented support, and effort items.

Scales	Items	Mean (*SD*)		α (CI)	
		Time 1	Time 2	Time 1	Time 2
Autonomy-oriented support[a]	My parents encourage me to ask questions about math homework assignments.	2.67 (0.72)	2.63 (0.68)	0.90 (0.88–0.91)	0.90 (0.89–0.92)
	My parents listen to my ideas about math homework assignments.				
	My parents listen to how I would like to do math homework assignments.				
	My parents convey confidence in my ability to do with math homework assignments.				
Content-oriented support[a]	My parents often ask how they can help me with my math homework.	2.46 (0.67)	2.42 (0.66)	0.86 (0.83–0.88)	0.87 (0.85–0.90)
	My parents help me with math if I ask them.				
	My parents always help me if I get stuck with my math homework.				
	I can always ask my parents if I don't understand something in math.				
Effort[a]	I have recently been doing my math homework to the best of my ability.	3.20 (0.61)	3.09 (0.58)	0.78 (0.73–0.82)	0.80 (0.76–0.84)
	I do my best on my math homework.				
	I always try to finish my math homework.				

[a]*Rating: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree.*

Time 2. These practices are similar with other research conducted in China (Xu, 2016; Xu et al., 2017). For instance, in one study involving Chinese students in grade 8 (Xu et al., 2017), 78.5% students did math assignments four or more days weekly, with about 34 min spent on math assignments each day (*SD* = 22.0).

The current study was a part of larger international research project approved by the Institutional Review Board at University of Macau. Written informed consent was obtained from the parents/legal guardians of all non-adult participants. Several researchers administered the instrument during typical school hours, and students were given an identification number to link two different sources of data (i.e., survey data and math achievement) from Time 1 to Time 2. The identifier was removed once two waves of data were completed.

Measures

Autonomy-Oriented Support

At each time point (Time 1 and 2), the same four-item scale measured autonomy-oriented support (Xu et al., 2017). These items (see **Table 1**) measured children's perspectives of parental role as autonomy supportive while doing math assignment (e.g., paying attention to their ideas and encouraging their initiatives; Time 1: $\alpha = 0.90$; Time 2: $\alpha = 0.90$).

Content-Oriented Support

At each wave, the same four-item scale measured content oriented support (Xu et al., 2017). These items (see **Table 1**) assessed the degree to which parents offered direct help on math assignments when asked by children (e.g., when children got stuck with math homework and had difficulty in figuring it out on themselves; Time 1: $\alpha = 0.86$; Time 2: $\alpha = 0.87$).

Effort

At each time point, the same three-item measured children's effort in doing math assignments, based on relevant research on homework effort (Trautwein et al., 2006; Xu, 2016). These items (see **Table 1**) measured how hard students worked on these assignments (Time 1: $\alpha = 0.78$; Time 2: $\alpha = 0.80$).

Achievement

Math achievement was assessed using standardized test at each wave. The content of the test was based on national math standards in China (Li and Li, 2018). The test was designed to measure student knowledge and competence in quadratic equation, quadratic function, rotation of figures and central symmetry, circle, inverse function, trigonometric function, probability, and projection and view. Anchor items were used to allow the linkage of the two waves. At each time, participants were given 120 min to work on the test. The reliability estimate was 0.86 for Time 1, and 0.88 for Time 2.

Data Analysis

All the analyses were implemented using Mplus (Muthén and Muthén, 1998–2012, version 7.31), where autonomy-oriented support, content-oriented support, and effort were measured by the same scales at each time point. The missing data for 11 indicators (4 autonomy-oriented support, 4 content-oriented support, and 3 effort) and one observed variable (i.e., achievement) were: Time 1 (*Mean* = 2.18%, *SD* = 0.51%), and Time 2 (*Mean* = 10.91%, *SD* = 1.66%). All models in the present investigation were based on MLR, along with FIML.

Measurement Invariance

Consistent with typical practices regarding multiple group invariance (Hong et al., 2003; Marsh et al., 2016), we examined gender invariance by testing configural model (baseline model), metric model (factor loading invariance), correlated uniqueness, and scalar models (intercept invariance).

Path Coefficient Invariance

We tested the path coefficients concerning autonomy-, content-oriented support, effort, and achievement from Time 1 to Time 2. Also included in the path model were paths regarding the same construct from Time 1 to Time 2. For example, Time 2 autonomy-oriented support was predicted by Time 2 content-oriented support, effort, and achievement, but also by Time 1 autonomy-oriented support). Hence, to test invariance of path coefficients, 16 paths were constrained equal over gender (**Figure 1**; 12 cross paths and 4 horizontal paths).

Goodness of Fit

We applied a number of goodness-of-fit indexes: (a) comparative fit index (CFI) near 0.95 (Hu and Bentler, 1999), (b) standardized root mean square residual (SRMR) $\leq$ 0.08 (Hu and Bentler, 1999), and (c) root mean square error of approximation (RMSEA) $\leq$ 0.06 (MacCallum et al., 1996), and Additionally, we applied the following recommendations for multigroup invariance testing; there is a support for more parsimonious model when ΔCFI < 0.01 and ΔRMESA < 0.015 (Cheung and Rensvold, 2002; Chen, 2007).

TABLE 2 | Tests for gender invariance: summary of goodness-of-fit statistics.

Invariance models	MLRχ^2	df	RMSEA	RMSEA 90% CI	CFI	SRMR
(1) Configural (baseline)	656.347	430	0.056	0.047–0.064	0.952	0.054
(2) Metric (factor loading)	669.268	446	0.055	0.046–0.063	0.952	0.058
(3) Correlated uniqueness	701.813	457	0.056	0.048–0.065	0.948	0.063
(4) Scalar (intercept)	728.449	473	0.057	0.048–0.065	0.945	0.066
(5) Path coefficient	744.322	489	0.056	0.048–0.064	0.945	0.073

RMSEA, root mean square error of approximation; CFI, Comparative Fit Index; SRMR, standard root mean squared residual.

TABLE 3 | Standardized factor loadings.

Variables	Time 1 constructs				Time 2 constructs			
	AO	CO	EF	Test	AO	CO	EF	Test
T1AO1	0.818							
T1AO2	0.889							
TIAO3	0.866							
TIAO4	0.743							
T1CO1		0.745						
T1CO2		0.719						
T1CO3		0.858						
T1CO4		0.794						
T1EF1			0.713					
T1EF2			0.789					
T1EF3			0.708					
T1TEST				1				
T2AO1					0.849			
T2AO2					0.873			
T2AO3					0.869			
T2AO4					0.757			
T2CO1						0.767		
T2CO2						0.725		
T2CO3						0.875		
T2CO4						0.828		
T2EF1							0.732	
T2EF2							0.821	
T2EF3							0.731	
T2TEST								1

Each variable was assigned a label that identifies the Time (T1 or T2), the construct (AO, autonomy-oriented support; CO, content-oriented support; EF, effort; and Test, math achievement), and for the multiple indicators of each latent construct, and the item number. In both waves, autonomy-oriented support was measured with the same four items (AO1–AO4), content-oriented support was measured with the same four items (CO1–CO4), and effort was measured with the same three items (EF1–EF3), whereas test was based on a single score for each wave.

RESULTS

The findings of the current investigation are presented into two sections. Section 1 centers on the factor structure represented the 22 indicators and the 2 observed variables. Part 2 investigates the models of reciprocal influences of autonomy-, content-oriented support, effort, and achievement using two waves of data.

The Factor Structure

We tested the factor structure invariance over gender (161 boys vs. 175 girls), by examining the following models: configural, metric, correlated uniqueness, and scalar (see **Table 2**). Overall, these models produced good fits (e.g., all CFIs $\geq$ 0.945). In addition, the fit of the most constrained Model 4 (scalar) was good (CFI = 0.945; RMSEA = 0.057; SRMR = 0.066), which hardly differed from that of the least-constrained Model 1 (configural; ΔCFI = 0.007, ΔRMESA = 0.001). Thus, these findings supported the invariance of factor structure for males and females.

As displayed in **Table 3**, the standardized factor loadings for each wave were quite large. Across both time points, the factor loadings ranged 0.743–0.889 for autonomy-oriented support, 0.719–0.875 for content-oriented support, and 0.713–0.821 for effort.

Within each of the two waves, there were large positive correlations between autonomy-oriented support and content-oriented support (0.56; see **Table 4**). Additionally, there were medium to large positive correlations between autonomy-oriented support and effort (0.27–0.37) and between effort and achievement (0.26–0.47). Furthermore, there were small positive correlations between autonomy-oriented support and achievement (0.17–0.23) and between content-oriented support and effort (0.16–0.17). Finally, there were non-significant to significant small negative correlations between content-oriented support and achievement (−0.07 – −0.12).

Reciprocal Effects Among Parental Homework Support, Effort, and Achievement

We further tested the structural path invariance over gender. As shown in **Table 2**, data showed a good fit (CFI = 0.945; SRMR = 0.073; RMSEA = 0.056; 90% CI [0.048 −0.064]), which hardly differed from that of Model 4 (ΔCFI < 0.001, ΔRMESA = 0.001). These findings supported the structural path invariance over gender.

TABLE 4 | Factor correlations.

	Time 1 constructs				Time 2 constructs			
	AO	**CO**	**EF**	**Test**	**AO**	**CO**	**EF**	**Test**
Time 1								
AO	1.000							
CO	0.56***	1.000						
EF	0.27***	0.16*	1.000					
Test	0.17**	−0.12*	0.47***	1.000				
Time 2								
AO	0.64***	0.43***	0.32***	0.18**	1.000			
CO	0.39***	0.65***	0.12	−0.08	0.56***	1.000		
EF	0.23***	0.27***	0.67***	0.25***	0.37***	0.17*	1.000	
Test	0.21***	−0.11	0.48***	0.91***	0.23***	−0.07	0.26***	1.000

*AO, autonomy-oriented support; CO, content-oriented support; EF, effort; and Test, achievement. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.*

Parental Homework Support and Achievement

There were no reciprocal effects between autonomy-oriented support and achievement (see **Table 5**). Not unexpectedly, the largest influence of T1 autonomy-oriented support was on T2 autonomy-oriented support ($\beta = 0.535$, $p < 0.001$). The influence of T1 autonomy-oriented support was statistically significant for T2 achievement ($\beta = 0.079$, $p < 0.01$), after controlling the effects of other T1 measures (content-oriented support, effort, and achievement). However, T1 achievement had a non-significant influence on T2 autonomy-oriented support ($\beta = 0.031$, $p > 0.05$).

Additionally, there were no reciprocal influences of content-oriented support and achievement. Whereas T1 content-oriented support had a substantial influence on T2 content-oriented support ($\beta = 0.621$, $p < 0.001$), it had a negative influence on T2 achievement ($\beta = -0.066$, $p < 0.05$). Meanwhile, T1 achievement had a non-significant influence on T2 content-oriented support ($\beta = -0.021$, $p > 0.05$).

Effort and Achievement

There was no support for reciprocal influences of effort and achievement. T1 effort had a statistically significant effect on T2

TABLE 5 | Path coefficients for models of reciprocal effects among autonomy-oriented support (AO), content-oriented support (CO), effort (EF), and test (math achievement).

Dependent variable/ Independent variable	Male		Female		Overall	
	Path coefficient	***SE***	**Path coefficient**	***SE***	**Path coefficient**	***SE***
T2AO						
T1AO	0.547***	0.074	0.524***	0.074	0.535***	0.072
T1ICO	0.106	0.069	0.100	0.065	0.105	0.066
T1EF	0.131*	0.060	0.108*	0.052	0.144*	0.060
T1TEST	0.035	0.053	0.040	0.060	0.031	0.057
T2CO						
T1AO	0.024	0.081	0.021	0.072	0.042	0.076
T1CO	0.668***	0.086	0.579***	0.070	0.621***	0.070
T1EF	0.021	0.071	0.016	0.053	0.012	0.064
T1TEST	0.021	0.055	0.022	0.058	0.021	0.058
T2EF						
T1AO	0.033	0.070	0.037	0.079	0.047	0.072
T1CO	0.172*	0.075	0.191*	0.081	0.178*	0.076
T1EF	0.662***	0.087	0.639***	0.073	0.668***	0.072
T1TEST	0.019	0.061	0.026	0.083	0.032	0.070
T2TEST						
T1AO	0.093**	0.033	0.079**	0.029	0.079**	0.030
T1CO	0.076*	0.032	0.064*	0.026	0.066*	0.027
T1EF	0.088*	0.040	0.065*	0.031	0.077*	0.035
T1TEST	0.840***	0.031	0.859***	0.030	0.851***	0.029

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

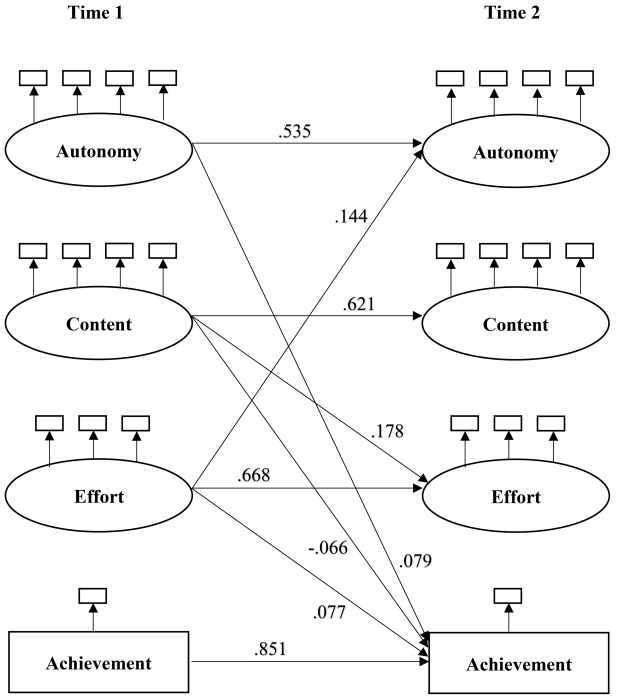

FIGURE 2 | Structural equation paths relating Time 1 (T1) to Time (T2). Only statistically significant paths are displayed.

achievement (β = 0.077, $p < 0.05$). However, T1 achievement had a non-significant influence on T2 effort (β = −0.032, $p > 0.05$).

Parental Homework Support and Effort

There were no reciprocal effects between autonomy-oriented support and effort. T1 effort had a significant effect on T2 autonomy-oriented support (β = 0.144, $p < 0.05$), after controlling the effects of other T1 measures (autonomy-, content-oriented support, and achievement). However, T1 autonomy-oriented support did not have a significant influence on T2 effort (β = −0.047, $p > 0.05$).

Additionally, there were no reciprocal influences of content-oriented support and effort. T1 content-oriented support had a significant effect on T2 effort (β = 0.178, $p < 0.05$), after controlling the effects of other T1 measures (autonomy-oriented support, effort, and achievement). However, the path from T1 effort to T2 content-oriented support was not significant (β = 0.012, $p > 0.05$).

DISCUSSION

We examined the reciprocal influences of parental homework support, effort, and achievement over two time points concerning math homework. Informed by self-determination theory (Deci and Ryan, 2008; Ryan et al., 2016) and Grolnick and Slowiaczek (1994) two models concerning the effects of parent involvement, we examined several hypotheses, some extending previous research, while others providing seemingly intriguing theoretical perspectives.

Parental Homework Support and Achievement

There was an asymmetrical pattern of reciprocal influences of autonomy-oriented support and achievement: prior higher autonomy-oriented support led to higher subsequent achievement, yet prior achievement was unrelated to subsequent autonomy-oriented support (see **Figure 2**). Furthermore, there was an asymmetrical pattern of reciprocal influences of content-oriented support and achievement: higher prior content-oriented support resulted in lower subsequent achievement, yet prior achievement was unrelated to subsequent content-oriented support.

The finding that higher prior autonomy-oriented support led to higher subsequent achievement is congruent with previous research concerning the role of autonomy support on student learning (e.g., Deci and Ryan, 2008), with homework in particular (Xu et al., 2017). Meanwhile, how do we interpret the result that prior content-oriented support had a negative effect on subsequent achievement? As compared with autonomy support, direct help from parents is viewed as more controlling particularly when children do not ask for help; it may result in a decreased sense of autonomy over time (Pomerantz et al., 2007). As content-oriented support in our study is conceptualized as the extent to which parents provide direct help on homework when asked by children, our study suggests that parental help may backfire even when asked by children. One possible explanation is that content-oriented support (i.e., even when asked by children) may lead to a sense of incompetence for children (e.g., implying that they could not solve math problems independently), which may in turn undermine subsequent achievement. Another explanation is that when asked by children for content-oriented support, many parents may find it difficult to withdraw their support as children become more competent and are well on their own. This explanation is somewhat substantiated by one observation drawn from their research synthesis on parental homework involvement that "as students reach adolescence, it may be important that parents gradually withdraw from the homework process and shift their involvement more to support of the child's own autonomous efforts." (Patall et al., 2008, p. 1089). Taken together, it could be argued that the present study extends prior research in the following way. That is, while consistent with previous studies that direct support has detrimental effect on student achievement (e.g., Veas et al., 2015; Fernández-Alonso et al., 2017), content-oriented support – even when asked by children – is likely to be controlling (e.g., in terms of what it means to children for homework assignments at hand, and what it means to parents for homework involvement over time).

Effort and Achievement

There was an asymmetrical pattern of reciprocal influences of effort and achievement: higher prior effort led to higher subsequent achievement, while prior achievement was unrelated

to subsequent effort. Our findings were not congruent with the prior finding (Marsh et al., 2016) concerning the lack of any support for reciprocal influences of effort and achievement (assessed by standardized test scores). One likely explanation is that Chinese culture emphasize the important role of effort in student achievement (Rao et al., 2000; Li, 2002). Thus, it makes logical sense that prior effort may have a more pronounced influence on subsequent academic achievement for Chinese students in particular.

Parental Homework Support and Effort

There was an asymmetrical pattern of reciprocal influences of autonomy-oriented support and effort: higher prior effort led to higher subsequent autonomy-oriented support, yet prior autonomy-oriented support was unrelated to subsequent effort. There was also an asymmetrical pattern of reciprocal influences of content-oriented support and effort: higher prior content-oriented support led to higher subsequent effort, yet prior effort was unrelated to subsequent content-oriented support.

These results provide partial empirical support to the commonly held assumption that whereas parents' behavior (e.g., parental support) influences the child's school-related behavior, the characteristics of the child (e.g., effort) can also influence parents' behavior (Grolnick and Slowiaczek, 1994; Raftery et al., 2012; Dumont et al., 2014; Kikas and Silinskas, 2016). On the other hand, our findings provide a more nuanced picture, in that the relations between different forms of parental homework support and homework effort were not asymmetrical (i.e., higher prior content-oriented support led to higher subsequent effort, whereas higher prior effort led to higher subsequent autonomy-oriented support).

How do we interpret the results that prior effort had a positive effect on subsequent autonomy-oriented support (yet unrelated to subsequent content-oriented support)? It seems logical that as children put more efforts in doing math homework, parents are more likely to pay attention to children's idea, encourage them to solve math problems by themselves, and express confidence in their capacities in following through math assignments. Meanwhile, as content-oriented support is referred to the degree to which parents offered direct help on homework when requested by children, putting more effort in homework may lead to less request for content-oriented support. Yet, more homework effort may also lead to more request for content-oriented support, as "students who exert greater task-oriented effort do not refrain from seeking needed help" (Karabenick and Knapp, 1991, p. 224). This observation is, to some degree, substantiated by zero-order correlation from the study by Skaalvik and Skaalvik (2013), in which effort (e.g., "I always do my homework.") was positively associated with certain help-seeking behavior (e.g., "If there is something I do not understand at school, I ask the teacher for help").

In addition, how do we interpret the results that prior content-oriented support (but not prior autonomy-oriented support) had a positive influence on subsequent effort? The finding concerning content-oriented support was consistent with Trautwein et al. (2006) in that parental provision of help (which is comparable to content-oriented support) was positively associated with homework effort. Yet, the finding concerning autonomy-oriented support is not consistent with related literature that autonomy support can promote task-oriented effort (Pomerantz et al., 2007; Deci and Ryan, 2008). One possible explanation is that in an achievement domain such as a math that requires more effort (Marsh et al., 2016), content-oriented support (compared with autonomy-oriented support) may play a more important role in promoting student effort in following through math homework. In other words, as working on math assignments in particular is viewed as a considerable challenge for many students (e.g., math anxiety; Else-Quest et al., 2008), it makes sense that students need content-oriented support (i.e., more than autonomy-oriented support) to enable them to exhibit more effort in completing math assignments in the face of various obstacles and difficulties (e.g., when they get stuck with math homework). This is further consistent with qualitative findings from US secondary students that content-oriented support (e.g., content-related parental assistance concerning algebra and geometry) had a positive effect on students' effort to complete their homework (Martinez, 2011).

Strengths, Limitations, and Directions for Further Research

Our investigation represents a significant advance over prior research on parental homework involvement by using models of reciprocal effects to examine relationships among parental homework support, effort, and achievement. Even though these are not causal effects, they permit a more robust examination of the relationships among these variables (e.g., concerning the direction of relationships; Selig and Little, 2012). Additionally, our study concerning the structural path invariance imply that our results are applicable over gender. As the fulfillment of measurement invariance is a prerequisite for meaningful and substantive cross-group mean comparisons, our current study extends prior research on parental homework involvement.

Specifically, as no prior studies that have studied the relationships among these constructs using models of reciprocal effects, our findings provide new insights concerning the role of prior parental homework support (i.e., autonomy-oriented support vs. content-oriented support) on subsequent homework effort and achievement, as well as the role of prior homework effort on subsequent autonomy-oriented support. Taken together, these findings extends our understanding of parental homework support, suggesting the need to differentiate these two types of parental homework support in future investigation.

The effect size in the present investigation were small. However, they represent longitudinal relationships. Indeed, small effect size are common, but not trivial while examining longitudinal changes (Adachi and Willoughby, 2015; Willoughby et al., 2015), as they reflect an ongoing process of cumulative and addictive effects.

As our study was based on students from two schools during one school, it would be important to replicate our findings using a representative sample of students in other settings over a longer period of time. Although our investigation incorporated standardized achievement tests to measure math achievement, we assessed parental homework involvement and effort using

self-report measures. Hence, there is a need to include multiple sources in further research (e.g., direct observation or parent reports). Meanwhile, like other researchers (Trautwein et al., 2012; Dumont et al., 2014), given the focus on children's perceptions of parental homework support, children's reports is the most appropriate and valid indicator of how they perceive their parental homework support as well as their own effort in the homework process (even if other sources may offer alternative perspectives).

As this is the first study, to our knowledge, to investigate reciprocal relations among parental homework support, effort, and achievement, it is important to continue this line of research in other countries, as cultural values may affect the relations among these constructs (e.g., cultural norms concerning autonomy, effort, academic learning, and role of parents in the homework process; Rao et al., 2000; Ryan and Deci, 2000; Xu et al., 2017). It would also be important to pursue this line of investigation at different development stages, as (a) the role of parental homework involvement on academic achievement was found to be moderated by school level (Patall et al., 2008), and as (b) parental involvement declines as children move from elementary to secondary school (Gonida and Cortina, 2014). Additionally, as parental rule-setting (Patall et al., 2008) or perceived parental structure (Dumont et al., 2014) were positively related to homework effort and achievement for younger students (grades 2–7), it would be intriguing to reframe this form of parental homework involvement as structure-oriented support and to incorporate it in future research on parental homework support at elementary school level in particular (i.e., along with autonomy- and content-oriented support).

In addition, there is a need to study reciprocal influences among parental homework support, effort, and achievement in different achievement areas (e.g., science), as (a) some achievement domains do not require similar degree of effort as math (Marsh et al., 2016), as (b) parental homework involvement may play out differently in math as compared with other achievement domains (Patall et al., 2008), and as (c) our results suggest that content-oriented support plays a more prominent role in promoting student effort in following through math assignments.

CONCLUSION

In conclusion, by using models of reciprocal effects among parental homework support (autonomy- and content-oriented support), effort, and achievement, our present study shed new insights into the relationships among these constructs – a promising line of investigation that has been inadequately conceptualized and studied in last several decades.

ETHICS STATEMENT

This research was carried out in according with the recommendations of the University of Macau. Written informed consent was obtained from the parents/legal guardians in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

JX contributed to the conception and the design of the work. JD was responsible for data collection. SW, HR, and AC contributed to literature review and several sections of writing. JX and JD contributed to manuscript write up and revision.

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The Role of Prior Achievement as an Antecedent to Student Homework Engagement

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The benefits of homework on student learning and academic achievement, to a large extent, depend on the degree of student engagement. Motivational engagement (my intention or why I do the homework), cognitive engagement (how I get involved in homework), and behavioral engagement (how much homework I do, how much time I devote to it, how I manage that time) are key aspects that condition the quality of the process of doing homework, learning, and academic achievement. Prior academic achievement is one of the variables that seems to be positively related to student engagement (both due its motivational component and to the training to do homework). The main purpose of this work was to study in detail this relationship in students of the last stage of Primary Education (N = 516). The results showed that (i) as achievement levels rise, the use of a shallow focus to doing homework decreases (and the use of a deep approach increases); (ii) there is also a progressive increase in the amount of homework done and in the management of the time dedicated to homework. On another hand, as in previous research, (iii) no relationship was observed between the levels of prior achievement and the amount of time spent doing homework.

Keywords: homework, academic achievement, motivational engagement, cognitive engagement, behavioral engagement, primary education

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INTRODUCTION

In recent years, extensive research aimed at analyzing the predictive value of diverse variables related to academic achievement has been developed. Although many of these predictive variables are of a cognitive and motivational nature (e.g., Dettmers et al., 2010; Miñano et al., 2012), there is no doubt that prior achievement and, especially, students' experiences of success and failure, are the main predictor of their future academic career.

Indeed, students' prior achievement has been widely viewed as a strong predictor of their academic success (Kitsantas and Zimmerman, 2009; Schneider and Preckel, 2017). Likewise, previous successful experiences can lead to important benefits in motivational, behavioral, and affective areas (Regueiro et al., 2017). Thus, in a study conducted by Goetz et al. (2008), it was found that prior achievement in the subject of mathematics positively predicted enjoyment of and positive feelings toward this subject. In this sense, Pan et al. (2013) observed that students with the highest levels of academic achievement were the most intrinsically motivated to do homework. In other studies (e.g., Goldberg and Cornell, 1998; Garon-Carrier et al., 2016) prior achievement

was associated with later intrinsic motivation over time, whereas the findings of other works (e.g., Taylor et al., 2014) provide some evidence that the relations between academic motivation types and achievement may be reciprocal.

In addition, motivational variables largely determine students' homework engagement (Valle et al., 2015b). In fact, during the process of doing homework, students must adapt to the demands of its performance, which requires not only planning and setting priorities, but also managing time, and coping with distractions, as well as controlling motivation and emotion.

In this way, the relevance of this study is to determine the role of prior academic achievement and, consequently, the successful experiences derived thereof, in the degree of motivational and cognitive engagement (operationalized in the student's approach to doing homework) and also students' behavioral engagement to homework (amount of homework done, amount of time spent on homework, and time optimization). We draw on the idea that motivation is a necessary but insufficient condition to activate cognitive and behavioral engagement toward a task (Appleton et al., 2006).

Motivational and Cognitive Engagement to Homework: Approach to Homework

The process of doing homework refers to what students do when faced with homework; that is, how they do their homework and how they manage personal and environmental resources when they do it. Therefore, rather than focusing on the amount of homework that should be assigned or on the time that should be spent on homework, the focus would be on the process, that is, on the quality of students' performance when faced with homework (Dettmers et al., 2010). In fact, in students' process of doing homework, *how* should matter more than *how much* (Fernández-Alonso et al., 2016; Rosário et al., 2018).

Quality in the process of homework preparation is considered in this paper as the higher or lower degree of depth with which the student deals with the tasks. Everything seems to indicate that the approach to homework used (motivational and cognitive engagement) not only influences the final performance of homework but also the quality of the process of doing homework. The approach to homework adopted by the student is one of the aspects that can provide more information about the motivation for doing homework and also the strategies and resources (consistent with those motivations) implemented for this purpose (Valle et al., 2017).

Students who adopt a deep approach will engage in homework with the intention of learning and reinforcing the contents acquired in class, trying to resolve the doubts that arise while doing homework, and relating the homework to what they learned previously (Valle et al., 2015b). Conversely, those who adopt a shallow approach will do homework because they feel obligated, and their priority will be to finish it as soon as possible in order to devote themselves to other more amusing activities. They will only be concerned about doing homework because they must hand it in and correct it in class, but not because they think that its performance contributes to consolidating or improving their learning (Valle et al., 2017).

Most of the studies have shown that the deeper the students' approach to learning, the better the quality of their learning outcomes (Cano et al., 2014). In addition, whereas the shallow approach is related to poor academic results (Rosário et al., 2010), the use of a deep approach is associated with high levels of understanding and achievement (Biggs, 1993), an intrinsic interest in learning, and high levels of comprehension (Trigwell et al., 2005). In the same vein, Bembenutty and White (2013) found that, when students do homework with a deep approach, showing interest in the task and a positive attitude, they tend to have good academic achievement in the different subjects.

Behavioral Homework Engagement: Amount of Homework Performed, Amount of Time Spent on Homework, Homework Time Management

Behavioral homework engagement manifests in the students' degree of engagement and active participation in the process of preparation of homework. A part of the recent research (e.g., see Rosário et al., 2009; Núñez et al., 2015a,b; Valle et al., 2015a) includes the study of three variables related to behavioral engagement: the amount of homework done, the amount of time spent on homework, and the optimization or management of that time.

The amount of teacher-assigned homework done is often positively related to improved academic achievement (Valle et al., 2016). In fact, some studies have found that students who do their homework obtain better academic grades than those who do not do it (Cooper, 1989; Trautwein et al., 2002).

As with the amount of homework, when referring to the time spent on homework, research advises differentiating between the amount of time spent on homework and the management or optimization of that time. Therefore, the adequate management of the time and effort invested is much more important for homework than the amount of time spent (e.g., number of hours dedicated to homework). In fact, in a study by Trautwein (2007), it was found that the relations between the amount of time spent on homework and academic achievement were moderate at the group level but negative at the individual level. These results may indicate that spending too much time doing homework can reflect insufficient prior knowledge or difficulty to understand the contents addressed in the homework. In other similar studies (e.g., see Fernández-Alonso et al., 2015), it was considered that many students who spend more time on homework probably have major gaps in their learning and concentration problems.

Therefore, the amount of time spent on homework is a merely quantitative aspect of the hours that students spend doing homework, but in no case is this necessarily a reflection of the effort and quality of their dedication (Flunger et al., 2015). Hence, managing the time spent on homework is a challenge for students, as adequate time management has a positive influence on students' academic success (Claessens et al., 2007), the completion of homework (Xu, 2005, 2011), and academic achievement (Eilam, 2001; Trautwein et al., 2015). In addition, students who manage their homework time well (but do not

necessarily spend more time) are the ones with a deeper approach to homework (Valle et al., 2015b, 2016).

Purpose of This Study

The main purpose of this work is to analyze how prior academic achievement conditions students' motivational and cognitive engagement (the approach to homework) and behavioral homework engagement (amount of homework done, amount of time spent, and time optimization). It attempts to provide evidence showing that prior experiences of success and failure largely condition students' academic achievement, which is also manifest in an improvement of the quality of motivational, cognitive, and behavioral homework engagement.

The study of this relationship can provide clear evidence about how prior academic achievement activates motivational (reasons for doing homework), cognitive (homework engagement), and behavioral factors (amount of homework done, amount of time spent, management of that time), which will ultimately determine the quality of the process of doing homework. The working hypothesis is that higher levels of prior achievement would be positively and significantly associated with motivational and cognitive engagement, characterized by a deep approach to homework aimed at understanding and meaning. In addition, we also expected that higher levels of prior achievement would be positively and significantly related to a greater amount of homework done and to better time optimization. On another hand, it was also hypothesized that high levels of achievement would be associated with low motivational and cognitive engagement, which defines the shallow approach to homework. In addition, it was expected that prior academic achievement would not be related to the amount of time that students dedicate to homework.

MATERIALS AND METHODS

Participants

The sample, selected through intentional sampling, is made up of 516 students from four public schools of Primary Education of the Autonomous Community of Galicia (Spain). Two schools are located in urban areas, and the other two are, respectively in rural and semi-urban areas. Concerning gender, 49% (n = 253) are boys and 51% (n = 263) are girls. Their ages ranged between 9 and 13 years (M = 10.35; SD = 0.99), 38.2% (n = 197) were enrolled in 4th grade of Primary Education, 36.4% (n = 188) were in 5th grade of Primary Education, and 25.4% (n = 131) were in 6th grade of Primary Education.

Instruments

Behavioral Homework Engagement

To measure behavioral engagement (the time dedicated to doing homework and the amount of homework done), we used the *Encuesta sobre los Deberes Escolares (EDE, Survey on School Homework),* which has been used in recent studies (e.g., see Rosário et al., 2009; Núñez et al., 2015a,b; Valle et al., 2015a) to obtain this kind of data.

To measure the *daily time devoted to doing homework*, students responded to three items (α = 74) (in general, during a typical week, on a typical weekend), from the general sentence "How much time do you usually spend on homework?", with the following response options: 1 = *less than 30 min*, 2 = *30 min to one hour*, 3 = *one hour to an hour and a half*, 4 = *one hour and a half to two hours*, 5 = *more than two hours*.

With regard to *optimizing the time spent on homework* (α = 0.79), this was measured through the responses to three items (in general, during a typical week, on a typical weekend) in which they were asked to indicate the level of optimization of the time normally spent on homework, using the following scale: 1 = *I waste it completely* (I am constantly distracted by anything), 2 = *I waste it more than I should*, 3 = *regular*, 4 = *I optimize it pretty much*, 5 = *I optimize it completely* (*I concentrate and I don't think about anything else until I finish*).

Finally, estimation of the *amount of homework done* by students was obtained through responses to an item about the amount of homework usually done, using a 5-point Likert-type scale (1 = *none*, 2 = *some*, 3 = *one half*, 4 = *almost all*, 5 = *all*).

Motivational and Cognitive Homework Engagement

To measure motivational and cognitive engagement (approach to homework), we used an adaptation of the *Students' Approaches to Learning Inventory* (Rosário et al., 2010, 2013), taking into account both the students' age and the homework context. The questionnaire is composed of twelve items, of which six evaluated students' motives and reasons for doing homework (three of them evaluate deep motives and another three shallow motives) and the other six items evaluate the cognitive strategies students implement when doing homework (three of them evaluate deep strategies and the other three shallow strategies). This instrument is based on existing research in the field of approaches to learning and study (e.g., Biggs et al., 2001), and provides information on two modes, or approaches, to homework: the shallow focus (α = 0.65) (e.g., item: "I usually do the homework, but rarely I notice how I'm doing") and deep approach (α = 0.80) (e.g., item: "Before I start doing homework, I think about whether what was taught in class is clear and, if it is not, I review the lesson before starting"). Participants responded to the items on a 5-point Likert -type scale ranging from 1 (*totally false*) to 5 (*absolutely true*).

Prior Academic Achievement

Prior academic achievement was assessed through students' report final card grades in Spanish Language, Galician Language, English Language, Knowledge of the Environment, and Mathematics. Average achievement was calculated with the mean grades in these five areas.

Procedure

The study protocol was approved by the Research and Teaching Ethics Committee of the University of A Coruña. Data about the target variable were collected during school hours by personnel external to the center itself, after obtaining written informed consent of the management team, the students' teachers, and the students' parents, in accordance with the ethical standards established in the Declaration of Helsinki. Before applying the

questionnaires, at a single time-point, participants were informed about the importance of responding sincerely to the different questions, emphasizing their completely confidential nature.

Data Analysis

In order to comply with the objectives of the work, we performed a Multivariate Analysis of Covariance (MANCOVA), taking as the factor students' prior academic achievement (with three levels: low, medium, and high) and as dependent variables those referring to the motivational and cognitive engagement (approaches do homework). The following criteria were used to determine the three levels of prior achievement: low achievement, up to the 33rd percentile; average achievement, from percentile 33 to 66; high achievement, as of the 66th percentile). Subsequently, we conducted another MANCOVA, taking prior academic achievement as the factor and, as dependent variables, those referring to behavioral engagement (quantity of homework done, amount of time spent, and optimization of that time). In order to statistically control for their possible effects, in both analyses, gender and grade were included as covariates.

As a measure of the effect size, we used the partial eta-squared coefficient (η_p^2), one of the most commonly used within educational research (e.g., Sun et al., 2010). The criterion established in the classical work of Cohen (1988) was used to interpret the effect sizes: null effect: $\eta_p^2 < 0.01$ ($d < 0.09$); small effect: $\eta_p^2 = 0.01$ to $\eta_p^2 = 0.058$ ($d = 0.10 - d = 0.49$); medium effect: $\eta_p^2 = 0.059$ to $\eta_p^2 = 0.137$ ($d = 0.50 - d = 0.79$); and large effect: $\eta_p^2 \geq 0.138$ ($d \geq 0.80$).

RESULTS

Descriptive and Correlational Analysis

The relations between the variables and the descriptive statistics are shown in **Table 1**. Prior academic achievement was positively and significantly related to the deep approach, the amount of homework done, and management of the time spent on homework. However, academic achievement had a negative and significant relationship with the shallow focus and it had no relationship with the amount of time spent on homework. The deep approach showed a positive and significant relationship with the amount of homework done and with time management, but it was negatively and significantly related to the shallow focus, and had no relation with the time spent on homework. The shallow approach did not have any relationship with the time spent on homework, but it did present a negative and significant relationship with the amount of homework done and with time management. The amount of homework done was positively and significantly related to time management and to the amount of time spent on homework, although in the latter case, the relationship was weaker. On another hand, there was no statistically significant relation between the amount of time spent on homework and time management.

TABLE 1 | Means, standard deviations, skewness, kurtosis, and correlation matrix of the target variables.

	1	2	3	4	5	6
1. Prior academic achievement	–					
2. Deep approach	0.15**	–				
3. Superficial approach	−0.32**	−0.17**	–			
4. Amount HW	0.33**	0.34	−0.16**	–		
5. HW time spent	−0.01	−0.01	−0.00	0.10*	–	
6. HW time management	0.25**	0.45**	−0.22**	0.38**	−0.02	–
M	3.14	4.01	2.62	4.63	2.52	4.06
SD	1.18	0.81	0.93	0.73	1.15	0.94
Skewness	−0.25	−0.88	0.48	−2.29	0.59	−1.17
Kurtosis	−0.89	0.59	−0.25	5.21	−0.35	1.52

*$p < 0.05$. **$p < 0.01$.

Differences in Motivational and Cognitive Engagement Depending on Prior Academic Achievement (Controlling for the Effect of Grade and Gender)

After controlling for the effects of grade [$\lambda_{Wilks} = 0.926$, $F(2,510) = 20.39$, $p < 0.001$, $\eta_p^2 = 0.074$] and gender [$\lambda_{Wilks} = 0.997$, $F(2,510) = 0.72$, $p = 0.489$, $\eta_p^2 = 0.003$], the results revealed statistically significant differences in the set of variables related to motivational and cognitive engagement as a function of the different levels of prior academic achievement [$\lambda_{Wilks} = 0.899$, $F(2,510) = 13.97$, $p < 0.001$, $\eta_p^2 = 0.052$]. The effect size was medium.

Taking into account the data on each dependent variable considered individually, there were statistically significant differences depending on the level of students' prior academic achievement in the shallow approach [$F(2,511) = 20.95$, $p < 0.001$, $\eta_p^2 = 0.095$] and the deep approach [$F(2,511) = 4.01$, $p < 0.05$, $\eta_p^2 = 0.0015$]. In the former case, the effect size was medium and, in the latter case, it was small. In addition, as can be seen, only the grade covariate was significant, with a medium effect size.

As can be observed in **Table 2** and **Figure 1**, as the levels of achievement rose, there was a decrease in the use of a shallow approach and an increase in the use of a deep approach.

TABLE 2 | Descriptive statistics (mean, standard deviation) corresponding to each of the levels of prior academic achievement in the variables related to motivational and cognitive engagement (approach to homework).

	Academic Achievement							
	Low		Medium		High		Total	
	M	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*
Deep approach	3.84	0.91	4.03	0.74	4.13	0.70	4.01	0.81
Superficial approach	2.99	0.95	2.66	0.94	2.29	0.76	2.62	0.93

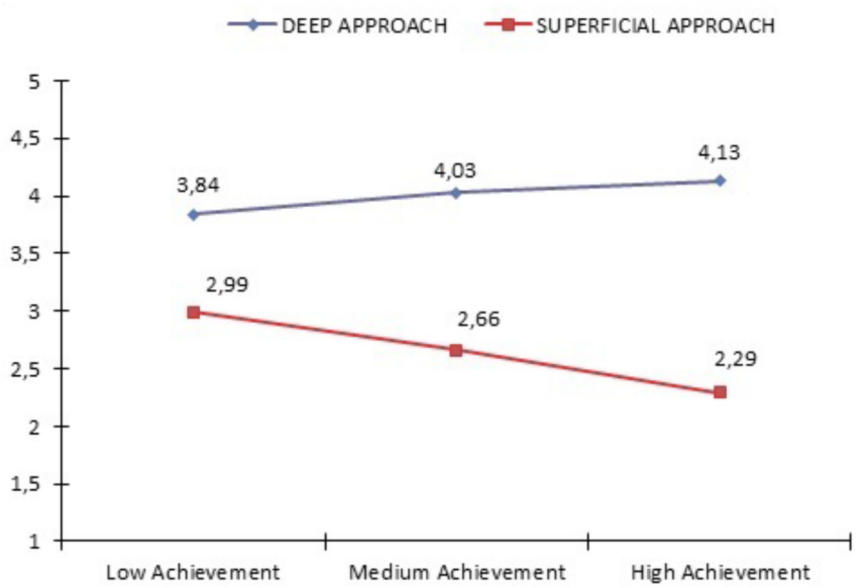

FIGURE 1 | Graphic representation of the mean values in motivational and cognitive engagement (deep approach, shallow approach) as a function of the levels of prior academic achievement.

Differences in Behavioral Engagement as a Function of Prior Academic Achievement (Controlling for the Effect of Grade and Gender)

After controlling for the effects of grade [$\lambda_{Wilks} = 0.937$, $F(3,509) = 11.33$, $p < 0.001$, $\eta_p^2 = 0.063$] and gender [$\lambda_{Wilks} = 0.993$, $F(3,509) = 1.14$, $p = 0.331$, $\eta_p^2 = 0.007$], the results showed statistically significant differences in the set of variables related to behavioral engagement as a function of the different levels of prior academic achievement [$\lambda_{Wilks} = 0.888$, $F(3,509) = 10.42$, $p < 0.001$, $\eta_p^2 = 0.058$]. The effect size was medium. Also in this case, only the grade covariate was significant, with a medium effect size.

Taking the data on each dependent variable considered individually, as a function of the level of students' prior academic achievement, there were statistically significant differences in amount of homework done [$F(2,511) = 27.51$, $p < 0.001$, $\eta_p^2 = 0.097$] and the optimization of the time spent on homework [$F(2,511) = 13.28$, $p < 0.05$, $\eta_p^2 = 0.049$]. In both cases, the effect size was medium, although the former was quite high. On another hand, there were no statistically significant differences in the time spent on homework [$F(2,511) = 0.39$, $p = 0.678$; $\eta_p^2 = 0.002$] as a function of prior achievement.

As can be seen in **Table 3** and **Figure 2**, the results indicated that, as prior academic achievement levels rose, there was a progressive increase in the amount of homework done and the optimization of the time devoted to homework. On another hand, there were no statistically significant differences as a function of prior achievement in the time spent on homework.

TABLE 3 | Descriptive statistics (mean, standard deviation) corresponding to each of the levels of prior academic achievement in the variables related to behavioral engagement.

	Academic Achievement							
	Low		Medium		High		Total	
	M	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*
Amount HW	4.28	0.97	4.73	0.55	4.82	0.50	4.62	0.73
HW Time spent	2.56	1.20	2.46	1.04	2.55	1.20	2.52	1.15
HW Time management	3.73	1.12	4.14	0.84	4.26	0.77	4.06	0.94

DISCUSSION

The results of this study highlight the relationships between prior academic achievement and students' degree of cognitive and motivational homework engagement. In fact, higher academic achievement levels are associated with a greater increase in the use of a deep approach and a decrease in a shallow approach to homework.

In addition, prior achievement is also linked with students' behavioral homework engagement. Thus, higher levels of academic achievement are associated with a greater amount of teacher-assigned homework done and a better optimization of the time spent on homework. On another hand, different levels of prior achievement do not appear to be associated with differences in the amount of time students spend doing homework.

These results indicate that prior experiences of academic success have positive consequences on students' degree of engagement with homework. These success experiences are a

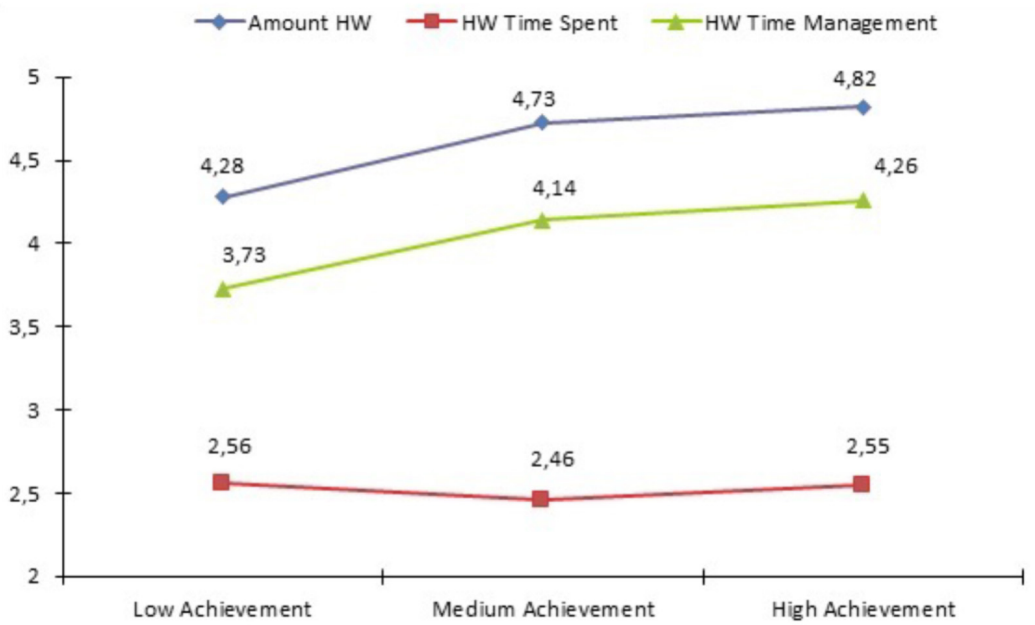

FIGURE 2 | Graphic representation of the mean values of the variables associated with behavioral engagement (amount of homework done-Amount HW-, time devoted to homework-HW Time Spent- and optimization of the time spent on homework-HW Time Management) as a function of the levels of prior academic achievement.

powerful source at the motivational, cognitive and behavioral level, as they not only generate students' greater confidence in their own abilities, but are also a real antidote for low self-efficacy beliefs and low motivation toward learning. In contrast, prior experiences of failure decrease students' confidence in their abilities, demotivating them to learn and leading them to avoid engaging in study activities (Bandura, 1993).

In this line, the findings of this study suggest that past successful experiences contribute to generate deeper and less shallow modes or approaches to homework. This finding leads to some educational implications of consideration, taking into account that the deep focus on homework is associated with a high desire to learn and understand the content of the tasks, and to relate the content with students' prior knowledge (Doménech and Gómez, 2011; Valle et al., 2015b), and, usually, it represents high academic achievement (Bembenutty and White, 2013; Núñez et al., 2014). However, students who use a shallow approach conceive homework as a necessary imposition to achieve other goals. Therefore, their main objective is to complete it as soon as possible, and their greatest concern is to bring it to class completed, in order to avoid reproaches or to please the teacher's demands, but not with the priority aim of learning (Valle et al., 2015b). As a result, they tend to obtain low academic results (Rosário et al., 2010).

Therefore, the link established between high prior academic achievement, increase of a deep approach to homework and decrease of a shallow approach is one of the keys to achieving an optimum and high quality homework performance, where the students' degree of cognitive and motivational engagement meets the necessary requirements to ensure that homework is a useful and beneficial tool to strengthen and improve the learning processes and consequently, students' results. In fact, a deep learning approach is associated with higher quality results (Cano et al., 2014). And also in the case of homework, the approach employed conditions not only the process of doing homework and the results, but also students' level of homework engagement.

Prior academic achievement is also related to the degree of behavioral homework engagement. Specifically, higher levels of prior achievement are associated with a greater amount of homework done and a better optimization of the time spent on homework. The positive relationship between the amount of homework done and academic achievement has been found in several research studies on homework (Cooper, 1989; Cooper et al., 1998; Trautwein et al., 2002; Valle et al., 2015a).

Within behavioral homework engagement, another variable is the time spent on homework. In this case, a difference has been established between the amount of time spent on homework and the quality of that time (time optimization) The results of this study indicate that there is only a positive and statistically significant relationship between prior achievement and the optimization of the time spent on homework, but there is no relationship with the amount of time spent on homework. These results are in line with other prior works (see, e.g., Trautwein et al., 2006; Flunger et al., 2015) in which it was found that students who spend more time on homework are not necessarily better students, but rather may be students who have greater difficulties, concentration problems, or who are not sufficiently motivated. The effort that a student makes doing homework is not necessarily related to the amount of time that he or she takes

to do it (Trautwein et al., 2015. However, our results emphasize the relevance of prior academic achievement in effective time management when doing homework. This finding is consistent with other studies (e.g., Núñez et al., 2015a) in which it was found that optimization of the time devoted to homework was the variable that best predicted students' academic achievement.

In this way, it can be deduced that the study of the relationship between prior achievement and time devoted to homework should take into account other matters related to the process of homework and should contemplate other variables—perhaps more relevant to this process—such as, for example, all those related to time management skills. In fact, the relationship between the amount of homework done, the time devoted to it, and academic achievement may be moderated by the actual optimization of the time students spend on homework (Valle et al., 2017). In the same vein, it should be noted that students who manage their homework time well are the ones who engage in it more deeply; hence, homework time optimization is more decisive than the amount of time devoted to homework (Valle et al., 2015b). Additionally, the criteria that we have used to determine the three levels of prior achievement should be taken into account. Although percentiles are a common grouping criterion in educational research, they can limit the statistical power of the results obtained.

Despite this limitations, the results of this work allow us to establish a clear relationship between prior academic achievement and students' degree of motivational, cognitive, and behavioral homework engagement. Previous experiences of academic success are associated with certain indicators that reveal the quality of the process of doing homework. These indicators are related to greater use of a deep approach to homework, with a better and more efficient management of the time devoted to homework and also with a greater amount of teacher-assigned homework done. Probably, these quality indicators of the process of doing homework will also have positive effects on the students' overall academic achievement and their degree of engagement in their learning process.

Future research should clarify some of the results that seem to call into question, for example, the relationship between the time spent on homework and achievement. In fact, although some multilevel studies show that, at the individual level, the time spent on homework has little incidence on academic achievement, when measured at the classroom level, the results are positive (Fernández-Alonso et al., 2014). The possible effect on homework of the variable "grade" should also be reviewed in greater detail, especially through longitudinal studies contemplating the possible change in the different variables involved in homework as students go on to higher grades. In this sense, future works should take into account, not only the three grades contemplated in this study, but also the first three years of primary education. Finally, socioeconomic status was not measured in our study. Consequently, future works should analyze the specific role played by students' socioeconomic status in the relationship between prior achievement and homework engagement.

AUTHOR CONTRIBUTIONS

IP, IE, and CF contributed to conception and design of the study and wrote the first draft of the manuscript. AS organized the database. IE and CF performed the statistical analysis. AdC, AS, and MG-S wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Homework and Academic Achievement in Latin America: A Multilevel Approach

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The relationship between homework and academic results has been widely researched. Most of that research has used English-speaking, European or Asian samples, and to date there have been no detailed studies into that relationship in Latin America and the Caribbean. The aim of this study is to examine the effect of quantitative homework characteristics on achievement in science. The sample comprised 61,938 students at 2,955 schools in the 15 Latin American countries (plus the Mexican state of New Leon) which participated in the Third Regional Comparative and Explanatory Study (TERCE), carried out by the Latin American Laboratory for Educational Quality (LLECE) in 2013. The mean age was 12.42 years old (±0.94). Within each country, three hierarchical-linear models were applied at two levels: student and school. The individual level considered time spent doing homework and the school level considered the amount and frequency of homework assignment. In addition, ten control variables were included in order to control the net effect of the characteristics of the homework on the result. The results confirmed that homework is widely assigned in the Latin American region. At the individual level, time spent on homework had little effect on academic performance, while in the quantitative homework characteristics it was the frequency of homework assignment which demonstrated a clearer effect rather than the amount of homework assigned.

Keywords: homework time, science, academic performance, multilevel models, Latin America

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INTRODUCTION

Student academic performance is influenced by a broad mix of factors which recent research and reviews have identified: opportunities to learn, time on tasks, classroom organization and management, teaching strategies, learner evaluation and feedback, the school environment, and family involvement and expectations about learning (Scheerens and Bosker, 1997; Scheerens et al., 2007, 2013b; Towsend, 2007; Hattie, 2009; Scheerens, 2016; Fernández-Alonso et al., 2017b). In addition, one must consider the contributions of educational theories originating from sociology which confirm that educational success is largely determined by cultural capital and by belonging to dominant groups (White, 1982; Sirin, 2005; Palardy et al., 2015) as well as the theories of learning

which indicate that neurobiological principles, prior knowledge, and cognitive and affective-motivational personality factors are basic components in the formula for academic success (Shell et al., 2010).

Although homework does not feature in the most important factors in the studies cited above, it has attracted a great deal of attention and been the subject of much research as it is the only teaching factor which is done at home. This characteristic of homework fuels social and family debate, and affects other key variables in school performance, such as family involvement, time on tasks, and learning self-regulation.

Research into homework has progressed toward comprehensive models, which include multiple variables related to the characteristics of the homework, teachers, students and their families (Epstein and Pinkow, 1988; Trautwein et al., 2006; Fernández-Alonso et al., 2016). Nonetheless, the aspect which has been studied the most is the relationship between homework time and school results (Goldstein, 1960; Paschal et al., 1984; Cooper, 1989; Cooper and Valentine, 2001; Trautwein and Köller, 2003; Cooper et al., 2006, 2012; Blazer, 2009; Canadian Council on Learning, 2009; Scheerens et al., 2013a; Fan et al., 2017). Despite the mountains of data gathered so far, the results are far from conclusive, as Scheerens et al. (2013a) clearly indicated. They reviewed 128 independent effects of homework time on individual performance with samples in dozens of countries and found varying results: 32% of studies showed negative effects, 33% showed non-significant effects, and 35% showed positive effects. In short, the debate remains open, and there are no simple, unequivocal answers to key questions like whether homework should be assigned or not, or how much time is most appropriate. This apparent contradiction in results, however, is down to two questions that most of the studies we reviewed had not considered. In the first place, when examining the association between achievement and homework time, much of the research had not addressed a key prior question: Why do some students spend longer than others completing their homework? Flunger et al. (2015) identified five student profiles according to time spent and students' behavior and effort related to homework. In addition, behavior and time spent on homework are conditioned by other variables which also have an influence on school results, such as cognitive capacity, school history, prior knowledge, motivation, sex, age, and sociological factors (De Jong et al., 2000; Trautwein et al., 2002; Trautwein, 2007; Dettmers et al., 2009; Fernández-Alonso et al., 2014, 2015, 2017a). Many studies which have examined the relationship between time spent on homework and school results have not included the effects of these variables in their analyses, hence these apparent contradictions. It is only by controlling for these variables that one may estimate a net effect of the relationship between the quantitative measures of homework and school achievement which is not confounded or affected by other factors.

As indicated by Trautwein and Köller (2003), a significant amount of the research has not addressed the fact that quantitative homework measures are multilevel variables which have different meanings and effects depending on the level being considered. We suppose that the item "How long do you spend on your homework?" when analyzed at the individual level would reflect the student's dedication and work habits. However, if this item is considered at the classroom or school level, it would tend to be an estimation of the amount of homework assigned. In that case it is capturing the effect of the teachers' homework policies, a measure with a completely different meaning. In addition, the effect of these two variables on performance is different, the individual measure has little effect on school results (Farrow et al., 1999; De Jong et al., 2000; Dettmers et al., 2010; Murillo and Martínez-Garrido, 2013; Fernández-Alonso et al., 2014; Núñez et al., 2014), and when it is statistically significant, the effect is negative (Trautwein, 2007; Trautwein et al., 2009; Lubbers et al., 2010; Chang et al., 2014; Fernández-Alonso et al., 2015, 2017a; Núñez et al., 2015). This is consistent with the idea that the time spent on homework by the different types of students is not related to school results (Flunger et al., 2015). Multilevel studies, on the other hand, have found positive effects at class and school level when using variables such as frequency and amount of homework (Farrow et al., 1999; De Jong et al., 2000; Dettmers et al., 2009; OECD, 2013; Fernández-Alonso et al., 2017a). It has also been found that when these two variables go together, the frequency of homework has more explanatory power than homework amount (Trautwein et al., 2002, 2009; Trautwein, 2007; Fernández-Alonso et al., 2014, 2015, 2017a). The classical statistical models do not permit the consideration of student and class level effects at the same time. For that reason, it is necessary to use hierarchical-linear models which can separate the effects of the quantitative homework measures into the two levels noted above.

One of the most hotly debated questions is whether the effect of quantitative homework measures is universal or whether there are factors within educational systems which lead to varying effects in different countries, regions and cultures. The amount of homework tends to be higher in Asian countries, whereas the effect of homework on results seems to be more significant in studies in English-speaking and European samples compared to Asian students (Scheerens et al., 2007, 2013a; Dettmers et al., 2009; Fan et al., 2017). There have not been sufficient studies in Latin America to allow conclusions to be drawn in this regard, although it is worth mentioning the work by Murillo and Martínez-Garrido (2013, 2014), the *Third Regional Comparative and Explanatory Study* (UNESCO-OREALC and LLECE, 2016a), and the analysis by Dettmers et al. (2009), which includes the three countries in this region which took part in the second edition of the *Program for Student Assessment* (PISA) in 2003.

Murillo and Martínez-Garrido (2013) used data from nine countries (in addition to Spain), their three level model (student-class-school) did not segregate data by country. The homework variables were reported by teachers and only considered at school level, with neither the amount, nor the frequency being statistically significant. The only positive relationship was between assigning homework and the result in mathematics, but not in Spanish. In their second study Murillo and Martínez-Garrido (2014) once again used measures of frequency and amount of homework reported by teachers, aggregated to school-level. They reported descriptive statistics by country, but the

data were not segregated at that level in the hierarchical-linear model, so there is no way to compare effects between countries. Once again they found that neither variable demonstrated a relationship with reading or mathematics results in students in the 3rd–6th years of primary education. UNESCO-OREALC and LLECE (2016a) did compare effects between countries, but the study only looked at one dichotomous variable at the student level reported by parents, not students: spending 30 min or more on homework every day (or not). Finally, the study by Dettmers et al. (2009) is the only one which used quantitative measures at two levels (student and school), although only three countries in the region participated. Once controlled for socio-economic level, the results are rather variable: in Mexico they found positive effects at both levels, in Brazil there was only a positive effect at student-level, and in Uruguay there were no significant effects at either level.

In summary, in the Latin American context, there are no studies which systematically compare the effects of quantitative homework measures using multilevel analysis and control variables. The data available are only general, not segregated by country or strata, and only include quantitative measures at a single level (Murillo and Martínez-Garrido, 2013, 2014; UNESCO-OREALC and LLECE, 2016a), and where those conditions are met, the studies include only a limited number of countries from the region (Dettmers et al., 2009). New intercultural analysis models allow much more rigorous comparisons between countries (Byrne and van de Vijver, 2017). In this context, our current study has two objectives. Firstly, to establish the prevalence of homework in Latin America, describing and comparing the quantitative characteristics of homework in the different Latin American countries. Secondly, to estimate the effects of homework time and characteristics of homework assignment (frequency and amount) on school results, adjusting the analysis models according to the socio-demographics of the students, schools, and countries.

MATERIALS AND METHODS

Participants

The sample population was defined as those students in the 6th grade of compulsory education in 2013 in the 15 participating Latin American countries and the Mexican state of New Leon. In each country the sample was selected following a two-stage stratified cluster method (OECD, 2009; Joncas and Foy, 2012). In the first stage, schools were selected with a probability proportional to their size, and in the second stage a complete class-group was selected from each school, giving a sample of more than 67,000 students. In this current study we excluded students lacking information in the science test, leading to a final sample made up of 61,938 students from 2,955 schools, representing a population of almost 9 million students. The mean age of the students was 12.42 years old with a standard deviation of 0.94. Over two thirds (69.4%) attended state schools, 65.8% attended an urban school; 49.6% were girls, and 81.9% were in the school year corresponding to their age, meaning that the remaining 18.1% had repeated at least one school year at the time of the test.

Instruments

Two types of instrument were used in the study: (a) tests of academic knowledge, from which we constructed the dependent variable in the study; (b) questionnaires about context for the students, their families, the teachers, and school management, from which we extracted the variables of interest and control variables for our study, with the exception of the relative levels of wealth in each country. The tests were taken during the TERCE evaluation program run by the United Nations Educational, Scientific and Cultural Organization (UNESCO) whose databases are freely available for secondary analysis (UNESCO-OREALC, 2016).

Tests of Academic Performance

Students completed a battery of tests evaluating reading, mathematics and science, in this study we decided to use the science results as a dependent variable. The science test was produced from a table of specifications organized into five domains and three cognitive processes (UNESCO-OREALC, 2016). It contained 92 items, mostly multiple-choice, grouped in six blocks which were distributed in six test booklets following a matrix design (Fernández-Alonso and Muñiz, 2011). Each student completed one test booklet containing 31 to 33 items they had to answer in 60 min. The items were adjusted to the Rasch model using the Winsteps program (Linacre, 2005). Each student's score was calculated via the methodology of plausible values, which is the most effective for recovering population parameters in evaluations of education systems (Mislevy et al., 1992; OECD, 2009; von Davier et al., 2009) In TERCE, the individual scores were estimated by combining students' item responses with information from various co-variables which functioned as imputation factors, they were expressed on a scale with a mean of 700 points and standard deviation 100 (UNESCO-OREALC and LLECE, 2016b).

Control Variables

When the dependent variable is school performance, it is necessary to include control variables to avoid overestimating the effects of the variables of interest (Fernández-Alonso et al., 2017b). We chose seven control variables from those available in TERCE, all of which are important in the prediction of academic achievement (Liu and Whitford, 2011; UNESCO-OREALC and LLECE, 2016a; Woitschach et al., 2017). Four describe student socio-demographic characteristics: *Gender* (1 = female); *Indigenous* (1 = member of indigenous population); *In paid work* (1 = works and is paid for that work); and *Student's Socioeconomic and cultural level (SEC)*, a standardized index created by TERCE composed of 17 items about parents' levels of education, type of work, family income range, amenities and services in the area where they live, and availability of reading material at home. The values of Cronbach's alpha for this index range between 0.8 and 0.9 depending on the country (UNESCO-OREALC, 2016). The remaining three variables refer to previous school history and the student's learning resources: *Repetition* (1 = the student has

repeated a year during their schooling); *Textbook* (1 = the student has a science textbook); and *Notebook* (1 = the student has a school notebook).

We used three variables to describe the social and demographic context of the schools, two were dichotomous: *School Type* (1 = private school) and whether a school was *Rural*. The third variable was the *School socioeconomic and cultural level,* which was the mean of the student SEC in that school.

Homework Variables

The questionnaire about student context contained two multiple choice items that were used to construct the variables of interest. Item 1 asked *how many days a week do you study or do homework?* with response options between 0 and 7. Item 2 asked *how long do you spend doing homework on the days when you study?* and had four options: (a) I don't study; (b) less than 1 h a day; (c) between 1 and 2 h; (d) more than 2 h. The responses were coded as 0, 30, 90, and 150 min, respectively.

These items were used to construct four variables: *Does no homework* (NoHW), a dichotomous variable where 1 indicates students who do not do homework; *Homework time* (HWTime), the mean daily minutes spent doing homework calculated as follows: *HWTime = Item1*Item2/7*. HWTime was squared in order to add a quadratic element to the regression (*HWTime_2*). Teachers' homework policies were described with two variables: The amount of homework (*HWAmount*), the mean homework time per school; and Frequency of homework assignment (*HWFreq*), the mean number of days in a school that students do homework.

Procedure

The cognitive tests were applied by expert personnel who were not employed by the school being tested. Tests were carried out on 2 days, the first day for reading and writing, and the second for mathematics and science. The tests for each subject took between 45 and 60 min, with a 30-min break in the middle; following that, after a 15-min break, the student context questionnaires took about 45 min to complete. The questionnaires for the schools, teachers and families were distributed on the first day, and collected at the end of the second day. UNESCO ethical guidelines were followed, and the families of the students selected to participate in the evaluation were informed about the study by the school administrations, and were able to choose whether those students would participate in the study or not.

Data Analysis

The first step in the analysis was to calculate the descriptive statistics for all variables. Following that, for each country three random-intercept hierarchical-linear models were created with two levels: student and school. The modeling strategy was as follows: first produce a null model without predictors to check the distribution of variance in each level. The second model included the four homework variables, and the third model added the control variables described previously. We used the maximum likelihood estimation method with robust standard errors using the HLM 7.01 program (Raudenbush et al., 2011). In all analyses we used the weightings provided by TERCE which were designed so that each country, regardless of size, would have an equal contribution in the analysis of results (UNESCO-OREALC, 2016), with the sum total of weights in each country being equivalent to 5000 students.

The amount of missing data in the variables ranged from 2 to 12%. We used a two-step strategy to recover missing data. Firstly, the incomplete cases were imputed with the mean of the subject, then the completely missing data were recovered using the iterative EM method with auxiliary variables in the Missing Value Analysis module of SPSS 24. Fernández-Alonso et al. (2012) found that this two-step strategy produces the best recovery of population data in studies with this (non-random) type of missing data and levels of missing data similar to those in TERCE.

RESULTS

Table 1 shows the data related to the first research objective, the two basic characteristics of homework assignment habits in each country.

The median number of days doing homework (between 4 and 5 in almost all countries) indicates that Latin American teachers set homework most days of the week. The median is less than 4 in only two cases (Costa Rica and Chile). For the combined TERCE data the estimated amount of homework is a little more than 50 min a day, the equivalent of a weekly volume of a little more than 6 h. However, there are huge variations between countries. For example, homework in the Dominican Republic requires 3.5 h a week more than in Chile. The final column shows the percentage of students who do not do homework. The correlation between this percentage and the amount of homework by country is negative ($r_{xy} = -0.66$), in other words countries with a smaller amount of homework tend to have a higher proportion of students who report not doing homework.

In the hierarchical-linear models, the effect of homework is small in Latin American countries (**Table 2**). In most countries not doing homework has a negative effect, which is statistically significant ($p < 0.10$) in half of the cases. In general the effect of homework time is not significant when considered at the individual level. Of the five statistically significant cases, four were positive and the other negative. Nevertheless, homework time has a small effect. In Ecuador, for example, where the positive effect is largest, once the control variables are added, the model predicts a gain of less than 8 points for each extra hour spent on homework. In the variables which describe the teachers' homework policies, the effect of the frequency of setting homework is positive in most countries and statistically significant in six cases. The amount of homework set exhibits mainly small, negative effects that are not statistically significant. The introduction of control variables in model 3 does not change the direction of the effects but it does mitigate them somewhat, with some cases losing statistical significance.

Table 3 shows the effects of the control variables in model 3. The most determinative variable is socioeconomic level, which is significant in all countries at the individual level, and in almost all countries at school level. Individual variables which

TABLE 1 | Frequency and amount of homework in Latin American countries.

Country	Frequency: days with homework (median)	Amount: total daily minutes		Percentage not doing homework
		Mean	*SEM*	
Argentina	4	46	0.6	10%
Brazil	4	45	0.5	8%
Chile	3	36	0.5	9%
Colombia	5	57	0.5	2%
Costa Rica	3	42	0.5	5%
Ecuador	5	68	0.6	2%
Guatemala	5	61	0.6	2%
Honduras	5	60	0.6	4%
Mexico	5	50	0.5	4%
Nicaragua	5	60	0.5	4%
Panama	5	60	0.6	5%
Paraguay	4	48	0.5	6%
Peru	5	65	0.6	2%
Dominican Rep.	5	72	0.6	4%
Uruguay	4	45	0.5	11%
New Leon	5	52	0.5	3%

stand out include repeating school years which has a negative effect in all cases, and availability of basic learning resources (science textbook and school notebook). Once the effect of those variables is controlled for, the variables of gender, being indigenous, and being in work have a smaller effect. A similar situation occurs with the type of school and whether it is urban or rural, which do not demonstrate statistically significant effects in most cases, probably because their effects are overshadowed by the dominance of the effects of the schools' socioeconomic and cultural levels.

Table 4 shows the distribution of the percentage of variance between the two levels of analysis in model 1 (without predictors) and the percentage of that variance explained by models 2 and 3. The percentage of variance in model 1 at school level (L2) indicates that there are significant differences between schools in Latin American countries. One group of countries (Ecuador, Guatemala, Honduras, Nicaragua, Paraguay and Peru) have approximately 50% of the variance in level 2, whereas in those cases where the variance is smaller, it is around 20% (Costa Rica and the Dominican Republic). The results indicate that the percentage of total variance explained by the homework model (model 2) is small, when it is not practically null. In countries where the effect of the homework variables is greater (Argentina and Colombia), the reduction of the total variance is about 7%, but in other cases (Costa Rica, Ecuador, Nicaragua, and Paraguay) the data explain less than 1% of the total variance. Furthermore, the reduction of variance between students is very small in all cases, which confirms that quantitative homework variables have more impact on the differences between schools than the differences between students. Finally, model 3 indicates that the control variables explain more than half of the variance between schools in most cases and between 15 and 30% of the total variance.

DISCUSSION AND CONCLUSION

There are three main reasons justifying interest in this work. The first is its general scientific character: the effect of quantitative homework variables on school results is something which has been widely researched (v. g., Goldstein, 1960; Paschal et al., 1984; Trautwein and Köller, 2003; Cooper et al., 2006, 2012; Trautwein et al., 2006; Scheerens et al., 2013a; Fan et al., 2017) but which has not produced a unanimous answer which is why it is important to add new evidence in that regard. Nonetheless, in the context of Latin America and the Caribbean, a region which represents approximately 8% of the world's population, there are no studies which focus on systematically analyzing this topic. Research available up to now has not presented data separated by country and has only assessed homework variables in aggregate (Murillo and Martínez-Garrido, 2013, 2014; UNESCO-OREALC and LLECE, 2016a). The second justification is the need to examine whether the results from the research cited above are also found in the Latin American context, which will let us see for the first time the prevalence of homework in those countries, and look at the possible differences between countries. In other words, allow us to analyze the invariance of the relationships in the various Latin American countries (Byrne and van de Vijver, 2017). This study aims to provide transcultural validity by offering data which can be compared with the evidence accumulated by studies in English-speaking, European and Asian populations. Finally, the third reason is that our research may serve as a guide and a stimulus for other similar research in Latin American countries.

If we consider the first objective, we can conclude that more than 90% of Latin American and Caribbean students do homework to some extent, which is comparable with Western and Asian countries (Dettmers et al., 2009; Fan et al., 2017),

TABLE 2 | Regression coefficients and SE of homework variables in models 2 and 3.

	Model 2: HW variables only								**Model 3: with control variables**							
	Level 1 variables (individual)				**Level 2 variables (school)**				**Level 1 variables (individual)**				**Level 2 variables (school)**			
	No HW		**HW Time**		**HW Freq**		**HW Amount**		**No HW**		**HW Time**		**HW Freq**		**HW Amount**	
	β	***SE***	β	***SE***	β	***SE***	β	***SE***	β	***SE***	β	***SE***	β	***SE***	β	***SE***
Argentina	**−13.80**	**8.27**	−0.09	0.07	**32.73**	**11.15**	−0.39	0.55	−12.70	7.95	−0.08	0.07	3.51	8.10	0.18	0.46
Brazil	9.45	12.19	0.09	0.08	**52.50**	**12.80**	**−1.77**	**0.78**	8.26	11.43	0.05	0.07	**23.87**	**11.08**	−0.67	0.71
Chile	−7.31	7.82	0.05	0.09	**43.58**	**14.80**	−0.64	0.96	−4.26	7.61	0.05	0.09	**49.00**	**12.90**	**−1.95**	**0.85**
Colombia	8.33	19.26	0.11	0.08	**62.05**	**20.99**	−0.33	0.72	5.59	18.68	0.09	0.09	28.30	20.16	−0.80	0.68
Costa Rica	−9.75	9.36	**−0.19**	**0.07**	3.01	10.64	−0.27	0.59	−12.01	8.64	**−0.17**	**0.07**	4.22	7.99	−0.39	0.46
Ecuador	**−22.30**	**11.55**	**0.15**	**0.04**	−6.03	18.33	0.40	0.39	−14.70	11.42	**0.13**	**0.04**	−0.70	14.30	−0.06	0.38
Guatemala	**−23.62**	**11.46**	0.01	0.04	**37.79**	**9.45**	−0.63	0.41	**−19.27**	**10.67**	0.00	0.04	**20.73**	**8.75**	**−0.65**	**0.39**
Honduras	**−28.39**	**11.32**	0.09	0.06	18.27	11.58	−0.13	0.51	**−23.73**	**11.70**	0.06	0.06	**21.29**	**11.21**	−0.50	0.52
Mexico	**−17.45**	**9.13**	0.10	0.07	**23.68**	**11.62**	−0.59	0.53	−12.80	9.29	**0.10**	**0.06**	**15.99**	**8.50**	−0.33	0.43
Nicaragua	3.28	9.73	0.02	0.05	13.75	11.99	−0.46	0.57	1.85	9.74	0.00	0.06	19.30	13.55	−0.73	0.55
Panama	−11.25	12.48	0.05	0.07	−4.49	12.23	**1.00**	**0.59**	−5.60	12.17	0.05	0.07	7.22	10.63	−0.04	0.52
Paraguay	−12.55	12.52	0.02	0.07	6.34	11.26	−0.51	0.57	−14.30	12.63	0.00	0.07	−0.04	11.54	−0.26	0.58
Peru	**−34.82**	**17.61**	**0.11**	**0.05**	7.87	11.38	0.69	0.47	**−32.65**	**17.16**	**0.11**	**0.05**	10.61	8.73	0.42	0.36
Dominican Rep.	**−37.87**	**12.38**	**0.07**	**0.04**	13.68	12.83	−0.20	0.50	**−34.19**	**12.14**	0.02	0.04	0.68	9.24	0.07	0.37
Uruguay	**−28.96**	**15.50**	0.05	0.17	−22.22	16.75	**1.97**	**1.08**	−20.26	13.34	0.05	0.15	**−22.85**	**9.55**	**1.21**	**0.60**
New Leon	−12.72	8.78	**0.12**	**0.06**	7.64	10.81	**0.98**	**0.59**	−12.38	8.64	**0.12**	**0.06**	**17.32**	**8.61**	0.24	0.46

SE, standard error; bold text indicates statistically significant effects with at least $p < 0.10$.

TABLE 3 | Regression coefficients and SE for the control variables.

	Level 1 variables (individual)														Level 2 variables (school)					
	SEC		Female		Indigenous		Repeat year		Working		Science textbook		Notebook		Type		Rural		Mean SEC	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Argentina	**10.24**	**3.02**	0.15	3.87	−9.57	7.04	**−31.54**	**4.09**	−16.96	12.64	4.75	4.68	**24.27**	**4.71**	**20.60**	**10.06**	**25.37**	**9.47**	**57.06**	**10.26**
Brazil	**25.79**	**3.48**	−6.09	5.52	2.77	10.09	**−24.97**	**4.99**	−9.05	9.39	**19.56**	**4.62**	**9.71**	**5.32**	12.97	9.93	12.43	11.45	**66.11**	**10.92**
Chile	**13.99**	**3.44**	−0.21	3.73	2.54	5.76	**−29.99**	**5.83**	2.90	12.28	**35.20**	**5.11**	−0.07	4.66	9.18	9.92	9.12	15.84	**66.49**	**7.30**
Colombia	**13.86**	**4.41**	**−10.21**	**5.49**	8.05	11.99	−9.31	6.69	−27.98	24.31	−5.61	6.44	**14.31**	**4.71**	−2.67	10.01	12.66	13.10	**50.05**	**10.22**
Costa Rica	**17.19**	**3.27**	**−11.41**	**3.72**	−7.47	9.56	**−29.22**	**3.63**	6.54	13.91	3.02	4.93	**11.03**	**5.30**	**36.88**	**13.59**	6.14	25.19	**38.48**	**9.41**
Ecuador	**17.64**	**2.46**	−5.44	3.68	2.75	6.84	**−16.91**	**4.23**	−1.61	8.18	**16.62**	**4.98**	6.18	4.96	−16.75	13.25	25.69	18.45	**67.37**	**9.64**
Guatemala	**12.08**	**2.30**	**−10.79**	**4.15**	**8.99**	**5.08**	**−15.75**	**3.62**	−9.15	6.03	−6.85	5.66	**10.34**	**4.40**	**38.37**	**12.47**	2.62	8.16	**48.77**	**8.13**
Honduras	**13.66**	**3.48**	−0.21	3.70	1.36	7.05	**−17.48**	**3.67**	−5.89	10.82	**−12.87**	**5.78**	**13.87**	**4.68**	26.75	21.98	−14.79	17.88	19.10	14.46
Mexico	**17.39**	**3.09**	−1.15	3.35	1.76	6.93	**−16.69**	**5.66**	−5.85	8.38	**24.55**	**4.57**	8.16	5.36	11.31	13.34	14.25	11.08	**47.93**	**8.24**
Nicaragua	**9.53**	**1.71**	**−7.88**	**2.47**	−0.02	7.80	**−9.31**	**3.73**	0.66	7.96	**−7.48**	**3.48**	**8.46**	**3.74**	21.58	13.28	5.57	15.91	**32.05**	**14.09**
Panama	**15.75**	**2.76**	4.49	3.88	2.84	5.04	**−8.36**	**4.51**	−9.36	11.77	**14.67**	**4.21**	9.38	6.27	7.97	11.04	8.61	10.73	**55.92**	**8.20**
Paraguay	**8.22**	**2.61**	3.85	3.62	−7.61	6.96	**−8.39**	**3.71**	−3.26	8.44	1.00	4.56	**17.72**	**6.74**	**38.81**	**13.60**	−11.58	15.21	**27.29**	**11.97**
Peru	**11.21**	**2.29**	−5.53	3.45	−5.40	5.13	**−19.14**	**3.47**	−6.45	6.63	5.99	4.37	**10.82**	**4.40**	**38.24**	**10.16**	**−49.98**	**11.50**	11.97	8.80
Dominican Rep.	**21.42**	**2.79**	−0.72	3.93	NA	NA	**−15.40**	**3.07**	−1.71	7.28	**19.22**	**4.26**	4.90	4.24	9.81	6.33	8.62	7.32	**45.80**	**6.51**
Uruguay	**28.70**	**4.86**	−11.72	7.98	18.24	14.84	**−42.97**	**8.21**	−39.19	24.84	10.74	7.97	17.36	12.0	**39.57**	**20.50**	**86.87**	**21.22**	**58.13**	**19.03**
New Leon	**5.23**	**2.20**	0.83	3.54	−6.01	7.94	**−12.29**	**4.27**	−7.07	6.29	**7.54**	**4.41**	2.86	4.88	**20.72**	**11.09**	**−16.54**	**9.20**	**29.21**	**6.80**

SE, standard error; NA, not apply. In Dominican Republic "Indigenous" was not considered.
Bold text indicates statistically significant effects with at least $p < 0.10$.

TABLE 4 | Distribution of the variance in model 1 and percentage of variance explained in models 2 and 3.

	Model 1: without predictors					Model 2: homework variables			Model 3: all variables		
	L1	L2	Total	% Var L1	% Var L2	L1	L2	Total	L1	L2	Total
Argentina	5663.5	3241.0	8904.5	64%	36%	0.3%	18.0%	6.8%	5.8%	64.4%	27.1%
Brazil	6174.2	2878.5	9052.7	68%	32%	0.2%	15.3%	5.0%	8.3%	72.2%	28.6%
Chile	9021.2	3745.2	12766.4	71%	29%	0.2%	15.4%	4.6%	4.6%	67.0%	22.9%
Colombia	6430.3	2637.1	9067.4	71%	29%	0.1%	23.8%	7.0%	2.8%	52.5%	17.3%
Costa Rica	5786.7	1756.0	7542.7	77%	23%	0.3%	−0.8%	0.0%	6.6%	57.7%	18.5%
Ecuador	4518.4	3962.2	8480.6	53%	47%	0.6%	0.7%	0.6%	3.9%	42.8%	22.1%
Guatemala	3275.0	3213.8	6488.8	50%	50%	0.1%	8.8%	4.4%	4.1%	72.9%	38.2%
Honduras	3306.9	3119.8	6426.7	51%	49%	0.8%	7.2%	3.9%	3.7%	30.2%	16.5%
Mexico	5199.3	2484.6	7683.9	68%	32%	0.3%	5.6%	2.0%	6.1%	61.0%	23.8%
Nicaragua	2586.3	2547.0	5133.3	50%	50%	0.1%	1.2%	0.6%	1.6%	26.6%	14.0%
Panama	5333.2	3005.1	8338.3	64%	36%	0.0%	5.6%	2.0%	3.7%	65.3%	25.9%
Paraguay	3824.2	4062.0	7886.2	48%	52%	0.0%	0.1%	0.1%	1.8%	26.1%	14.3%
Peru	4041.0	4049.1	8090.1	50%	50%	0.6%	12.2%	6.4%	4.1%	54.0%	29.1%
Dominican Rep.	4154.4	1035.3	5189.7	80%	20%	1.3%	10.7%	3.2%	9.5%	65.1%	20.6%
Uruguay	8959.3	3117.9	12077.2	74%	26%	1.3%	7.0%	2.8%	11.6%	81.1%	29.6%
New Leon	5638.0	2188.9	7826.9	72%	28%	0.2%	11.8%	3.5%	1.2%	48.4%	14.4%

L1, Level 1 variables (individual); L2, level 2 variables (school).

and which seems to confirm that homework assignment is a universal teaching resource. The amount of daily homework in each region is highly variable. For example, in the Dominican Republic students report spending twice as long on homework as in Chile. Nonetheless, the time spent on homework in most countries ranges between 45 and 60 min a day, which is in line with what one would expect for students in the 6th grade according to Cooper's (2001) "10 min rule."

Previous evidence from multilevel analyses indicated that the effect of homework time at the individual level is small and when it is statistically significant, this effect is negative (Trautwein, 2007; Dettmers et al., 2010; Núñez et al., 2014, 2015). These results seem to be confirmed in Latin America and the Caribbean, as in the model with control variables only Ecuador, Mexico (including New Leon) and Peru gave results contrary to that hypothesis. In the case with the greatest effect (Ecuador), the model predicts gains of less than 8% of a standard deviation for each extra hour spent on homework; little yield for the effort and dedication needed.

In general, the quantitative variables describing teachers' homework policies produce expected results, although the proportion of statistically significant effects is rather lower than one might expect based on the evidence available from other contexts. After applying the control variables, only half of the countries demonstrated statistical significance for the frequency or amount of homework set. Nevertheless, these data are consistent with previous research indicating that the frequency of homework seems to have more impact on results than the amount of homework set (Trautwein et al., 2002, 2009; Trautwein, 2007; Fernández-Alonso et al., 2014). These results have clear educational implications for teachers' homework policies, as they seem to indicate that the frequent assignment of homework has more positive effects than assigning large amounts of homework.

It is worth noting that the effects of homework frequency and homework amount on scores in science are closely related as the correlation between these effects is very negative ($r = -0.88$). This would seem to indicate that in those countries where frequency has less influence, homework amount has a greater effect. The most extreme case is Uruguay, the only country where homework frequency shows a statistically significant negative effect, but one which is compensated for by the opposite effect of homework amount. These data have new educational implications: very large amounts of homework not only seem detrimental (in most countries the effect of homework amount is negative), but there is also evidence indicating that within-class differences between students are greater in those class groups with a larger amount of homework (Fernández-Alonso et al., 2017a).

These results must be interpreted in light of our study's limitations. The most important of which is probably the lack of a measure of prior performance. In the data, the only variable related to school history was the repetition of a school year, which as one might expect, had a negative effect in every case. However, research has repeatedly shown that measures of previous performance are the best predictors in this type of study (Murillo and Martínez-Garrido, 2013; Núñez et al., 2014; Fernández-Alonso et al., 2015). In addition, the statistical models used in this study are correlational and therefore the conclusions cannot be read in causal terms. As Trautwein and Lüdtke (2009) clearly indicated, the word "effect" must be understood as "predictive effect," as it is not possible to establish the direction of the association. Our study predicts achievement in science with generic homework measures. It would have been better

to employ measures which were specific to the subject being studied (e.g., time spent on science homework, Trautwein and Lüdtke, 2007, 2009). Nevertheless, studies which have looked at the relationship between results in various subjects and specific homework time measures have found similar effect sizes in the subjects they evaluated (Lubbers et al., 2010; Chang et al., 2014). An additional limitation is that although TERCE evaluated two age cohorts: 3rd and 6th year of compulsory education, in the context questionnaire for the 3rd year there was insufficient information to construct variables such as homework time and homework amount. For that reason in this study we only focus on the 6th year sample, something which should be borne in mind when considering the generalizability of the results. Future research must be directed toward including other variables which have been shown to be important. The specification and confirmation of a comprehensive model which addresses student behavior and motivation, homework characteristics, teachers' use of homework, teaching quality, teacher review and feedback, and the role of the family in homework is an unresolved issue in the Latin American context, while there is already evidence of this type available in other regions (Epstein and Pinkow, 1988; Cooper, 1989; Trautwein et al., 2006; Cunha et al., 2018; León et al., 2018).

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the United Nations Educational, Scientific and Cultural Organization (UNESCO). All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

RF-A and JM designed the research. RF-A, PW, and AG-L analyzed the data. MÁ-D and MC interpreted the data. RF-A, PW, AG-L, MÁ-D, and MC drafted the paper. JM revised it critically. All authors gave final approval of the version to be published and have ensured the accuracy and integrity of the work.

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"Homework Should Be. . .but We Do Not Live in an Ideal World": Mathematics Teachers' Perspectives on Quality Homework and on Homework Assigned in Elementary and Middle Schools

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Existing literature has analyzed homework characteristics associated with academic results. Researchers and educators defend the need to provide quality homework, but there is still much to be learned about the characteristics of quality homework (e.g., purposes, type). Acknowledging that teachers play an important role in designing and assigning homework, this study explored teachers' perspectives regarding: (i) the characteristics of quality homework and (ii) the characteristics of the homework tasks assigned. In the current study, mathematics teachers from elementary and middle schools (N = 78) participated in focus group discussions. To enhance the trustworthiness of the findings, homework tasks assigned by 25% of the participants were analyzed for triangulation of data purposes. Data were analyzed using thematic analysis for elementary and middle school separately. Teachers discussed the various characteristics of quality homework (e.g., short assignments, adjusted to the availability of students) and shared the characteristics of the homework tasks typically assigned, highlighting a few differences (e.g., degree of individualization of homework, purposes) between these two topics. Globally, data on the homework tasks assigned were consistent with teachers' reports about the characteristics of the homework tasks they usually assigned. Findings provide valuable insights for research and practice aimed to promote the quality of homework and consequently students' learning and progress.

Keywords: perceived quality homework, homework characteristics, math, teachers' perspectives, elementary school, middle school, focus group, homework samples

INTRODUCTION

The extensive literature on homework suggests the importance of completing homework tasks to foster students' academic achievement (e.g., Trautwein and Lüdtke, 2009; Hagger et al., 2015; Núñez et al., 2015a; Valle et al., 2016; Fernández-Alonso et al., 2017). However, existing research also indicate that the amount of homework assigned is not always related to high academic achievement

(Epstein and Van Voorhis, 2001; Epstein and Van Voorhis, 2012). In the words of Dettmers et al. (2010) "homework works if quality is high" (p. 467). However, further research is needed to answer the question "What is quality homework?".

Teachers are responsible for designing and assigning homework, thus our knowledge on their perspectives about this topic and the characteristics of the homework typically assigned is expected to be a relevant contribution to the literature on the quality of homework. Moreover, data on the characteristics of homework could provide valuable information to unveil the complex network of relationships between homework and academic achievement (e.g., Cooper, 2001; Trautwein and Köller, 2003; Trautwein et al., 2009a; Xu, 2010).

Thus, focusing on the perspective of mathematics teachers from elementary and middle school, the aims of the present study are twofold: to explore the characteristics of quality homework, and to identify the characteristics of the homework tasks typically assigned at these school levels. Findings may help deepen our understanding of why homework may impact differently the mathematics achievement of elementary and middle school students (see Fan et al., 2017).

Research Background on Homework Characteristics

Homework is a complex educational process involving a diverse set of variables that each may influence students' academic outcomes (e.g., Corno, 2000; Trautwein and Köller, 2003; Cooper et al., 2006; Epstein and Van Voorhis, 2012). Cooper (1989, 2001) presented a model outlining the factors that may potentially influence the effect of homework at the three stages of the homework process (i.e., design of the homework assignment, completion of homework and homework follow-up practices). At the first stage teachers are expected to consider class characteristics (e.g., students' prior knowledge, grade level, number of students per class), and also variables that may influence the impact of homework on students' outcomes, such as homework assignment characteristics. In 1989, Cooper (see also Cooper et al., 2006) presented a list of the characteristics of homework assignments as follows: amount (comprising homework frequency and length), purpose, skill area targeted, degree of individualization, student degree of choice, completion deadlines, and social context. Based on existing literature, Trautwein et al. (2006b) proposed a distinct organization for the assignment characteristics. The proposal included: homework frequency (i.e., how often homework assignments are prescribed to students), quality, control, and adaptivity. "Homework frequency" and "adaptivity" are similar to "amount" and "degree of individualization" in Cooper's model, respectively. Both homework models provide a relevant theoretical framework for the present study.

Prior research has analyzed the relationship between homework variables, students' behaviors and academic achievement, and found different results depending on the variables examined (see Trautwein et al., 2009b; Fan et al., 2017). For example, while homework frequency consistently and positively predicted students' academic achievement (e.g., Trautwein et al., 2002; Trautwein, 2007; Fernández-Alonso et al., 2015), findings regarding the amount of homework assigned (usually assessed by the time spent on homework) have shown mixed results (e.g., Trautwein, 2007; Dettmers et al., 2009; Núñez et al., 2015a). Data indicated a positive association between the amount of homework and students' academic achievement in high school (e.g., OECD, 2014a); however, this relationship is almost null in elementary school (e.g., Cooper et al., 2006; Rosário et al., 2009). Finally, other studies reported a negative association between time spent on homework and students' academic achievement at different school levels (e.g., Trautwein et al., 2009b; Rosário et al., 2011; Núñez et al., 2015a).

Homework purposes are among the factors that may influence the effect of homework on students' homework behaviors and academic achievement (Cooper, 2001; Trautwein et al., 2009a; Epstein and Van Voorhis, 2012; Rosário et al., 2015). In his model Cooper (1989, 2001) reported instructional purposes (i.e., practicing or reviewing, preparation, integration and extension) and non-instructional purposes (i.e., parent-child communication, fulfilling directives, punishment, and community relations). Depending on their nature, homework instructional purposes may vary throughout schooling (Muhlenbruck et al., 2000; Epstein and Van Voorhis, 2001). For example, in elementary school, teachers are likely to use homework as an opportunity to review the content taught in class, while in secondary school (6th–12th grade), teachers are prone to use homework to prepare students for the content to be learned in subsequent classes (Muhlenbruck et al., 2000). Still, studies have recently shown that practicing the content learned is the homework purpose most frequently used throughout schooling (e.g., Xu and Yuan, 2003; Danielson et al., 2011; Kaur, 2011; Bang, 2012; Kukliansky et al., 2014). Studies using quantitative methodologies have analyzed the role played by homework purposes in students' effort and achievement (Trautwein et al., 2009a; Rosário et al., 2015, 2018), and reported distinct results depending on the subject analyzed. For example, Foyle et al. (1990) found that homework assignments with the purposes of practice and preparation improved the performance of 5th-grade students' social studies when compared with the no-homework group. However, no statistical difference was found between the two types of homework purposes analyzed (i.e., practice and preparation). When examining the homework purposes reported by 8th-grade teachers of French as a Second Language (e.g., drilling and practicing, motivating, linking school and home), Trautwein et al. (2009a) found that students in classes assigned tasks with high emphasis on motivation displayed more effort and achieved higher outcomes than their peers. On the contrary, students in classes assigned tasks with high drill and practice reported less homework effort and achievement (Trautwein et al., 2009a). A recent study by Rosário et al. (2015) analyzed the relationship between homework assignments with various types of purposes (i.e., practice, preparation and extension) and 6th-grade mathematics achievement. These authors reported that homework with the purpose of "extension" impacted positively on students' academic achievement while the other two homework purposes did not.

Cooper (1989, 2001) identified the "degree of individualization" as a characteristic of homework focused on the need to design homework addressing different levels of performance. For example, some students need to be assigned practice exercises with a low level of difficulty to help them reach school goals, while others need to be assigned exercises with high levels of complexity to foster their motivation for homework (Trautwein et al., 2002). When there is a disparity between the level of difficulty of homework assignments and students' skills level, students may have to spend long hours doing homework, and they may experience negative emotions or even avoid doing homework (Corno, 2000). On the contrary, when homework assignments meet students' learning needs (e.g., Bang, 2012; Kukliansky et al., 2014), both students' homework effort and academic achievement increase (e.g., Trautwein et al., 2006a; Zakharov et al., 2014). Teachers may also decide on the time given to students to complete their homework (Cooper, 1989; Cooper et al., 2006). For example, homework may be assigned to be delivered in the following class (e.g., Kaur et al., 2004) or within a week (e.g., Kaur, 2011). However, research on the beneficial effects of each practice is still limited.

Trautwein et al. (2006b) investigated homework characteristics other than those previously reported. Their line of research analyzed students' perception of homework quality and homework control (e.g., Trautwein et al., 2006b; Dettmers et al., 2010). Findings on homework quality (e.g., level of difficulty of the mathematics exercises, Trautwein et al., 2002; homework "cognitively activating" and "well prepared", Trautwein et al., 2006b, p. 448; homework selection and level of challenge, Dettmers et al., 2010; Rosário et al., 2018) varied regarding the various measures and levels of analysis considered. For example, focusing on mathematics, Trautwein et al. (2002) concluded that "demanding" exercises improved 7th-grade students' achievement at student and class levels, while "repetitive exercises" impacted negatively on students' achievement. Dettmers et al. (2010) found that homework assignments perceived by students as "well-prepared and interesting" (p. 471) positively predicted 9th- and 10th-grade students' homework motivation (expectancy and value beliefs) and behavior (effort and time) at student and class level, and mathematics achievement at class level only. These authors also reported that "cognitively challenging" homework (p. 471), as perceived by students, negatively predicted students' expectancy beliefs at both levels, and students' homework effort at student level (Dettmers et al., 2010). Moreover, this study showed that "challenging homework" significantly and positively impacted on students' mathematics achievement at class level (Dettmers et al., 2010). At elementary school, homework quality (assessed through homework selection) predicted positively 6th-grade students' homework effort, homework performance, and mathematics achievement (Rosário et al., 2018).

Finally, Trautwein and colleagues investigated the variable "homework control" perceived by middle school students and found mixed results. The works by Trautwein and Lüdtke (2007, 2009) found that "homework control" predicted positively students' homework effort in mathematics, but other studies (e.g., Trautwein et al., 2002, 2006b) did not predict homework effort and mathematics achievement.

The Present Study

A vast body of research indicates that homework enhances students' academic achievement [see the meta-analysis conducted by Fan et al. (2017)], however, maladaptive homework behaviors of students (e.g., procrastination, lack of interest in homework, failure to complete homework) may affect homework benefits (Bembenutty, 2011a; Hong et al., 2011; Rosário et al., 2019). These behaviors may be related to the characteristics of the homework assigned (e.g., large amount of homework, disconnect between the type and level of difficulty of homework assignments and students' needs and abilities, see Margolis and McCabe, 2004; Trautwein, 2007).

Homework is only valuable to students' learning when its quality is perceived by students (Dettmers et al., 2010). Nevertheless, little is known about the meaning of homework quality for teachers who are responsible for assigning homework. What do teachers understand to be quality homework? To our knowledge, the previous studies exploring teachers' perspectives on their homework practices did not relate data with quality homework (e.g., Xu and Yuan, 2003; Danielson et al., 2011; Kaur, 2011; Bang, 2012; Kukliansky et al., 2014). For example, Kukliansky et al. (2014) found a disconnect between middle school science teachers' perspectives about their homework practices and their actual homework practices observed in class. However, results were not further explained.

The current study aims to explore teachers' perspectives on the characteristics of quality homework, and on the characteristics underlying the homework tasks assigned. Findings are expected to shed some light on the role of teachers in the homework process and contribute to maximize the benefits of homework. Our results may be useful for either homework research (e.g., by informing new quantitative studies grounded on data from teachers' perspectives) or educational practice (e.g., by identifying new avenues for teacher training and the defining of guidelines for homework practices).

This study is particularly important in mathematics for the following reasons: mathematics is among the school subjects where teachers assign the largest amount of homework (e.g., Rønning, 2011; Xu, 2015), while students continue to yield worrying school results in the subject, especially in middle and high school (Gottfried et al., 2007; OECD, 2014b). Moreover, a recent meta-analysis focused on mathematics and science homework showed that the relationship between homework and academic achievement in middle school is weaker than in elementary school (Fan et al., 2017). Thus, we collected data through focus group discussions with elementary and middle school mathematics teachers in order to analyze any potential variations in their perspectives on the characteristics of quality homework, and on the characteristics of homework tasks they typically assign. Regarding the latter topic, we also collected photos of homework tasks assigned by 25% of the participating teachers in order to triangulate data and enhance the trustworthiness of our findings.

Our exploratory study was guided by the following research questions:

(1) How do elementary and middle school mathematics teachers perceive quality homework?
(2) How do elementary and middle school mathematics teachers describe the homework tasks they typically assign to students?

MATERIALS AND METHODS

The Study Context

Despite recommendations of the need for clear homework policies (e.g., Cooper et al., 2006; Bembenutty, 2011b), Portugal has no formal guidelines for homework (e.g., concerning the frequency, length, type of tasks). Still, many teachers usually include homework as part of students' overall grade and ask parents to monitor their children's homework completion. Moreover, according to participants there is no specific training on homework practices for pre-service or in-service teachers.

The Portuguese educational system is organized as follows: the last two years of elementary school encompass 5th and 6th grade (10 and 11 years old), while middle school encompasses 7th, 8th, and 9th grade (12 to 14 years old). At the two school levels mentioned, mathematics is a compulsory subject and students attend three to five mathematics lessons per week depending on the duration of each class (270 min per week for Grades 5 and 6, and 225 min per week for Grades 7–9). All students are assessed by their mathematics teacher (through continuous assessment tests), and at the end of elementary and middle school levels (6th and 9th grade) students are assessed externally through a national exam that counts for 30% of the overall grade. In Portuguese schools assigning homework is a frequently used educational practice, mostly in mathematics, and usually counts toward the overall grade, ranging between 2% and 5% depending on school boards (Rosário et al., 2018).

Participants

In the current study, all participants were involved in focus groups and 25% of them, randomly selected, were asked to submit photos of homework tasks assigned.

According to Morgan (1997), to maximize the discussion among participants it is important that they share some characteristics and experiences related to the aims of the study in question. In the current study, teachers were eligible to participate when the following criteria were met: (i) they had been teaching mathematics at elementary or middle school levels for at least two years; and (ii) they would assign homework regularly, at least twice a week, in order to have enough experiences to share in the focus group.

All mathematics teachers (N = 130) from 25 elementary and middle schools in Northern Portugal were contacted by email. The email informed teachers of the purposes and procedures of the study (e.g., inclusion criteria, duration of the session, session videotaping, selection of teachers to send photos of homework tasks assigned), and invited them to participate in the study. To facilitate recruitment, researchers scheduled focus group discussions considering participants' availability. Of the volunteer teachers, all participants met the inclusion criteria. The research team did not allocate teachers with hierarchical relationships in the same group, as this might limit freedom of responses, affect the dynamics of the discussion, and, consequently, the outcomes (Kitzinger, 1995).

Initially we conducted four focus groups with elementary school teachers (5th and 6th grade, 10 and 11 years old) and four focus groups with middle school teachers (7th, 8th, and 9th grade, 12, 13 and 14 years old). Subsequently, two additional focus group discussions (one for each school level) were conducted to ensure the saturation of data. Finally, seventy-eight mathematics teachers (61 females and 17 males; an acceptance rate of 60%) from 16 schools participated in our study (see **Table 1**). The teachers enrolled in 10 focus groups comprised of seven to nine teachers per group. Twenty teachers were randomly selected and asked to participate in the second data collection; all answered positively to our invitation (15 females and 5 males).

According to our participants, in the school context, mathematics teachers may teach one to eight classes of different grade levels. In the current research, participants were teaching one to five classes of two or three grade levels at schools in urban or near urban contexts. The participants practiced the mandatory nationwide curriculum and a continuous assessment policy.

Data Collection

We carried out this study following the recommendations of the ethics committee of the University of Minho. All teachers gave written informed consent to participate in the research in accordance with the Declaration of Helsinki. The collaboration involved participating in one focus group discussion, and, for 25% of the participants, submitting photos by email of the homework tasks assigned.

In the current study, aiming to deepen our comprehension of the research questions, focus group interviews were conducted to capture participants' thoughts about a particular topic (Kitzinger, 1995; Morgan, 1997). The focus groups were conducted by two members of the research team (a moderator and a field note-taker) in the first term of the school year and followed the procedure described by Krueger and Casey (2000). To prevent mishandling the discussions and to encourage teachers to participate in the sessions, the two facilitators attended a

TABLE 1 | Participants' demographic information.

School level	Gender	Teaching experience	Education	Workload per week
Elementary school	8 M	13–38 years	34 UG	5–15 h: 22 T
(FG 2, 4, 5, 7 and 8)	30 F		4 MD	16–25 h: 16 T
Middle school	9 M	13–38 years	34 UG	5–15 h: 5 T
(FG 1, 3, 6, 9 and 10)	31 F		6 MD	16–25 h: 27 T
				26–35 h: 8 T

FG, focus group; M, male; F, female; UG, University Graduate; MD, Master's Degree; T, teachers.

course on qualitative research offered at their home institution specifically targeting focus group methodology.

All focus group interviews were videotaped. The sessions were held in a meeting room at the University of Minho facilities, and lasted 90 to 105 min. Before starting the discussion, teachers filled in a questionnaire with sociodemographic information, and were invited to read and sign a written informed consent form. Researchers introduced themselves, and read out the information regarding the study purpose and the focus group ground rules. Participants were ensured of the confidentiality of their responses (e.g., names and researchers' personal notes that might link participants to their schools were deleted). Then, the investigators initiated the discussion (see **Table 2**). At the end of each focus group discussion, participants were given the opportunity to ask questions or make further contributions.

After the focus group discussions, we randomly selected 25% of the participating teachers (i.e., 10 teachers from each school level), each asked to submit photos of the homework tasks assigned by email over the course of three weeks (period between two mathematics assessment tests). This data collection aimed to triangulate data from focus groups regarding the characteristics of homework usually assigned. To encourage participation, the research team sent teachers a friendly reminder email every evening throughout the period of data collection. In total, we received 125 photos (51% were from middle school teachers).

Data Analysis

Videotapes were used to assist the verbatim transcription of focus group data. Both focus group data and photos of the homework assignments were analyzed using thematic analysis (Braun and Clarke, 2006), assisted by QSR International's NVivo 10 software (Richards, 2005). In this analysis there are no rigid guidelines on how to determine themes; to assure that the analysis is rigorous, researchers are expected to follow a consistent procedure throughout the analysis process (Braun and Clarke, 2006). For the current study, to identify themes and sub-themes, we used the extensiveness of comments criterion (number of participants who express a theme, Krueger and Casey, 2000).

Firstly, following an inductive process one member of the research team read the first eight focus group transcriptions several times, took notes on the overall ideas of the data, and made a list of possible codes for data at a semantic level (Braun and Clarke, 2006). Using a cluster analysis by word similarity procedure in Nvivo, all codes were grouped in order to identify sub-themes and themes posteriorly. All the themes and sub-themes were independently and iteratively identified and compared with the literature on homework (Peterson and Irving, 2008). Then, the themes and sub-themes were compared with the homework characteristics already reported in the literature (e.g., Cooper, 1989; Epstein and Van Voorhis, 2001; Trautwein et al., 2006b). New sub-themes emerged from participants' discourses (i.e., "adjusted to the availability of students," "teachers diagnose learning"), and were grouped in the themes reported in the literature. After, all themes and sub-themes were organized in a coding scheme (for an example see **Table 3**). Finally, the researcher coded the two other focus group discussions, no new information was added related to the research questions. Given that the generated patterns of data were not changed, the researcher concluded that thematic saturation was reached.

An external auditor, trained on the coding scheme, revised all transcriptions, the coding scheme and the coding process in order to minimize researchers' biases and increase the trustworthiness of the study (Lincoln and Guba, 1985). The first author and the external auditor examined the final categorization of data and reached consensus.

Two other members of the research team coded independently the photos of the homework assignments using the same coding scheme of the focus groups. To analyze data, the researchers had to define the sub-themes "short assignments" (i.e., up to three exercises) and "long assignments" (i.e., more than three exercises). In the end, the two researchers reviewed the coding process and discussed the differences found (e.g., some exercises had several sub questions, so one of the researchers coded it as "long assignments"; see the homework sample 4 of the **Supplementary Material**). However, the researchers reached consensus, deciding not to count the number of sub questions of each exercise individually, because these types of questions are related and do not require a significant amount of additional time.

Inter-rater reliability (Cohen's Kappa) was calculated. The Cohen's Kappa was 0.86 for the data analysis of the focus groups and 0.85 for data analysis of the photos of homework assignments, which is considered very good according to Landis and Koch (1977). To obtain a pattern of data considering the school levels, a matrix coding query was run for each data source (i.e., focus groups and photos of homework assignments). Using the various criteria options in NVivo 10, we crossed participants' classifications (i.e., school level attribute) and nodes and displayed the frequencies of responses for each row–column combination (Bazeley and Jackson, 2013).

In the end of this process of data analysis, for establishing the trustworthiness of findings, 20 teachers (i.e., ten participants of each grade level) were randomly invited, and all agreed, to provide a member check of the findings (Lincoln and Guba, 1985). Member checking involved two phases. First, teachers were asked individually to read a summary of the findings and to fill in a 5-point Likert scale (1, completely disagree; 5, completely agree) with four items: "Findings reflect my perspective regarding

TABLE 2 | Focus group questions.

1. Perceived Characteristics of quality homework
1.1. If you were asked to tell someone what homework is, how would you define/describe it?
1.2. What are the characteristics of quality homework?
2. Characteristics of Assigned Homework
2.1. What types of homework assignments do you usually give your students?
2.2. What are the reasons that make you give those types homework assignments?
2.3. When and how do you design homework?
2.4. How often do you assign homework?

To ensure that the questions would be clearly understood, they were presented to two teachers from the same grade levels as the participants prior to the beginning of the study. The two teachers did not participate in the focus groups.

TABLE 3 | Examples of the coding scheme.

Theme	Sub-theme	Description
Instructional homework purposes (Cooper et al., 2006)	Practice or review	Homework aims to practice, review and consolidate the material taught in class, as well to study for tests (Epstein and Van Voorhis, 2001; Cooper et al., 2006).
	Diagnose learning (student, teacher or both) (emerging sub-theme)	Homework aims to help students, teachers or both monitor learning difficulties, and therefore adjust behaviors. Students can further study some contents and teachers can review contents and/or adjust their teaching methods. Exemplar quote: "Homework helps students understand what contents they understood or not. . .and this also helps me. If the students tell me that they did not understand something I can clarify the contents, correct mistakes. . ." (P5 FG8).
	Personal development	Homework aims to promote students' responsibility, persistence, time management, work habits, autonomy (Epstein and Van Voorhis, 2001).
	Extension	Homework aims to develop cognitive skills and requires: knowledge and skills transference to new situations such as problem solving and projects (Cooper et al., 2006; Rosário et al., 2015).
Degree of individualization (Cooper et al., 2006) or adaptivity/adaptability (Trautwein et al., 2006a)	Student/groups of students or class	Homework tailored to meet the needs of each student or groups of students or to the class as a whole (Cooper et al., 2006). Homework adjusted to students' knowledge (the teacher assign "different homework assignments depending on how good they are", Trautwein et al., 2006a, p. 1103).
	Adjusted to the availability of students (emerging sub-theme)	Homework is assigned considering: students' schedule, extracurricular activities, assessment tests or exams, the need for leisure. . . Exemplar quote: "If I learn that students have assessment tests during the week, I choose not to assign homework or, if it is really necessary, I just assign an exercise to be solved very quickly" (P3 FG10).

homework quality"; "Findings reflect my perspective regarding homework practices"; "Findings reflect what was discussed in the focus group where I participated", and "I feel that my opinion was influenced by the other teachers during the discussion" (inverted item). Secondly, teachers were gathered by school level and asked to critically analyze and discuss whether an authentic representation was made of their perspectives regarding quality homework and homework practices (Creswell, 2007).

RESULTS

This study explored teachers' perspectives on the characteristics of quality homework, and on the characteristics of the homework tasks typically assigned. To report results, we used the frequency of occurrence criterion of the categories defined by Hill et al. (2005). Each theme may be classified as "General" when all participants, or all except one, mention a particular theme; "Typical" when more than half of the cases mention a theme; "Variant" when more than 3, and less than half of the cases mention a theme; and "Rare" when the frequency is between 2 and 3 cases. In the current study, only general and typical themes were reported to discuss the most salient data.

The results section was organized by each research question. Throughout the analysis of the results, quotes from participants were presented to illustrate data. For the second research question, data from the homework assignments collected as photographs were also included.

Initial Data Screening

All participating teachers defended the importance of completing homework, arguing that homework can help students to develop their learning and to engage in school life. Furthermore, participants also agreed on the importance of delivering this message to students. Nevertheless, all teachers acknowledged that assigning homework daily present a challenge to their teaching routine because of the heavy workload faced daily (e.g., large numbers of students per class, too many classes to teach, teaching classes from different grade levels which means preparing different lessons, administrative workload).

Teachers at both school levels talked spontaneously about the nature of the tasks they usually assign, and the majority reported selecting homework tasks from a textbook. However, participants also referred to creating exercises fit to particular learning goals. Data collected from the homework assigned corroborated this information. Most of participating teachers reported that they had not received any guidance from their school board regarding homework.

How do Elementary and Middle School Teachers Perceive Quality Homework?

Three main themes were identified by elementary school teachers (i.e., instructional purposes, degree of individualization/adaptivity, and length of homework) and two were identified by middle school teachers (i.e., instructional purposes, and degree of individualization/adaptivity). **Figure 1** depicts the themes and sub-themes reported by teachers in the focus groups.

In all focus group discussions, all teachers from elementary and middle school mentioned "instructional purposes" as the main characteristic of quality homework. When asked to further explain the importance of this characteristic, teachers at both school levels in all focus group talked about the need for "practicing or reviewing" the content delivered in class to strengthen students' knowledge. A teacher illustrated this idea

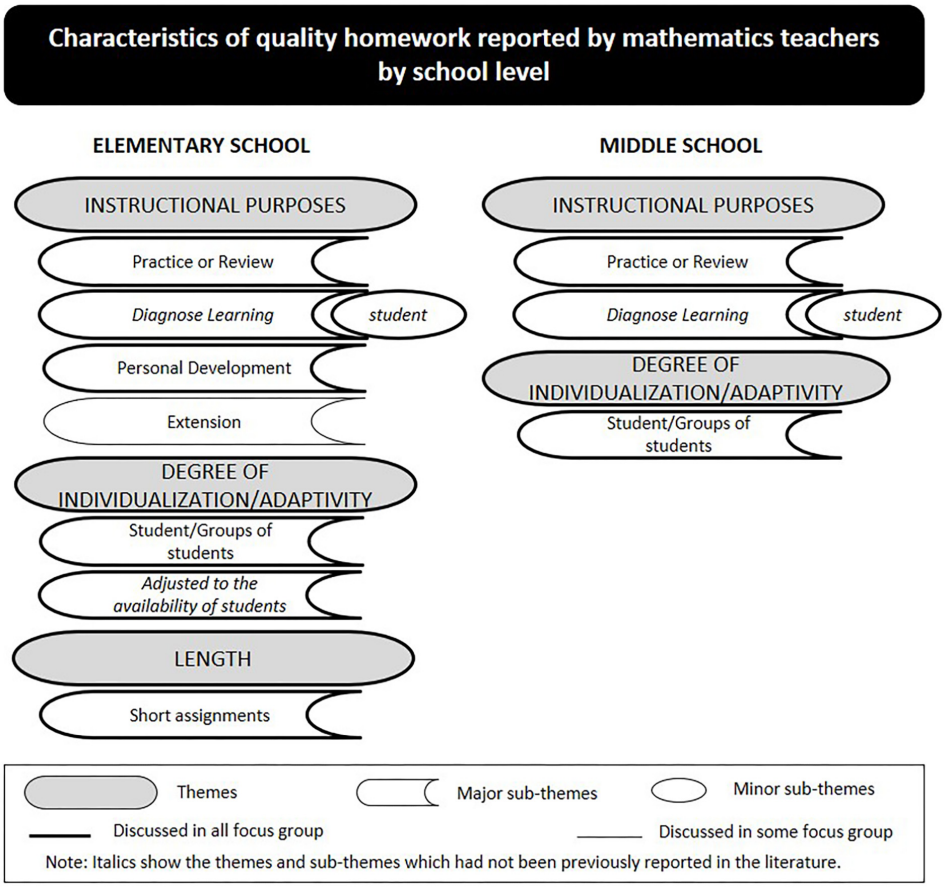

FIGURE 1 | Characteristics of quality homework reported by mathematics teachers by school level.

clearly: "it is not worth teaching new content when students do not master the material previously covered" (P1 FG3). This idea was supported by participants in all focus groups; "at home they [students] have to work on the same content as those taught in class" (P1 FG7), "students have to revisit exercises and practice" (P2 FG9), "train over and over again" (P6 FG1), "practice, practice, practice" (P4 FG2).

While discussing the benefits of designing homework with the purpose of practicing the content learned, teachers at both school levels agreed on the fact that homework may be a useful tool for students to diagnose their own learning achievements while working independently. Teachers were empathetic with their peers when discussing the instrumentality of homework as a "thermometer" for students to assess their own progress. This idea was discussed in similar ways in all focus group, as the following quotation illustrates:

P2 FG1: Homework should be a bridge between class and home... students are expected to work independently, learn about their difficulties when doing homework, and check whether they understood the content.

When asked to outline other characteristics of quality homework, several elementary school teachers in all focus group mentioned that quality homework should also promote "student development" as an instructional purpose. These participants explained that homework is an instructional tool that should be designed to "foster students' autonomy" (P9 FG4), "develop study habits and routines" (P1 FG8), and "promote organization skills and study methods" (P6 FG7). These thoughts were unanimous among participants in all focus groups. While some teachers introduced real-life examples to illustrate the ideas posited by their colleagues, others nodded their heads in agreement.

In addition, some elementary school teachers observed that homework tasks requiring transference of knowledge could help develop students' complex thinking, a highly valued topic in the current mathematics curriculum worldwide. Teachers discussed this topic enthusiastically in two opposite directions: while some teachers defended this purpose as a characteristic of quality homework, others disagreed, as the following conversation excerpt illustrates:

P7 FG5: For me good homework would be a real challenge, like a problem-solving scenario that stimulates learning transference and develops mathematical reasoning ... mathematical insight. It's hard because it forces them [students] to think in more complex ways; still, I believe this is the type of homework with the most potential gains for them.

P3 FG5: That's a good point, but they [students] give up easily. They just don't do their homework. This type of homework implies competencies that the majority of students do not master. . .

P1 FG5: Not to mention that this type of homework takes up a lot of teaching time. . . explaining, checking. . ., and we simply don't have time for this.

Globally, participants agreed on the potential of assigning homework with the purpose of instigating students to transfer learning to new tasks. However, participants also discussed the limitations faced daily in their teaching (e.g., number of students per class, students' lack of prior knowledge) and concluded that homework with this purpose hinders the successful development of their lesson plans. This perspective may help explain why many participants did not perceive this purpose as a significant characteristic of quality homework. Further commenting on the characteristics of quality homework, the majority of participants at both school levels agreed that quality homework should be tailored to meet students' learning needs. The importance of individualized homework was intensely discussed in all focus groups, and several participants suggested the need for designing homework targeted at a particular student or groups of students with common education needs. The following statements exemplifies participants' opinions:

P3 FG3: Ideally, homework should be targeted at each student individually. For André a simple exercise, for Ana a more challenging exercise . . . in an ideal world homework should be tailored to students' needs.

P6 FG6: Given the diversity of students in our classes, we may find a rainbow of levels of prior knowledge. . . quality homework should be as varied as our students' needs.

As discussed in the focus groups, to foster the engagement of high-achievers in homework completion, homework tasks should be challenging enough (as reported previously by P3 FG3). However, participants at both school levels observed that their heavy daily workload prevents them from assigning individualized homework:

P1 FG1: I know it's important to assign differentiated homework tasks, and I believe in it... but this option faces real-life barriers, such as the number of classes we have to teach, each with thirty students, tons of bureaucratic stuff we have to deal with... All this raises real-life questions, real impediments. . . how can we design homework tasks for individual students?

Considering this challenge, teachers from both school levels suggested that quality homework should comprise exercises with increasing levels of difficulty. This strategy would respond to the heterogeneity of students' learning needs without assigning individualized homework tasks to each student.

While discussing individualized homework, elementary school teachers added that assignments should be designed bearing in mind students' availability (e.g., school timetable, extracurricular activities, and exam dates). Participants noted that teachers should learn the amount of workload their students have, and should be aware about the importance of students' well-being.

P4 FG1: If students have large amounts of homework, this could be very uncomfortable and even frustrating. . . They have to do homework of other subjects and add time to extracurricular activities. . . responding to all demands can be very stressful.

P4 FG2: I think that we have to learn about the learning context of our students, namely their limitations to complete homework in the time they have available. We all have good intentions and want them to progress, but if students do not have enough time to do their homework, this won't work. So, quality homework would be, for example, when students have exams and the teacher gives them little or no homework at all.

The discussion about the length of homework found consensus among the elementary school teachers in all focus group in that quality homework should be "brief". During the discussions, elementary school teachers further explained that assigning long tasks is not beneficial because "they [students] end up demotivated" (P3 FG4). Besides, "completing long homework assignments takes hours!" (P5 FG4).

How do Elementary and Middle School Teachers Describe the Homework Tasks They Typically Assign to Students?

When discussing the characteristics of the homework tasks usually assigned to their students four main themes were identified by elementary school teachers (i.e., instructional purposes, degree of individualization/adaptivity, frequency and completion deadlines), and two main themes were raised by middle school (i.e., instructional purposes, and degree of individualization/adaptivity). **Figure 2** gives a general overview of the findings. Data gathered from photos added themes to findings as follows: one (i.e., length) to elementary school and two (i.e., length and completion deadlines) to middle school (see **Figure 3**).

While describing the characteristics of the homework tasks usually assigned, teachers frequently felt the need to compare the quality homework characteristics previously discussed with those practices. In fact, at this stage, teachers' discourse was often focused on the analysis of the similarities and potential discrepancies found.

The majority of teachers at both school levels in all focus group reported that they assign homework with the purpose of practicing and reviewing the materials covered earlier. Participants at both school levels highlighted the need to practice the contents covered because by the end of 6th- and 9th-grade students have to sit for a national exam for which they have to be trained. This educational context may interfere with the underlying homework purposes teachers have, as this quotation illustrates:

P3 FG3: When teaching mathematics, we set several goals, but our main focus is always the final exam they [students] have to take. I like students who think for themselves, who push themselves out of their comfort zone. However, I'm aware that they have to score high on national exams, otherwise. . . so, I assign homework to practice the contents covered.

Beyond assigning homework with the purpose of practicing and reviewing, middle school teachers also mentioned assigning homework with the purpose of diagnosing skills and personal development (see **Figure 2**). Many teachers reported that they use

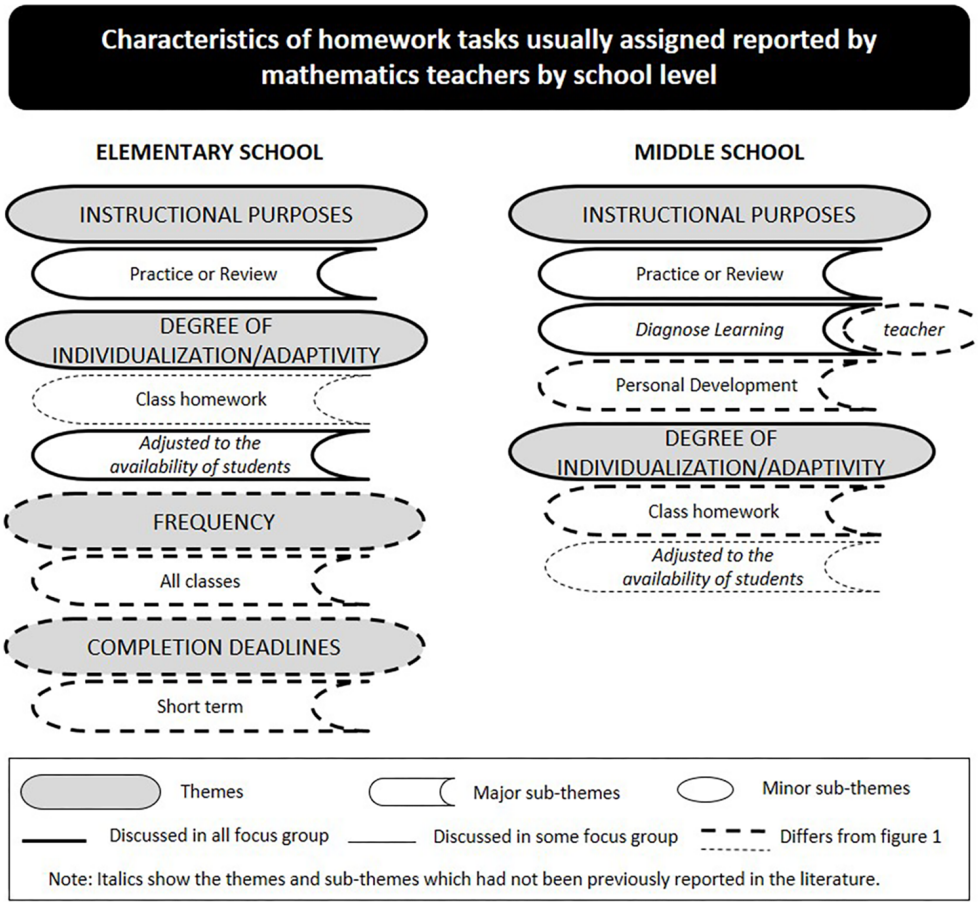

FIGURE 2 | Characteristics of the homework tasks usually assigned as reported by mathematics teachers.

homework as a tool to diagnose students' skills. However, several recognized that they had previously defended the importance of homework to help students to evaluate their own learning (see **Figure 1**). When discussing the latter point, participants observed the need to find out about whether students had understood the content taught in class, and to decide which changes to teaching style, homework assigned, or both may be necessary.

Participant teachers at middle school in all focus groups profusely discussed the purpose of personal development when assigning homework. In fact, not many teachers at this school level mentioned this purpose as a characteristic of quality homework (it was a variant category, so it was not reported), yet it was referred to as a cornerstone in their homework practice. Reflecting on this discrepancy, middle school teachers explained in a displeased tone that their students were expected to have developed study habits and manage their school work with autonomy and responsibility. However, this "educational scenario is rare, so I feel the need to assign homework with this aim [personal development]" (P4 FG9).

Moving further in the discussion, the majority of teachers at both school levels reported to assign whole-class homework (homework designed for the whole class with no focus on special cases). "Individualized homework requires a great amount of time to be monitored" (P1 FG6), explained several participants while recalling earlier comments. Teachers justified their position referring to the impediments already mentioned (e.g., large number of students per class, number of classes from different grade levels which means preparing different lessons). Besides, teachers discussed the challenge of coping with heterogeneous classes, as one participant noted: "the class is so diverse that it is difficult to select homework tasks to address the needs of every single student. I would like to do it. . .but we do not live in an ideal world" (P9 FG4).

Moreover, teachers at both school levels (see **Figure 2**) reported to assign homework according to the availability of students; still, only elementary school teachers had earlier referred to the importance of this characteristic in quality homework. When teachers were asked to elaborate on this idea, they defended the need to negotiate with students about specific homework characteristics, for example, the amount of homework and submission deadline. In some classes, matching students' requests, teachers might assign a "weekly homework pack" (P7 FG10). This option provides students with the opportunity to complete homework according to their availability (e.g., choosing some days during the week or weekend). Teachers agreed that 'negotiation' fosters students' engagement and homework

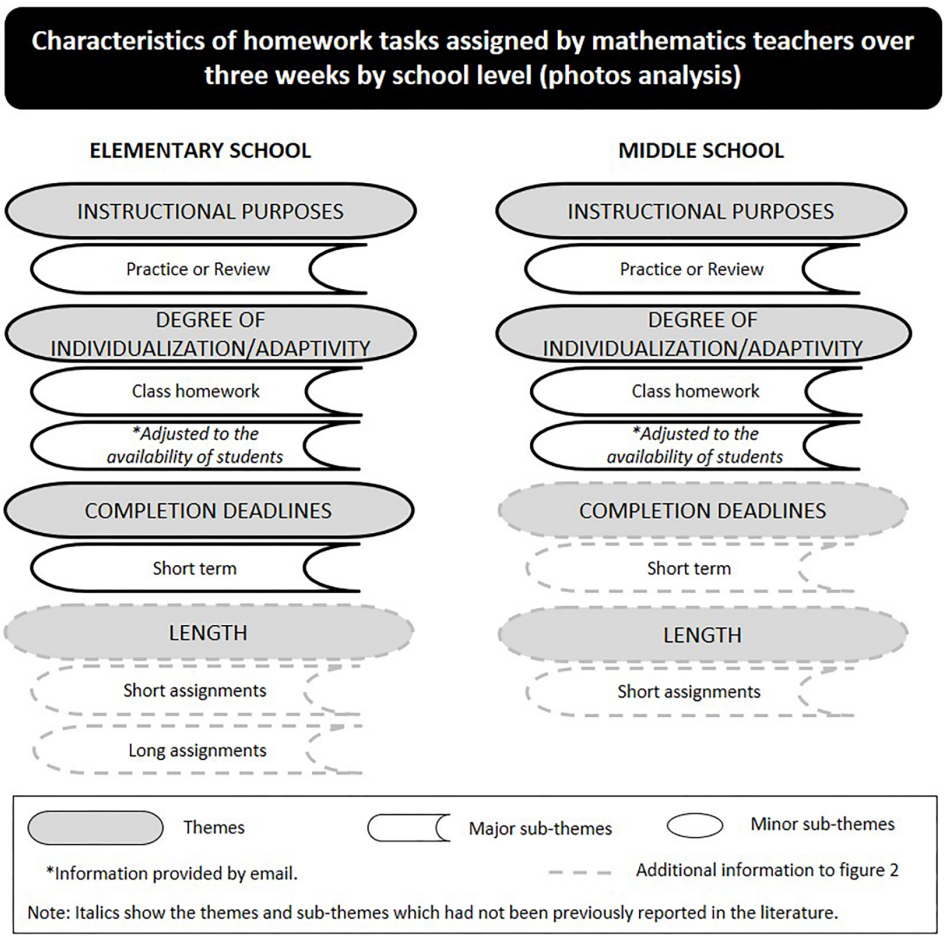

FIGURE 3 | Characteristics of the homework tasks assigned by mathematics teachers.

compliance (e.g., "I do not agree that students do homework on weekends, but if they show their wish and actually they complete it, for me that's okay", P7 FG10). In addition, teachers expressed worry about their students' often heavy workload. Many students stay in school from 8.30 am to 6.30 pm and then attend extracurricular activities (e.g., soccer training, private music lessons). These activities leave students very little free time to enjoy as they wish, as the following statement suggests:

P8 FG4: Today I talked to a group of 5th-graders which play soccer after school three times a week. They told me that sometimes they study between 10.00 and 11.00 p.m. I was astonished. How is this possible? It's clearly too much for these kids.

Finally, elementary school teachers in all focus group referred frequency and completion deadlines as characteristics of the homework they usually assign. The majority of teachers informed that they assign homework in almost every class (i.e., teachers reported to exclude tests eves of other subjects), to be handed in the following class.

The photos of the homework assignments (see some examples in **Supplementary Material**) submitted by the participating teachers served to triangulate data. The analysis showed that teachers' discourses about the characteristics of homework assigned and the homework samples are congruent, and added information about the length of homework (elementary and middle schools) and the completion deadlines (middle school) (see **Figure 3**).

DISCUSSION AND IMPLICATIONS FOR PRACTICE AND RESEARCH

Homework research have reported teachers' perspectives on their homework practices (e.g., Brock et al., 2007; Danielson et al., 2011; Kaur, 2011; Bang, 2012; Kukliansky et al., 2014), however, literature lacks research on the quality of homework. This study adds to the literature by examining the perspectives of teachers from two school levels regarding quality homework. Moreover, participants described the characteristics of the homework assignments they typically assign, which triggered the discussion about the match between the characteristics of quality homework and the tasks actually assigned. While discussing these key aspects of the homework process, the current study provides valuable information which may help deepen our understanding

of the different contributions of homework to students' learning. Furthermore, findings are expected to inform teachers and school administrators' homework practices and, hopefully, improve the quality of students' learning.

All teachers at both school levels valued homework as an important educational tool for their teaching practice. Consistent with the literature, participants indicated practicing or reviewing the material covered in class as the main purpose of both the homework typically assigned (Danielson et al., 2011; Kaur, 2011) and quality homework. Despite the extended use of this homework purpose by teachers, a recent study conducted with mathematics teachers found that homework with the purpose of practicing the material covered in class did not impact significantly the academic achievement of 6th-grade students; however, homework designed with the purpose of solving problems did (extension homework) (Rosário et al., 2015). Interestingly, in the current study only teachers from elementary school mentioned the homework purpose "extension" as being part of quality homework, but these teachers did not report to use it in practice (at least it was not a typical category) (see **Figure 2**). Extension homework was not referenced by middle school teachers either as quality homework or as a characteristic of homework assigned. Given that middle school students are expected to master complex math skills at this level (e.g., National Research Council and Mathematics Learning Study Committee, 2001), this finding may help school administrators and teachers reflect on the value and benefits of homework to students learning progress.

Moreover, teachers at both school levels stressed the use of homework as a tool to help students evaluate their own learning as a characteristic of quality homework; however, this purpose was not said to be a characteristic of the homework usually assigned. If teachers do not explicitly emphasize this homework purpose to their students, they may not perceive its importance and lose opportunities to evaluate and improve their work.

In addition, elementary school teachers identified personal development as a characteristic of quality homework. However, only middle school teachers reported assigning homework aiming to promote students' personal development, and evaluate students' learning (which does not imply that students evaluate their own learning). These findings are important because existing literature has highlighted the role played by homework in promoting students' autonomy and learning throughout schooling (Rosário et al., 2009, 2011; Ramdass and Zimmerman, 2011; Núñez et al., 2015b).

Globally, data show a disconnect between what teachers believe to be the characteristics of quality homework and the characteristics of the homework assigned, which should be further analyzed in depth. For example, teachers reported that middle school students lack the autonomy and responsibility expected for this school level, which translates to poor homework behaviors. In fact, contrary to what they would expect, middle school teachers reported the need to promote students' personal development (i.e., responsibility and autonomy). This finding is consistent with the decrease of students' engagement in academic activities found in middle school (e.g., Cleary and Chen, 2009; Wang and Eccles, 2012). This scenario may present a dilemma to middle school teachers regarding the purposes of homework. On one hand, students should have homework with more demanding purposes (e.g., extension); on another hand, students need to master work habits, responsibility and autonomy, otherwise homework may be counterproductive according to the participating teachers' perspective.

Additionally, prior research has indicated that classes assigned challenging homework demonstrated high mathematics achievement (Trautwein et al., 2002; Dettmers et al., 2010). Moreover, the study by Zakharov et al. (2014) found that Russian high school students from basic and advanced tracks benefited differently from two types of homework (i.e., basic short-answer questions, and open-ended questions with high level of complexity). Results showed that a high proportion of basic or complex homework exercises enhanced mathematics exam performance for students in the basic track; whereas only a high proportion of complex homework exercises enhanced mathematics exam performance for students in the advanced track. In fact, for these students, a low proportion of complex homework exercises was detrimental to their achievement. These findings, together with our own, may help explain why the relationship between homework and mathematics achievement in middle school is lower than in elementary school (see Fan et al., 2017). Our findings suggest the need for teachers to reflect upon the importance of assigning homework to promote students' development in elementary school, and of assigning homework with challenging purposes as students advance in schooling to foster high academic outcomes. There is evidence that even students with poor prior knowledge need assignments with some degree of difficulty to promote their achievement (see Zakharov et al., 2014). It is important to note, however, the need to support the autonomy of students (e.g., providing different the types of assignments, opportunities for students to express negative feelings toward tasks, answer students' questions) to minimize the threat that difficult homework exercises may pose to students' sense of competence; otherwise an excessively high degree of difficulty can lead to students' disengagement (see Patall et al., 2018). Moreover, teachers should consider students' interests (e.g., which contents and types of homework tasks students like) and discuss homework purposes with their students to foster their understanding of the tasks assigned and, consequently, their engagement in homework (Xu, 2010, 2018; Epstein and Van Voorhis, 2012; Rosário et al., 2018).

We also found differences between teachers' perspectives of quality homework and their reported homework practices concerning the degree of individualization when assigning homework. Contrary to the perspectives that quality homework stresses individual needs, teachers reported to assign homework to the whole class. In spite of the educational costs associated with assigning homework adjusted to specific students or groups of students (mentioned several times by participants), research has reported benefits for students when homework assignments match their educational needs (e.g., Cooper, 2001; Trautwein et al., 2006a; Zakharov et al., 2014). The above-mentioned study by Zakharov et al. (2014) also shed light on this topic while supporting our participants' suggestion to assign homework with increasing level of difficulty aiming to match the variety of

students' levels of knowledge (see also Dettmers et al., 2010). However, teachers did not mention this idea when discussing the characteristic of homework typically assigned. Thus, school administrators may wish to consider training teachers (e.g., using mentoring, see Núñez et al., 2013) to help them overcome some of the obstacles faced when designing and assigning homework targeting students' individual characteristics and learning needs.

Another interesting finding is related to the sub-theme of homework adjusted to the availability of students. This was reported while discussing homework quality (elementary school) and characteristics of homework typically assigned (elementary and middle school). Moreover, some elementary and middle school teachers explained by email the reasons why they did not assign homework in some circumstances [e.g., eves of assessment tests of other subjects, extracurricular activities, short time between classes (last class of the day and next class in the following morning)]. These teachers' behaviors show concern for students' well-being, which may positively influence the relationship between students and teachers. As some participants mentioned, "students value this attitude" (P1 FG5). Thus, future research may explore how homework adjusted to the availability of students may contribute to encouraging positive behaviors, emotions and outcomes of students toward their homework.

Data gathered from the photos of the assigned homework tasks allowed a detailed analysis of the length and completion deadlines of homework. Long assignments did not match elementary school teachers' perspectives of quality homework. However, a long homework was assigned once and aimed to help students practice the material covered for the mathematics assessment test. Here, practices diverged. Some teachers assigned this homework some weeks before and others assign it in last class before the test. For this reason, the "long term" completion deadline was not a typical category, hence not reported. Future research could consider studying the impact of this homework characteristic on students' behaviors and academic performance.

Finally, our findings show that quality homework, according to teachers' perspectives, requires attention to a combination of several characteristics of homework. Future studies may include measures to assess characteristics of homework other than "challenge" and "selection" already investigated (Trautwein et al., 2006b; Dettmers et al., 2010; Rosário et al., 2018); for example, homework adjusted to the availability of students.

Strengths and Limitations of the Study

The current study analyzed the teachers' perspectives on the characteristics of quality homework and of the homework they typically assigned. Despite the incapability to generalize data, we believe that these findings provide important insights into the characteristics that may impact a homework assignment's effectiveness, especially at middle school level. For example, our results showed a disconnect between teachers' perspectives about the characteristics of quality homework and the characteristics of the homework they assign. This finding is relevant and emphasizes the need to reflect on the consistency between educational discourses and educational practices. Teachers and school administrators could consider finding opportunities to reflect on this disconnect, which may also occur in other educational practices (e.g., teacher feedback, types of questions asked in class). Present data indicate that middle school teachers reported to assign homework with the major purpose of practicing and reviewing the material, but they also aim to develop students' responsibility and autonomy; still they neglect homework with the purpose of extension which is focused on encouraging students to display an autonomous role, solve problems and transfer the contents learned (see discussion section). Current findings also highlight the challenges and dilemmas teachers face when they assign homework, which is important to address in teachers' training. In fact, assigning quality homework, that is, homework that works, is not an easy task for teachers and our findings provide empirical data to discuss and reflect upon its implications for research and educational practice. Although our findings cannot be generalized, still they are expected to provide important clues to enhance teachers' homework practices in different contexts and educational settings, given that homework is among the most universal educational practices in the classroom, is a topic of public debate (e.g., some arguments against homework are related to the characteristics of the assignments, and to the malpractices in using this educational tool) and an active area of research in many countries (Fan et al., 2017).

Moreover, these findings have identified some of the most common obstacles teachers struggle with; such data may be useful to school administrators when designing policies and to teacher training. The administrative obstacles (e.g., large number of students per class) reported by teachers may help understand some of the discrepancies found between teachers' definition of quality homework and their actual homework practices (e.g., degree of individualization), and also identify which problems related to homework may require intervention. Furthermore, future research could further investigate this topic by interviewing teachers, videotaping classroom activities and discussing data in order to design new avenues of homework practices.

We share the perspective of Trautwein et al. (2006b) on the importance of mapping the characteristics of homework positively associated with students' homework behaviors. Data from this study may inform future studies analyzing these relationships, promote adaptive homework behaviors and enhance learning.

Methodologically, this research followed rigorous procedures to increase the trustworthiness of findings, improving the validity of the study (e.g., Lincoln and Guba, 1985) that should be accounted for. Data from two data sources (i.e., focus groups and the homework assignments photographed) were consistent, and the member checking conducted in both phases allowed the opportunity to learn that the findings of the focus group seem to accurately reflect the overall teachers' perspectives regarding quality homework and their homework practices.

Despite the promising contributions of this study to the body of research regarding homework practices, this specific research provides an incomplete perspective of the homework process as it has only addressed the perspectives of one of the agents involved. Future research may consider analyzing students' perspectives about the same topic and contrast data

with those of teachers. Findings are expected to help us identify the homework characteristics most highly valued by students and learn about whether they match those of teachers.

Furthermore, data from homework assignments (photos) were provided by 25% of the participating teachers and for a short period of time (i.e., three weeks in one school term). Future research may consider conducting small-scale studies by collecting data from various sources of information aiming at triangulating data (e.g., analyzing homework assignments given in class, interviewing students, conducting in-class observations) at different times of the school year. Researchers should also consider conducting similar studies in different subjects to compare data and inform teachers' training.

Finally, our participants' description does not include data regarding the teaching methodology followed by teachers in class. However, due to the potential interference of this variable in results, future research may consider collect and report data regarding school modality and the teaching methodology followed in class.

CONCLUSION

Homework is an instructional tool that has proved to enhance students' learning (Cooper et al., 2006; Fernández-Alonso et al., 2015; Valle et al., 2016; Fan et al., 2017; Rosário et al., 2018). Still, homework is a complex process and needs to be analyzed thoroughly. For instance, when planning and designing homework, teachers need to choose a set of homework characteristics (e.g., frequency, purposes, degree of individualization, see Cooper, 2001; Trautwein et al., 2006b) considering students' attributes (e.g., Cooper, 2001), which may pose a daily challenge even for experienced teachers as those of the current study. Regardless of grade level, quality homework results from the balance of a set of homework characteristics, several of which were addressed by our participants. As our data suggest, teachers need time and space to reflect on their practices and design homework tasks suited for their students. To improve the quality of homework design, school administrators may consider organizing teacher training addressing theoretical models of homework assignment and related research, discussing homework characteristics and their influence on students' homework behaviors (e.g., amount of homework completed, homework effort), and academic achievement. We believe that this training would increase teachers' knowledge and self-efficacy beliefs to develop homework practices best suited to their students' needs, manage work obstacles and, hopefully, assign quality homework.

ETHICS STATEMENT

This study was reviewed and approved by the ethics committee of the University of Minho. All research participants provided written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

PR and TN substantially contributed to the conception and the design of the work. TN and JC were responsible for the literature search. JC, TN, AN, and TM were responsible for the acquisition, analysis, and interpretation of data for the work. PR was also in charge of technical guidance. JN made important intellectual contribution in manuscript revision. PR, JC, and TN wrote the manuscript with valuable inputs from the remaining authors. All authors agreed for all aspects of the work and approved the version to be published.

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Effect of Parents' Encouragement on Reading Motivation: The Mediating Effect of Reading Self-Concept and the Moderating Effect of Gender

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Previous research has found that parental encouragement is associated with children's motivation to read. However, little is known about the underlying mechanisms of this association or factors that might strengthen or weaken these processes. The current research scrutinized a moderated mediation model that comprised of parental encouragement (predictor variable), reading self-concept (mediator), gender (moderator), and reading motivation (outcome variable) simultaneously. A total of 254 Chinese students (M_{age} = 11.35 years, SD_{age} = 0.87) completed the Parents' Encouragement of Extracurricular Reading Questionnaire, Reading Self-Concept Scale, and Pupil Reading Motivation Scale. Path analysis revealed that parents' encouragement was associated with children's reading motivation both directly and indirectly via reading self-concept, and the effect of parents' encouragement on children's motivation was more positive for boys than girls, while the effect of reading self-concept on children's motivation was more positive for girls than boys. Our results highlight the importance of parental encouragement in improving children's reading motivation, and the findings and their implications are discussed.

Keywords: parents' encouragement, reading motivation, reading self-concept, gender, moderated mediation effect

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INTRODUCTION

Reading is a means to understand the external world, the basis for students to learn, and a basic skill for individual survival and development (Smith et al., 2000). However, these benefits depend on the students' motivation to read. Reading motivation is closely connected to reading comprehension and achievement (Jang et al., 2015; Cartwright et al., 2016) and has been illustrated to forecast the following reading achievement as well (Schaffner et al., 2016). Students with high motivation for reading spend more time on reading activities and show improved ability over time (Schaffner et al., 2013). In contrast, poor readers usually display low motivation to read, and improving reading motivation may be effective in helping poor readers become proficient (Morgan and Fuchs, 2007).

The correlation between reading motivation and reading ability suggests the possibility that each is influenced by the other (Morgan and Fuchs, 2007). That is, reading motivation might promote better reading skills, but better reading skills might also generate more motivation. Other factors might also increase reading motivation. These include disposition, beliefs and goals

(Conradi et al., 2014). Disposition refers to positive attitudes about and interest in reading. Beliefs include self-concept about reading (an overall self-perception of oneself as a reader) and self-efficacy about reading (a judgment of one's capacity of finishing a specific reading task). Goals are an individual's orientation and intentions toward reading. However, these factors are mostly internal, and situational factors also have an important effect on reading motivation.

Family literacy theory further emphasizes the effects of the learner's home environment and parent involvement on literacy and achievement. Parents' encouragement (Shuck et al., 1983) and the home literacy environment (Yeo et al., 2014) are important contextual factors associated with higher reading performance. Parents' encouragement and praise have also been shown to predict toddlers' reading comprehension 7 years later (Gunderson et al., 2018). Family literacy theory is also relevant for conceptualizing contextual influences on children's motivation for reading. For example, previous studies have showed that parent involvement and encouragement have a substantial effect on students' interest in reading (Baker and Scher, 2002; Yeo et al., 2014). However, the nature of the encouragement is important. The promise of a reward leads to improvement in reading scores in the short term, but encouragement has more lasting effects on student performance (Cheo, 2017).

However, most of these studies have not tested mediators or moderators of the association between parents' encouragement and children's reading motivation. Therefore, little is known how these two processes were integrated. In this research, a complicated conceptual model, in which reading self-concept mediated the relation between parents' encouragement and children's reading motivation, was tested, and gender moderated these direct and indirect relationships.

The Mediating Role of Reading Self-Concept

Reading self-concept refers to one person's whole self-perception as a reader, with one's sense of competence and the role ascribed to reading as one's partial personal identity included (Conradi et al., 2014). According to the hypothesis of self-enhancement, self-concept is a fundamental premise for achievement, which may itself be produced by more involvement and effort in reading activities (Marsh and Yeung, 1997). From another perspective, the hypothesis of skill-development implies that academic self-concept results from the achievement, which can be accounted for by social comparisons (Möller and Pohlmann, 2010). For example, two students on the same achievement levels will advance different self-concepts in accordance with the average achievement in their class or school. In addition, self-concept related to reading can affect reading achievement through the mediating effect of reading motivation and meta-cognition (Chapman and Tunmer, 1997), because a positive self-concept is a vital premise for coping with learning difficulties, and in turn, an adaptive response to difficulties encountered in leaning facilitates positive academic process. There may also be reciprocal effects between the self-concept and achievement in reading (Retelsdorf et al., 2014).

Though the individual persons differ in self- and task perceptions and in success expectations, Frome and Eccles (1998) suggested that these differences come directly from children's interpretation of reality and their parents, but not from the reality itself. Parents' beliefs and encouragement are important for cultivating their children's self-concept and competencies, and parents' reading perception is related to children's reading self-concept (Frome and Eccles, 1998). Competent parents provide more direct help, encouragement and positive emotional influence in the interaction with their children (Mondell and Tyler, 1981). Such behaviors could directly influence the relationship between parents' capacity and the child's reading self-concept and capacity. Grolnick et al. (1991) have ascertained that parents' behavior does not have direct influence on the children through skill building as traditionally assumed, but through its impact on their attitudes and motivations connected with school. Nevertheless, Bandura et al. (1996) suggested that parents' encouragement can further develop their children's academic competence by enhancing their children's trusts in their academic capacity. The primary indicator of young children's motivation usually derives from their competency beliefs, and their experiencing early task mastery is supposed to result in higher reading self-concept, and hence greater motivation. To the contrary, declines in motivation is supposed to result from early declines in reading self-concept which would result later in less frequent reading practice (Gottfried, 1990). Harter (1999) reviewed extensive socialization literature on self-concept and concluded that authoritative child rearing is more beneficial than authoritarian or permissive practices. Moreover, social support–especially from parents–is important for forming self-concept. These studies suggest that parents' self-efficacy and encouragement help shape children's reading self-concept and academic achievement.

The Moderating Role of Gender

The gender may influence the reading motivation and reading self-concept. Gender differences in students' academic self-concept often exceed differences in actual achievement (Hyde and Durik, 2005). Based on the expectancy-value theory, significant others such as parents, peers and teachers would shape the gender stereotypes, which influence the students in many aspects such as their competence beliefs, values, and achievement-related behavior. Gender stereotypes of reading get more support from girls than boys (Retelsdorf et al., 2015).

Generally, girls have higher language-related self-concepts, and boys are believed to have higher mathematics-related self-concepts (Pesu et al., 2016). Indeed, evidence has it that it is reported that girls have higher confidence in their linguistic competence than boys do (Ireson and Hallam, 2009). Moreover, a longitudinal study revealed that these gender differences in language-related self-concepts increase over time across Grade 1–12 (Archambault et al., 2010). A higher proportion of girls maintained strong and stable language-related self-concepts over time; by contrast, a higher proportion of boys indicated substantial decline in language-related self-concepts.

In addition, there appear to be gender differences in reading motivation, reporting that the males have lower motivation

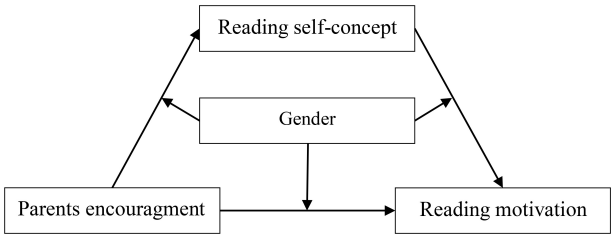

FIGURE 1 | A moderated mediation model predicting reading motivation.

for reading than the females (Marinak and Gambrell, 2010; McGeown et al., 2012). Compared to males, females read more frequently (Logan and Johnston, 2009), in both childhood and adolescence. Significant gender differences in reading skills are also frequently reported by children (Martin et al., 2007) and adolescents (Chiu and McBride-Chang, 2006). Compared to girls, other researchers found that reading attitudes, motivation and interest were significantly more strongly related to reading skills for boys (Logan and Johnston, 2009; Logan and Medford, 2011). However, in a recent study of adequate and struggling readers, there was little evidence of consistent gender differences in reading motivation (Wolters et al., 2014).

The Present Research

In the present research, parents' encouragement was designed as the independent variable, reading motivation the dependent variable, reading self-concept the mediating variable, and gender the moderating variable to explore influences on the association between parents' encouragement and pupils' reading motivation. We tested the following hypotheses. H1, parents' encouragement is associated with reading motivation; H2, parents' encouragement is associated with reading motivation through the mediating effect of reading self-concept; H3, gender moderates the influence of parents' encouragement on reading motivation. Mediation analysis is a statistical approach used to understand how an independent variable *X* affects a dependent variable *Y* through a mediator *M*, while moderation analysis is used to determine whether the size or sign of the effect of *X* on *Y* depends on (i.e., "interacts with") a moderator variable (Hayes, 2013). The proposed research model is portrayed in **Figure 1**.

MATERIALS AND METHODS

Participants

Two hundred and fifty-four students (M_{age} = 11.35 years, SD_{age} = 0.88) participated in the present study, who were from two primary schools in Zhengzhou, a city located in central China. Among the sample, 18.1% were from Grade 4, 28.0% were from Grade 5, and 53.9% were from Grade 6. Furthermore, 49.2% of these participants were female, and 72.0% had one or more siblings. The majority of participants reported their place of residence as urban (83.9%).

Measures

Parents' Encouragement

Parents' encouragement was measured using the Parents' Encouragement of Extracurricular Reading Questionnaire (PEERQ), a Chinese language measure designed by Gu et al. (2017b). This questionnaire consists of 7 items (e.g., Did your parents give you some reading skills?), and each item was rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*almost once a day*), and higher scores reflected more encouragement. The PEERQ has shown good reliability and validity in previous research (e.g., Gu et al., 2017a). In the present study, Cronbach' α for this scale was 0.83. Moreover, confirmatory factor analysis (CFA) suggested that all the factor loadings ranged from 0.56 to 0.78, and the unidimensional model fitted the data well: χ^2/df = 2.35, TLI = 0.96, CFI = 0.97, RMSEA = 0.073, SRMR = 0.031, indicative of good structural validity.

Reading Motivation

Reading motivation was measured by 9 items adopted from the Pupil Reading Motivation Scale (PRMS) developed in Chinese by Liu (2012). A sample item from this measure is, "After finishing the reading homework assigned by the teacher, I will do some extra reading exercises by myself." Each item was rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Responses for negative statements were reversely coded, and the average score of all items was calculated so that higher scores reflected higher motivation. In the present study, Cronbach' α for this measure was 0.76, and CFA showed that all the factor loadings ranged from 0.45 to 0.60, and the one-factor solution fitted the data well: χ^2/df = 2.43, TLI = 0.86, CFI = 0.89, RMSEA = 0.075, SRMR = 0.053.

Reading Self-Concept

Reading self-concept was measured by a translated Chinese version of the reading self-concept subscale of the PIRLS Student Questionnaire (Martin et al., 2007), including four items. Each item was rated on a 5-point Likert scale as mentioned above. And the higher scores reflected a more positive self-concept. The reliability and validity has been verified in previous research (e.g., De Naeghel et al., 2012). In the present study, Cronbach' α for this scale was 0.78, and CFA revealed that all the factor loadings ranged from 0.55 to 0.84, and the unidimensional model fitted the data well: χ^2/df = 3.44, TLI = 0.93, CFI = 0.97, RMSEA = 0.098, SRMR = 0.066.

Procedure

The assessments were individually administered within a 2-week period in the second month of the academic year, by trained graduate students in a quiet room at the school. Considerable time was taken with these measures to ensure that the response requirements were fully understood and total administration time was around 15 minutes. In order to minimize answering bias (e.g., acquiescence, social desirability), the items of PRMS and RSCS in this study were presented in a randomized order. In addition, we set up a filler item (i.e., I never lie.). If participants answered "strongly agree", it would be treated as invalid response.

Data Analysis

In the first place, we employed SPSS software (version 24.0) to analyze descriptive statistics and correlations. In the second, the causal steps approach (Baron and Kenny, 1986) was adopted to investigate the mediation role of reading self-concept in linking parent encouragement and reading motivation. This approach tests the regression coefficients for the effects of predictor on outcome (Step 1), predictor on mediator (Step 2), and mediator on outcome controlling for the predictor (Step 3). Since the causal steps approach does not directly test the mediating effect, and the sampling distribution of mediation effects is often skewed especially for small samples (e.g., $n < 400$), bias-corrected bootstrapping is applied to examine the significance of the mediation effect. As a resampling method, bootstrapping is especially useful when the behavior of a statistic over repeated sampling is either not known, too complicated to derive, or highly context dependent. In mediation analysis, bootstrapping is used to generate an empirically derived representation of the sampling distribution of the indirect effect, and this empirical representation is used for the construction of a confidence interval for αβ (for details, see Hayes, 2013). We can reject the null hypothesis of no mediation if the bootstrapped confidence interval does not contain zero.

Finally, we employing Model 59 of the PROCESS macro to conduct moderated mediation analysis (Step 4 and Step 5) so as to decide whether the indirect path was moderated by gender.

RESULTS

Descriptive Statistics

Descriptive statistics and correlations for the measured variables are presented in **Table 1**. As expected, parent encouragement, reading self-concept, and reading motivation were positively related to each other. Moreover, parent encouragement was negatively associated with place of residence, which indicated that students from urban areas had more parent encouragement than those from rural areas. Age was found to be both negatively associated with parent encouragement and reading motivation, indicating that younger students had more parent encouragement and reading motivation.

Mediation Analyses

Next, the mediation effect of reading self-concept on the association between parent encouragement and reading motivation was tested, and the results were presented in **Table 2**. After controlling covariates (i.e., age, only child,

TABLE 1 | Means, standard deviations, and correlations among the study variables.

Variables	1	2	3	4	5	6	7
1. Age	–						
2. Gender	– 0.11	–					
3. Only child	0.04	0.15*	–				
4. Place of residence	0.13*	– 0.00	0.11	–			
5. Parent encouragement	– 0.19**	– 0.06	0.02	– 0.19**	–		
6. Reading self-concept	– 0.10	0.08	– 0.05	– 0.09	0.25***	–	
7. Reading motivation	– 0.14*	0.04	0.02	– –0.02	0.40***	0.50***	–
M	11.35	0.49	0.72	0.15	3.46	3.94	4.04
SD	0.88	0.50	0.45	0.36	1.00	0.84	0.86

*N = 254. Gender was coded as 0, male and 1, female; only child was coded as 0, no and 1, yes; place of residence was coded as 0, rural and 1, urban. *p < 0.05, **p < 0.01, ***p < 0.001.*

TABLE 2 | Tests of the mediation effect and the moderated mediation effect.

	Mediation analyses						Moderated mediation analyses			
	Step 1 (Criterion: RM)		Step 2 (Criterion: RSC)		Step 3 (Criterion: RM)		Step 4 (Criterion: RSC)		Step 5 (Criterion: RM)	
	b	*t*	*b*	*t*	*b*	*t*	*b*	*t*	*b*	*t*
Age	– 0.06	– 0.93	– 0.04	– 0.55	– 0.04	– 0.76	– 0.04	– 0.55	– 0.04	– 0.78
Only child	0.01	0.10	– 0.15	– 1.05	0.08	0.64	– 0.15	– 1.04	0.08	0.71
PR	0.19	1.11	– 0.09	– 0.50	0.23	1.49	– 0.08	– 0.47	0.26	1.74
Gender	0.08	0.68	0.16	1.28	0.01	0.11	0.16	1.27	0.01	0.08
PE	0.40	6.49***	0.22	3.44**	0.30	5.38***	0.25	2.86***	0.46	6.22***
RSC					0.43	7.85***			0.32	4.42***
PE × Gender							– 0.06	– 0.48	– 0.34	– 3.18**
RSC × Gender									0.26	2.39*
R^2	0.16		0.07		0.33		0.07		0.37	
F	9.29***		3.33**		19.97***		2.81*		17.30***	

*N = 254. PR, place of residence; PE, parent encouragement; RSC, reading self-concept; RM, reading motivation. *p < 0.05, **p < 0.01, ***p < 0.001.*

place of residence, and gender), parent encouragement was significantly correlated with reading motivation (Step 1: β = 0.40, $p < 0.001$) and reading self-concept (Step 2: β = 0.22, $p < 0.01$). Furthermore, when parent encouragement (Step 3: β = 0.30, $p < 0.001$) and reading self-concept (Step 3: β = 0.43, $p < 0.001$) were employed as predictors, they both displayed significant effects on reading motivation. Analysis from bias-corrected bootstrapping with 2000 samples utilizing the PROCESS macro (Hayes, 2013) illustrated a significant mediation effect [$B = 0.10$, $SE = 0.03$, 95%CI (0.04, 0.16)], with parent encouragement still showing a significant direct effect on motivation [$B = 0.30$, $SE = 0.06$, 95%CI (0.19, 0.41)]. The ratio of the mediation effect to the total effect was 0.24 [95%CI (0.11, 0.40)]. Therefore, reading self-concept partially mediated the relation of parent encouragement and reading motivation. Accordingly, both Hypothesis 1 and Hypothesis 2 were supported.

Moderated Mediation Analyses

We employed Model 59 of PROCESS (Hayes, 2013) to investigate whether the mediation effect of reading self-concept was moderated by gender. As seen in **Table 2**, after controlling covariates (i.e., age, only child, and place of residence), reading self-concept was significantly predicted by parent encouragement (Step 4: β = 0.25, $p < 0.001$), but not by the interaction effect of parent encouragement and gender (Step 4: β = −0.06, $p > 0.05$). The direct effect of reading self-concept on reading motivation was significant (Step 5: β = 0.32, $p < 0.001$), and there was a positive and significant moderation effect of gender between reading self-concept and reading motivation (Step 5: β = 0.26, $p < 0.05$). Moreover, gender was also found to moderate the direct effect of parent encouragement on reading motivation (Step 5: β = –0.34, $p < 0.01$). These observations suggested that both the direct and indirect association between parent encouragement and reading motivation was moderated by gender. More specifically, this was a second stage moderated mediation model, which linked reading self-concept and reading motivation. Thus, Hypotheses 3 was supported.

A test of simple slopes was conducted to demonstrate more clearly how gender moderated the influence of parent encouragement and reading self-concept on reading motivation. As revealed in **Figure 2**, the relation between reading self-concept and reading motivation for females was significant ($\beta_{simple} = 0.58$, $p < 0.001$). This relation was way too weaker, however, for males ($\beta_{simple} = 0.32$, $p < 0.001$). Furthermore, **Figure 3** showed that the direct effect of parent encouragement on reading motivation for males was significant ($\beta_{simple} = 0.46$, $p < 0.001$). This effect was much weaker, however, for females ($\beta_{simple} = 0.12$, $p > 0.05$). The analysis of conditional indirect effect analysis further illustrated that the whole indirect effect was more noticeable for females [$B = 0.11$, SE = 0.06, 95% CI (0.01, 0.23)], than for males [$B = 0.08$, SE = 0.03, 95% CI (0.03, 0.16)].

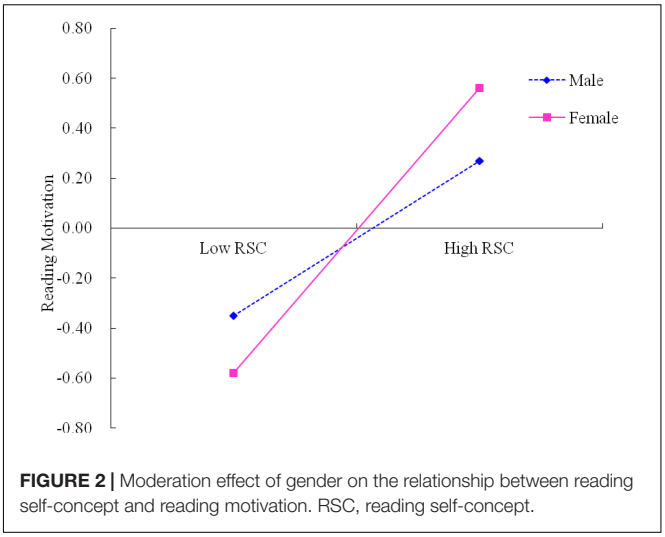

FIGURE 2 | Moderation effect of gender on the relationship between reading self-concept and reading motivation. RSC, reading self-concept.

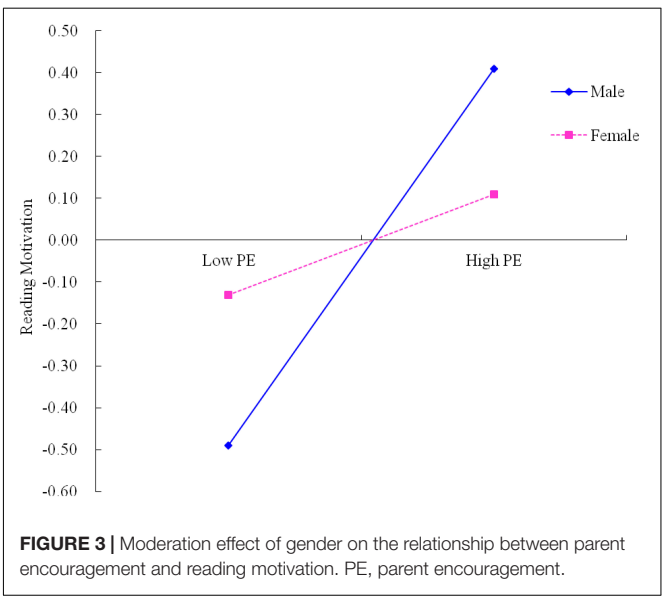

FIGURE 3 | Moderation effect of gender on the relationship between parent encouragement and reading motivation. PE, parent encouragement.

DISCUSSION

The present study examined whether and how parents' encouragement affects their children's reading motivation. Parents' encouragement was directly associated with children's reading motivation, and this association was partially mediated by children's reading self-concept. Furthermore, the direct effect of the parents' encouragement on children's reading motivation was stronger for boys, and the effect of reading self-concept on children's reading motivation was stronger for girls.

The direct effect of parents' encouragement on children's reading motivation is consistent with Yeo et al. (2014). It is possible that parents who encourage their children to read spend more time interacting with their children in the context of reading, and express more positive emotions about reading activation. This association between positive experiences and reading activity will benefit pupils' reading motivation.

There was a significant mediating effect of reading self-concept in the association between parents' encouragement and pupils' reading motivation, indicating that parents' encouragement may help to improve pupils' reading self-concept, which further enriches their reading motivation. Children's self-concept is mainly derived from their parents,

teachers and peers' beliefs (Pesu et al., 2016). When parents give encouragement, pupils will believe that reading has value and that they have the competency to read. Furthermore, higher reading self-concept usually means that pupils will regard reading as interesting, resulting in higher reading self-efficacy.

Interestingly, the results indicated that the moderating effects of gender between parents' encouragement and motivation and between reading self-concept and motivation were opposite. Specifically, parents' encouragement has a stronger impact on boys' compared to girls' reading motivation. The possible reason is that girls might be peculiarly vulnerable to the proposed negative effects of personal encouragement resulting in subsequent failure. Traditional socialization practices are inclined to concentrate on dependence and interpersonal relationships for females, while independence and achievement for males (Corpus and Lepper, 2007). Hence, since parents' encouragement may foreground external evaluation and restrict autonomy for females, it is inclines either to promote feelings of competence or to be neglected by males. Recent study also suggested that parental encouragement and support can more effectively improve boys' beliefs and motivation than girls' (Simpkins et al., 2015). In contrast, reading self-concept has a stronger impact on girls' compared to boys' reading motivation. The gender stereotype from parents and teachers is that girls outperform boys in reading, and this view has a negative effect on boys' reading self-concept, but not girls' (Retelsdorf et al., 2015). Girls persistently demonstrated more positive attitudes toward recreational reading, and greater stability in reading attitudes over time than boys, and they also enjoyed reading significantly more than boys (Marinak and Gambrell, 2010). In addition, they expressed different preferences to the types of books which they read. Specifically, it was reported that boys preferred to read comic and humorous books while girls enjoyed reading adventure books. And even those who had fluent reading abilities weren't inclined to read aloud (Merisuo-Storm, 2006).

The present results showed that the relation between reading self-concept and reading motivation was stronger for females than males. This moderation effect is likely to be related to gender identity (McGeown et al., 2012). For example, children report that compared to their fathers, their mothers read more, and spend more time teaching them to read (Millard, 1997). Compared with mathematics, science and sports, which are often seen as being more associated with being male, reading is usually regarded as a more feminine activity (Meece et al., 2006). As a result, reading self-concept may affect reading motivation more strongly for girls than for boys.

The findings in the present study suggest that parents' encouragement can influence their children's reading motivation directly and through the mediating effect of reading self-concept, raising important implications for students who are eager to improve reading interest and ability. Parents' encouragement can facilitate the children to stimulate reading motivation and construct higher reading self-concept. As a result, readers in the beginning period who have initial success can indulge in reading for information and pleasure, but lack of parents' encouragement is bad for the children to develop their reading motivation and reading self-concept. Thus, those who have difficulty and failure in the initial reading period are usually hindered by the less rewarding process of developing basic competence in the lexical level. Once children have stepped into the "swamp" of negative anticipations, lower motivation, and limited practice, they have increasing difficulty in getting back on the road of proficient reading. In addition, the present study suggests that when parents and teachers foster the children's reading motivation and reading self-concept, they should avoid the negative influence of gender stereotypes on reading self-concept, and give boys more encouragement so as to inspire their reading motivation them through improving their reading self-concepts.

It is necessary for future studies to cope with several limitations innate in the current research. Firstly, though the cross-sectional designs utilized in the present research gives useful information about variable relationships, longitudinal study would be beneficial to verify the causal relationship between parents' encouragement and children's reading motivation. Secondly, the collection of our data depended on pupils' self-report. Though pupils are more susceptible to their own motivation and self-concept than their parents are, at this age social desirability may be a greater influence on girls, whereas boys be tempted to present themselves as less compliant. Multiple informants (e.g., the reports from themselves, their parents, and their teachers) will be beneficial in ruling out the social desirability bias from gender and testing rigorously research hypotheses. Thirdly, this study merely concentrated on the influence of factors in general such as parents' encouragement and reading self-concept on pupils' reading motivation. Future research is supposed to further investigate how specific parent' encouragement, or specific types of books are related to pupils' reading motivation. Finally, how to turn reading motivation into reading achievement is very important. The main aim in the present study is to investigate the relationship between parental encouragement and child's reading motivation, but in future research, an objective measure of actual reading achievement would be useful to evaluate the interpretation of our finding, and assess potential reciprocal effects of motivation on reading self-concept.

In summary, this study explored the underlying mechanism of parents' encouragement on primary school students' reading motivation. The results suggest some valuable conclusions: (1) parents' encouragement can influence their children's reading motivation directly and through the mediating effect of reading self-concept; (2) parents' encouragement has a stronger impact on boys' compared to girls' reading motivation, whereas reading self-concept has a stronger impact on girls' compared to boys' reading motivation.

DATA AVAILABILITY

The datasets for this manuscript are not publicly available. Requests to access the datasets should be directed to guhonglei1985@163.com.

ETHICS STATEMENT

The study protocol was approved by Guangdong University of Technology Research Ethnics Committee, and has been executed consistent with ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Written informed consents were obtained from the participants' parents and all children provided informed assent.

AUTHOR CONTRIBUTIONS

TX and HG designed the study and wrote the first draft of the manuscript. HG collected the data, developed, and performed the statistical analysis in conjunction with TX. WL revised critically the final draft together with TX and HG.

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Effects of Parental Autonomy Support and Teacher Support on Middle School Students' Homework Effort: Homework Autonomous Motivation as Mediator

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The present study tested whether students' autonomous motivation mediated the association between adult support (parental autonomy support, teacher support) and students' homework effort. A sample of 666 Chinese middle school students was recruited to complete the parental autonomy support questionnaire, teacher support questionnaire, homework autonomous motivation questionnaire and homework effort questionnaire. Structural equation modeling showed that both parental autonomy support and teacher support positively predicted mathematics homework effort, and mathematics homework autonomous motivation was a mediator in these associations. The present study reveals the importance of adult support and autonomous motivation, and has theoretical and practical implications.

Keywords: homework effort, parental autonomy support, teacher support, homework autonomous motivation, mathematics, middle school students

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INTRODUCTION

Homework refers to tasks assigned by teachers, which students complete during their extracurricular time (Cooper, 2001). Students' effort toward homework is predictive of homework outcomes (Trautwein and Köller, 2003; Trautwein and Lüdtke, 2007). The homework model holds that homework effort is evidenced in four dimensions: investment, compliance (doing homework carefully and independently), concentration (doing homework with focus) and number of tasks (percentage of tasks attempted) (Trautwein et al., 2006). Furthermore, Trautwein et al. (2006) developed the Homework Effort Questionnaire with three subscales: homework completion compliance, concentration, and percentage of tasks attempted. Academic engagement research consistently connects homework effort with performance (Trautwein and Köller, 2003; Trautwein and Lüdtke, 2007; Flunger et al., 2015). Recent evidence suggests that homework effort is associated with environmental variables such as family and school factors, including homework quality (Dettmers et al., 2010; Liu et al., 2016), teacher feedback and support (Liu et al., 2017), parental involvement quality and motivation for homework (Dumont et al., 2014; Liu et al., 2017), and individual variables such as gender (Xu, 2011), conscientiousness (Trautwein et al., 2006; Flunger et al., 2017), homework motivation (Trautwein and Lüdtke, 2009; Flunger et al., 2017; Liu et al., 2017), and homework emotions (Dettmers et al., 2011; Goetz et al., 2012; Liu et al., 2017).

This study concerned how adult support from family and school influences homework together. Existing studies have found that adult support is positively associated with adolescents' social and academic adjustment (Kocayörük et al., 2015; Tennant et al., 2015; Morton, 2016). However, it is still unclear how parent support and teacher support together impact homework effort.

Based on the self-determination theory, the satisfaction of adolescents' needs-autonomy, competence and relatedness-is fundamental to autonomous motivation (Deci and Ryan, 2000), leading to higher academic engagement (Roth et al., 2009). Previous studies explored the relationship between parental involvement and adolescents' academic engagement and performance (Moon and Hofferth, 2016; Boonk et al., 2018). The present study extends and expands literature by considering the concurrent influences of parental support and teacher support on homework effort. Accordingly, we expected that parental autonomy support and teacher support positively predict homework effort. In addition, adult support, as an external factor, affects individual behaviors via internal factors (Helgeson and Lopez, 2010). Therefore, the present study also tested the mediating role of autonomous motivation.

Parental Autonomy Support and Homework Effort

Previous studies have found that parental involvement which includes parental autonomy support as one indicator is closed to learning (Cheung and Pomerantz, 2011; Choi et al., 2015). Parental involvement means parents involve in children's schooling to contribute to their academic achievement (Cheung and Pomerantz, 2011; Baker, 2015). In general, parental involvement is significantly predictive of students' academic performance (Choi et al., 2015; Moon and Hofferth, 2016). A meta-analysis study found that parental homework involvement was significantly associated with students' general achievement and mathematics achievement, though the effect sizes were very small (ES = 0.024; ES = 0.063) (Castro et al., 2015). However, parents' content support, one form of parental support, is not always positively, even negatively, related to students' academic performance (including mathematics performance); parents' controlling or intrusive support impairs adolescents' motivation and academic achievement (Levpuscek and Zupancic, 2009; Boonk et al., 2018; Xu et al., 2018). Specifically, research in parental involvement in homework, however, has found that parental involvement in homework both promoted and impaired students' performance (Desimone, 1999; Cooper et al., 2000; Corno and Xu, 2004; Pomerantz et al., 2005). Some researchers hold that the quality rather than the quantity of parental involvement in homework is crucial to students' achievement (Trautwein et al., 2006; Knollmann and Wild, 2007), and revealed some dimensions that positively associate with academic engagement and achievement, for example, parental autonomy support (Cooper et al., 2000; Pomerantz et al., 2007; Katz et al., 2011; Dumont et al., 2012; Moroni et al., 2015; Boonk et al., 2018; Xu et al., 2018).

Parental autonomy support is critical to adolescents' development and learning. Parental autonomy support can be defined as parental encouragement of students' problem-solving, selection and decision-making (Grolnick, 1989). Parental autonomy support is demonstrated through honoring students' opinions, encouraging self-determination, providing opportunities to make independent choices, avoiding the use of controlling language, and offering an autonomous family environment (Deci and Ryan, 2012). A family environment that supports autonomy encourages adolescents to solve problems actively, think independently and search for an identity, thus improving their sense of control and competence.

Extensive research has shown that parents' support for autonomy is beneficial to students' learning engagement (Roth et al., 2009), academic ability and achievement (Soenens and Vansteenkiste, 2005; Wang et al., 2007; Liew et al., 2014; Pomerantz et al., 2014; Vasquez et al., 2016). A qualitative study of 15 parents showed that parent-reported support for autonomy was associated with students' homework enjoyment (Froiland, 2015). Froiland (2011) intervened to improve parental autonomy support for 7 weeks, which improved elementary school students' positive emotions about homework and their academic intrinsic motivation. Further, a study of elementary and junior high school students showed that parents' support for autonomy in homework was beneficial for students' mastery goals and achievement (Gonida and Cortina, 2014).

According to the self-determination theory (Deci and Ryan, 2000), adolescents urge parental support for autonomy, for example, being encouraged to arrange homework and solve problems independently. Such support is beneficial to students' autonomous motivation and learning engagement (Roth et al., 2009), academic performance (Boonk et al., 2018; Xu et al., 2018), and healthy development and well-being (Kocayörük et al., 2015). Based on the previous work, the present study proposed that parental autonomy support is associated with students' homework effort positively.

Teacher Support and Homework Effort

As leaders of class activities, teachers are frequently in contact with students and are important sources of support. The types of teacher support perceived by students in school include autonomy support, cognitive support and emotional support (Chai et al., 2011; Chai and Gong, 2013). Autonomy support is indicated by teachers' respect for students' opinions and feelings, opportunities to choose, encouragement of independent problem-solving, and provision of time for thinking (Lam et al., 2009; Chai et al., 2011; Chai and Gong, 2013). Teachers' cognitive support is demonstrated through providing students learning strategies, guiding the problem-solving processes, and offering reasonable assignments and effective feedback (Chai et al., 2011). Emotional support concerns teachers' care for their students, connection to students' emotions, and response to students' negative academic emotions (Rosiek, 2003; Titsworth et al., 2010).

Existing research has shown that teacher support is linked to students' mastery motivation (Ruzek et al., 2016), positive emotions, the use of self-regulated strategies (Wang and Eccles, 2013), academic engagement (Jang et al., 2010, 2016) and academic effort (Federici and Skaalvik, 2014). In mathematics

domain, Sakiz et al. (2012) found that perceived teacher support was positively associated with middle school students' self-efficacy beliefs, academic enjoyment and academic effort. In a sample of Chinese elementary school students, Liu et al. (2018) found that teacher support directly affected students' mathematics engagement in cognitive, behavioral and emotional realms. Taken together, it was hypothesized that students' homework effort is impacted by teacher support.

The Mediating Role of Autonomous Motivation

Autonomous motivation is an individual factor that may mediate the associations between adult support and homework effort. Autonomous motivation refers to the motivation that individuals experience when they have volition and free choice. For instance, interest is a typical autonomous motivation (Deci and Ryan, 2000). Autonomous motivation takes on great significance in individuals' learning behaviors; for example, it significantly predicts junior high school students' academic effort and achievement (Mih, 2013; Mouratidis et al., 2018). Similarly, homework motivation, which activates students in doing homework, is critical to homework achievement (Ayten and Eunsook, 2012).

Parents' and teachers' supportive behaviors promote the internalization of students' learning motivation, thus activating their autonomous motivation (Grolnick et al., 2007; Roth et al., 2007; Froiland, 2011). Extensive research has shown that parental autonomy support promotes students' academic autonomous motivation (Froiland, 2015; Vasquez et al., 2016); teacher support also significantly predicts elementary and middle school students' intrinsic motivation and autonomous motivation for homework (Katz et al., 2009; Hagger et al., 2015; Liu et al., 2017). In addition, autonomous motivation research connects parent and teacher support with students' academic effort and achievement (Mih, 2013). However, it is still unknown whether autonomous motivation for homework is a mediator in the relationships between adult support and students' homework effort.

The Present Study and Hypotheses

Given that homework effort is subject-specific (Trautwein et al., 2006), we focused on mathematics, which is the basic subject of STEM disciplines (English, 2016). Compared to mathematics in primary grades, mathematics in middle school increases in content and complexity, and thus middle school students may need more support from adults, such as teachers and parents (Zhang, 2016). Adult support can be measured by different methods such as direct observation or self-report from adults or students. However, studies focusing on adult support provide complex results. On the one hand, researchers found that students' perceived supportive teaching is positively associated with students' motivation and engagement (Stroet et al., 2013; Patall et al., 2018). On the other hand, compared to students' perceived teacher support, directly observed or teacher-reported supportive teaching has smaller or little association with students' motivation and engagement (Stroet et al., 2013). Therefore, students' perceived teacher support rather than teacher self-reported support or observed teacher support was considered as an important adult support in the present study.

Next, according to expectancy-value theory of achievement motivation, parental support reported by parents is the more distal factor, while parental support reported by students is the more proximal factor (Wigfield and Eccles, 2000). Parents-reported support influences students' achievement motivation through students' perceived parental support (Dinkelmann and Buff, 2016). As a consequence, students' perceived support may have a stronger association with their achievement. In the current study, students' perceptions of parental autonomy support and teacher support were measured.

The present study explored the effect of adult support on homework and tested the following hypotheses. We tested the effects of parental autonomy support and mathematics teacher support on middle school students' homework effort. (H1a) Middle school students' perceptions of parental autonomy support and of (H1b) mathematics teacher support will positively predict mathematics homework effort. The mediating role of mathematics autonomous motivation in the links between parental autonomy support and mathematics homework effort, and between mathematics teacher support and mathematics homework effort, was also tested. (H2a) Parental autonomy support and (H2b) mathematics teacher support will predict mathematics homework effort through mathematics autonomous motivation.

MATERIALS AND METHODS

Participants

Participants were 666 seventh and eighth graders recruited from three middle schools in the cities of Wuhan and Xiaogan in Hubei Province, Central China. All the schools were in middle to upper middle level in the two cities. All the classes were randomly selected from the schools. Of these, 322 were seventh graders (169 males) from seven different classes and 344 were eighth graders (182 males) from eight different classes. Their average age was 12.91 years (SD = 0.78).

Measures

Parental Autonomy Support

Parental autonomy support was assessed by the Psychological Autonomy Support Questionnaire, a Chinese-language measure developed by Wang et al. (2007). The questionnaire consists of eight items, including two subscales which assess choice making (4 items, e.g., "My parents allow me to make choices whenever possible") and opinion exchange (4 items, e.g., "My parents encourage me to give my ideas and opinions when it comes to decisions about me"). Each item was rated on a scale from 1 (not at all true) to 5 (very true). Higher scores indicate greater parental autonomy support. In the current study, CFA results showed that: χ^2/df = 3.21, RMSEA = 0.06, SRMR = 0.03, TLI = 0.96, CFI = 0.98. The overall score (the mean of 8 items) was used in the current study, with α = 0.88.

Mathematics Teacher Support

Mathematics teacher support was measured with the Questionnaire on Perceived Mathematics Teacher Support for Middle School Students, a Chinese-language measure developed by Chai and Gong (2013). This questionnaire consisted of three subscales: teacher autonomy support (5 items, e.g., "When solving mathematics problems, the mathematics teacher allows us to propose solutions that differ from the standard answers"), teacher cognitive support (5 items, e.g., "The mathematics teacher encourages us to look for solutions rather than telling us the answers directly"), and teacher affective support (7 items, e.g., "The mathematics teacher knows and cares about me"). All items were rated on a scale from 1 (not at all true) to 5 (very true). Higher scores indicate greater teacher support. In the present study, CFA results showed that: χ^2/df = 3.26, RMSEA = 0.06, SRMR = 0.05, TLI = 0.93, CFI = 0.94. The overall score (the mean of 17 items) was used in the current analyses. The Cronnbach's α in this study is 0.94.

Mathematics Homework Autonomous Motivation

To assess students' mathematics autonomous motivation, we used the Chinese version of the Questionnaire on Students' Autonomous Motivation in Mathematics Homework (Liu et al., 2017; for original version, see Katz et al., 2011). The original questionnaire consisted of an autonomous motivation subscale (11 items, e.g., "I do my homework because it is fun") and controlled motivation subscale (8 items). The present study used the autonomous subscale, with items rated on a scale from 1 (not at all true) to 5 (very true). Five items were deleted because their factor loadings were lower than 0.5 in CFA results (Hair et al., 1998). The resulting 6-item scale had α = 0.89. In the current study, CFA results showed that: χ^2/df = 3.52, RMSEA = 0.06, SRMR = 0.03, TLI = 0.98, CFI = 0.99.

Homework Effort

The Chinese version of the Homework Effort Questionnaire was used to assess homework effort (Zhang, 2008; for original version, see Trautwein et al., 2006). This 8-item questionnaire included three dimensions: homework completion compliance (3 items, e.g., "I've recently been doing my mathematics homework to the best of my ability"), concentration (4 items, e.g., "I concentrate hard when I do my mathematics homework"), and percentage of tasks attempted. Items were rated on a 4-point Likert scale from *extremely disagree* to *extremely agree*. The measure has been shown to be reliable in mathematics research, with α = 0.81 (Liu et al., 2016). To fit domain specificity, we added the word "mathematics" before "homework" in each item. In the current study, CFA results showed that: χ^2/df = 3.64, RMSEA = 0.06, SRMR = 0.04, TLI = 0.92, CFI = 0.96. The Cronnbach's α in this study is 0.78.

Procedure

The study was first approved by the Ethical Committee of the author's University. Then, informed written consent was provided by all middle schoolers, parents' written informed consent was obtained separately before the assessment. After that, paper-and-pencil questionnaires were group-administered to middle school students during regular class sessions by trained graduate students who were major in psychology. All the graduate students administered the assessment according to the same guidelines. The whole process took about 20 min.

Data Analysis

First, Pearson correlations were used to test relationships among variables. Next, the measurement model was set up with Mplus 7 to assess whether indicators represented their latent variables, and to examine correlations among all latent variables. We used χ^2/df, RMSEA, SRMR, CFI, and TLI to assess model fit. For RMSEA, a value $\leq$0.05 represents good model fit, and 0.08 is acceptable (Browne and Cudeck, 1993); for SRMR, a value $<$0.08 is acceptable (Hu and Bentler, 1998); A CFI value $\geq$0.90 or a TLI value $\geq$0.90 represent an acceptable model fit (Hu and Bentler, 1999; Byrne, 2010).

We set up a structural equation model to test our hypotheses. Considering the hierarchical structure of the data, we used "type = complex" (in the analysis command) and "cluster = class" (in the variable command) to compute the standard errors and chi-square tests of model fit. The maximum likelihood estimation in Mplus 7 was also selected. To reduce the complexity of the model, we used item parceling with dimensional scales as item parcels (Bandalos, 2002), but homework autonomous motivation was parceled as three item parcels according to its single-factor CFA results. We first tested the predictions regarding parental autonomy support and teacher support as predictors of homework effort. Second, the mediating role of homework autonomous motivation in each link between support and effort was examined. We used the indexes χ^2/df, RMSEA, SRMR, CFI, and TLI to assess model fit. According to Rosenthal and Rosnow (1991), we used Cohen's *d* to report the sizes of the effects and indirect effects. Finally, we used bootstrapping and an estimated bias-corrected 95% confidence interval to test the indirect effects.

RESULTS

Preliminary Analyses

The descriptive statistics and Pearson correlations among the variables are presented in **Table 1**. The correlations among all of the variables are significant. We examined the distributions of variables with skewness and kurtosis, and the results showed that all the variables are normal distributions according to the criterion of Finney and DiStefano (2006) (see **Table 1**).

Follow-up difference tests indicated that boys reported higher homework autonomous motivation than girls, M_{Male} = 3.67, M_{Female} = 3.38, t = 3.57, $p < 0.001$, d = 0.34. Therefore, we controlled the impacts of gender on homework autonomous motivation.

Measurement Model

The measurement model included four latent factors (parental autonomy support, teacher support, homework autonomous motivation, and homework effort) and 11 observed variables. An initial test of the measurement model indicated a good fit to the data, χ^2/df = 3.06, RMSEA = 0.06, SRMR = 0.05,

TABLE 1 | Descriptive statistics and Pearson correlations among variables.

	1	2	3	4	5	6	7	8	9	10	11
1 PAS1	—										
2 PAS2	0.76**	—									
3 TS1	0.20**	0.20**	—								
4 TS2	0.14**	0.18**	0.75**	—							
5 TS3	0.11**	0.15**	0.70**	0.84**	—						
6 HAM1	0.24**	0.28**	0.37**	0.32**	0.28**	—					
7 HAM2	0.26**	0.29**	0.44**	0.40**	0.31**	0.73**	—				
8 HAM3	0.28**	0.27**	0.41**	0.34**	0.27**	0.71**	0.78**	—			
9 HE1	0.25**	0.23**	0.26**	0.19**	0.16**	0.28**	0.35**	0.37**	—		
10 HE2	0.24**	0.21**	0.27**	0.14**	0.14**	0.37**	0.40**	0.39**	0.36**	—	
11 HE3	0.13**	0.13**	0.30**	0.21**	0.20**	0.22**	0.24**	0.29**	0.34**	0.32**	—
M	3.63	3.69	3.57	4.07	4.23	3.53	3.67	3.43	3.53	2.67	3.62
S	1.06	1.06	1.03	0.90	0.89	1.22	1.16	1.23	0.53	0.50	0.66
Skewness	−0.58	−0.68	−0.57	−1.20	−1.53	−0.45	−0.56	−0.42	−1.56	−0.30	−1.99
Kurtosis	−0.49	−0.31	−0.25	1.33	2.15	−0.79	−0.62	−0.80	3.29	−0.36	4.15

*PAS1, PAS2 (Measures of Parental autonomy support), TS1, TS2, TS3 (Measures of Teacher support), HAM1, HAM2, HAM3 (Measures of Homework autonomous motivation), HE1, HE2, HE3 (Measures of Homework effort). N = 666, **$p < 0.01$.*

CFI = 0.96, and TLI = 0.95. Most loadings were higher than 0.80, the lowest standardized loading being 0.49 for a homework effort item. This indicated that the measurement model had sufficient convergent validity.

The Mediating Role of Mathematics Homework Autonomous Motivation

According to our hypotheses and Pearson correlations results, we conducted structural equation model analysis with parental autonomy support and mathematics teacher support as predictors, homework autonomous motivation as mediator, and mathematics homework effort as outcome variable. Gender was also included as a covariate for homework autonomous motivation. Following the suggestions from Bandalos (2002), item parceling was used to reduce the complexity of the model, with dimensional scales as item parcels. Mathematics homework autonomous motivation as a single dimension scale was created using single-factor CFA before item parceling. Results demonstrated that the model fit the data well (χ^2/df = 4.55, RMSEA = 0.07, SRMR = 0.07, CFI = 0.97, TLI = 0.98), so we parceled mathematics homework autonomous motivation as three item parcels. According to the mediating effect analysis procedure (Wen and Ye, 2014), we first analyzed the direct roles of parental autonomy support and teacher support on mathematics homework effort. Results showed that parental autonomy support (b = 0.35, $p < 0.001$, d = 0.52) and teacher support (b = 0.31, $p < 0.001$, d = 0.49) significantly predicted mathematics homework effort.

The present study tested the mediating role of mathematics homework autonomous motivation in the relations between parental autonomy support and mathematics homework effort, and between mathematics teacher support and mathematics homework effort (see **Figure 1**). This model indicated a good fit to the data (χ^2/df = 2.86, RMSEA = 0. 05, SRMR = 0.06, TLI = 0. 96, CFI = 0.97). Results showed that parental autonomy support and mathematics teacher support both positively predicted mathematics homework autonomous motivation (b = 0.29, $p < 0.001$, d = 0.58; b = 0.40, $p < 0.001$, d = 0.82). In addition, mathematics homework autonomous motivation significantly predicted mathematics homework effort (b = 0.56, $p < 0.001$, d = 0.73). Then, adding the mediating variable (mathematics homework autonomous motivation), parental autonomy support still significantly predicted mathematics homework effort (b = 0.20, $p < 0.001$, d = 0.30), however, mathematics teacher support was no longer predictive of mathematics homework effort (b = 0.07, $p > 0.05$). This result indicated that mathematics homework autonomous motivation partly mediated the relationship between parental autonomy support and mathematics homework effort, and fully mediated the relationship between mathematics teacher support and mathematics homework effort.

Finally, we used bootstrapping to test whether the above mediating effects were significant (Preacher and Hayes, 2008). Results indicated that the 95% confidence interval of the mediating effect on the association between parental autonomy support and mathematics homework effort was [0.091, 0.266], and the 95% confidence interval of the mediating effect on the relationship between mathematics teacher support and mathematics homework effort was [0.154, 0.311]. These two 95% confidence intervals did not include 0 (see **Table 2**), suggesting that the mediating role of mathematics homework autonomous motivation was significant in both cases.

DISCUSSION

It is difficult to overstate the importance of homework (Fan et al., 2017), a key element of which is homework effort. Building on previous research on homework effort, we tested the effects of students' perceived parental autonomy support and teacher support on middle school students' mathematics

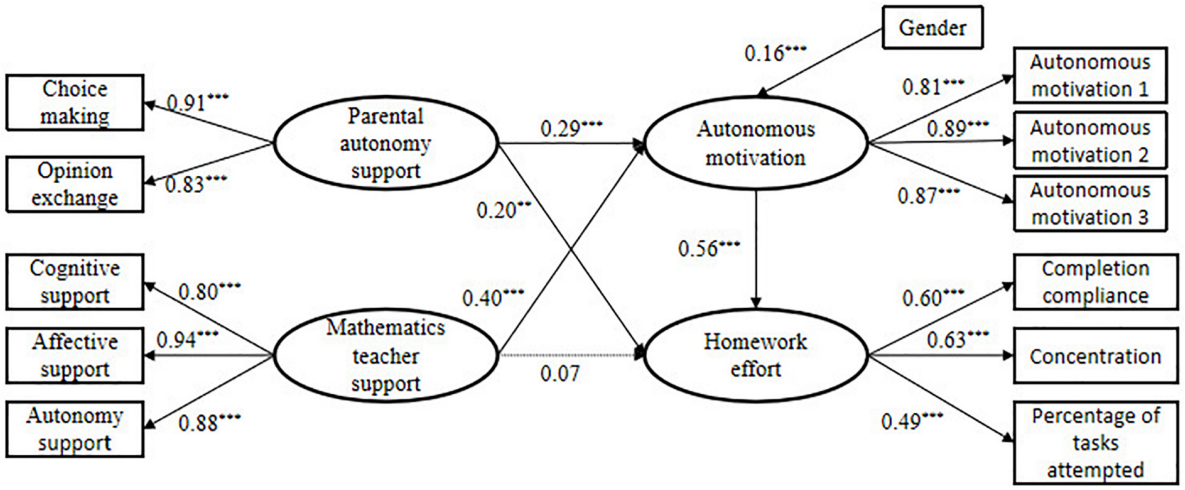

FIGURE 1 | Structural model of the associations among parental autonomy support, teacher support, autonomous motivation and homework effort. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

homework effort. Our results showed that both parental autonomy support and teacher support perceived by middle school students positively predicted mathematics homework effort, and mathematics homework autonomous motivation was a mediator in these associations. These findings suggest that support from parents and teachers is beneficial to middle school students' autonomous motivation and homework effort.

The Effect of Parental Autonomy Support on Mathematics Homework Effort

As expected, the present study found that students' perceived parental autonomy support positively predicted middle school students' homework effort. This means that students who perceived more parental autonomy support put greater effort into mathematics homework. A long line of studies has suggested that parental autonomy support enhances students' academic engagement (Wang et al., 2007; Woolley and Bowen, 2007; Wang and Eccles, 2012). The present study found the same positive relationship between parental autonomy support and students' homework effort, which supports the self-determination theory (Deci and Ryan, 2000). This theory holds that autonomy support influences individuals' engagement in tasks by satisfying their need for autonomy. The sense of autonomy is a vital developmental task for adolescents (Van Petegem et al., 2012). As they reach puberty, young adolescents' desire for autonomy seemingly comes out of the blue. With autonomy support from parents (e.g., encouragement to think independently and search for an identity), adolescents put more effort into learning tasks, increasing their sense of control.

The Effect of Mathematics Teacher Support on Mathematics Homework Effort

The present results revealed that mathematics teacher support students perceived positively predicted middle school students' homework effort, which confirmed Hypothesis 1b. Empirical studies have proven that teacher support significantly predicts students' motivation, academic engagement and effort (Meyer and Turner, 2007; Jang et al., 2010; Federici and Skaalvik, 2014; Chai and Gong, 2015; Chen et al., 2015). Dietrich et al. (2015) also found that perceived teacher support is linked to intrinsic value and effort. In line with the above studies, we also found that students' perceived teacher support positively impacted on homework effort. From the perspective of self-determination theory, autonomy support, cognitive support and emotional support provided by teachers meet students' basic psychological needs, leading to a boost in their homework effort.

The Mediating Role of Mathematics Homework Autonomous Motivation

As expected, the results from the present study revealed that mathematics homework autonomous motivation partially accounted for the relationship between students' perceived parental autonomy support and mathematics homework

TABLE 2 | Path coefficients of the model.

Path	Estimated effect	SE	95% CI	*p*	Cohen's *d*
PAS → HAM → HE	0.164	0.043	[0.091, 0.266]	<0.001	0.29
TS → HAM → HE	0.224	0.040	[0.154, 0.311]	<0.001	0.44

PAS, parental autonomy support; HAM, homework autonomous motivation; HE, homework effort; TS, teacher support.

effort. To be specific, perceived parental autonomy support appears to facilitate students' autonomous motivation, and thus enhance effort in homework; at the same time, parental autonomy support could promote homework effort directly. A meta-analysis reported the positive relationship between parental autonomy support and students' academic autonomous motivation (Vasquez et al., 2016); in addition, academic autonomous motivation significantly predicted academic engagement (Dong and Liu, 2016). By replicating earlier results showing that autonomous motivation is a mediator in the link between parental autonomy support and students' effort (Mih, 2013), our results added evidence in the mathematics homework domain. Our results confirmed the self-determination theory (Deci and Ryan, 2000). That is, autonomy support strengthens students' sense of control and competence by providing them meaningful opportunities to search for an identity. Consequently, growing up with autonomy support from parents, adolescents whose autonomy needs are satisfied are motivated to invest more effort in homework.

In line with previous studies (Chen et al., 2015), we found that the association between mathematics teacher support students perceived and students' homework effort was mediated by homework autonomous motivation, which confirmed Hypothesis 2b. After adding homework autonomous motivation, the direct effect of teacher support was no longer significant. This means that support from mathematics teachers significantly promotes students' mathematics homework autonomous motivation, thus increasing their homework effort. Once teachers provide autonomy support, it is likely to enhance students' need for autonomy (Chen et al., 2015), intrinsic or autonomous motivation (Roth et al., 2007; Liu et al., 2017). Perceived teachers' emotional support benefits teacher-student relationships, brings students a sense of belonging, and creates a willingness to consent to doing homework; this internalization of the value of homework leads to higher autonomous motivation and homework effort. Teacher cognitive support facilitates students' learning motivation (Lam et al., 2009), which boosts their engagement in homework. Therefore, by satisfying students' basic psychological needs, mathematics teacher support leads to students investing more effort in mathematics homework through enhancing their homework autonomous motivation.

Further, this study found gender difference in mathematics homework autonomous motivation. Existing studies have found that longitudinal changes of motivation do vary with gender (Lee and Kim, 2014). Furthermore, gender difference in motivation may increase in specific subject, such as mathematics. A large body of studies has reported that boys has higher intrinsic motivation than girls in mathematics (Meece et al., 2006; Huang et al., 2008; Lee and Kim, 2014). This study added new evidence of gender difference in mathematics homework domain. However, the gender differences in other variables were non-significant. This means that parents and teachers provided similar support for boys and girls, and the gender difference in mathematics homework autonomous motivation did not influence their mathematics homework effort significantly. Future research needs to consider the possible effect of gender on homework motivation and its role in the link between adult support and homework effort by enlarging sample and including other grades.

Implications and Future Research

Theoretically, we provide empirical support for the self-determination theory in mathematics homework. Practically, our results also have implications for middle school students' education in the family and school contexts. For the sake of middle school students' mathematics learning, including mathematics homework effort, parents and teachers should provide more support, especially autonomy support. Parents can provide autonomy support from three perspectives: empathy, meaningful rationale and meaningful choices (Brenning et al., 2015). To be more specific, try to understand children's perspective when communicate homework and school life; offer meaningful reasons why homework is important; allow children to arrange their homework time. These three key strategies also apply to teachers, for example, assigning tasks with different difficulty for students with different mathematics abilities, allowing them to solve problems with various strategies, providing support and feedback when they have confusion or problems, and encouraging and comforting students who are upset. Increased support from important others is beneficial to students' autonomous motivation, and leads to effort and engagement in mathematics learning inclusive of mathematics homework.

The present study makes contributions to promoting mathematics homework effort; however, several limitations should be noted. Firstly, a cross-sectional design was used in this study, so the results fail to show causal relationships among variables. For instance, teachers may exhibit more supportive behaviors to students with high motivation and engagement (Nurmi, 2012); however, low-achieving students are more likely to be exposed to intrusive and controlling behaviors of teachers and parents (Nurmi, 2012; Su et al., 2015). Future research should consider using longitudinal methods, repeatedly measuring teacher and parent support, and students' autonomous motivation and homework effort, to further test possible causal mechanisms affecting homework effort.

Secondly, although our investigation considered the effect of different adult support and mathematical autonomous motivation on mathematical homework effort by using structural equation model, all the measures were assessed by self-report. Future research needs to include multiple sources, for example, adults' and students' reports or observation to reveal the effect of adults' support from different perspective on students' mathematical homework effort. At the same time, the present study measured the effects of general parental autonomy support and mathematics teacher support on students' homework effort. However, it is still unknown whether the effect sizes would be the same if the adult support is measured specific to homework. Studies on parental support specific to homework have found inconsistent results. For example, Dumont et al. (2012) found that parental homework support is positively associated with students' academic achievement. While, parental homework

support may also contribute to students' helpless behaviors (Orkin et al., 2017). In the future, researchers can measure adult support specific to homework to explore its effects on homework effort and achievement.

Thirdly, the level of support from different teachers is different, so the ideal way is to construct multilevel structure model by incorporating teacher support as a teacher-level variable. However, we did not construct the multilevel model because of the small sample, so we cannot explain the relationship between teacher support and homework effort in class level. In the future, it is necessary to enlarge the sample to separate the effect of the teacher-level variable by constructing multilevel structure model.

Finally, this study failed to consider individual variables, for example, previous achievement, as covariates. Previous research has shown that students' previous achievement influences their perception of parental homework involvement and homework behaviors (Núñez et al., 2017). Besides, high-achieving students perceive more emotional support from teachers (Liao et al., 2016). Therefore, future research in this area should consider and collect potential covariates.

DATA AVAILABILITY

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

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of "Ethical Committee of Central China Normal University" with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the "Ethical Committee of Central China Normal University."

AUTHOR CONTRIBUTIONS

LG contributed conception and design of the study and was responsible for data collection. YC performed the statistical analysis of the structural equation model. XF and KX contributed to preliminary analyses, manuscript draft, and manuscript revision. SG guided the design of the study, data collection, data analysis, and writing and revision of the manuscript.

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Individual Precursors of Student Homework Behavioral Engagement: The Role of Intrinsic Motivation, Perceived Homework Utility and Homework Attitude

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Currently, the concept of *engagement* is crucial in the field of learning and school achievement. It is a multidimensional concept (e.g., behavioral, emotional, and cognitive dimensions) that has been widely used as a theoretical framework to explain the processes of school engagement and dropout. However, this conceptual framework has been scarcely used in the field of homework. The aim of the present study was to analyze the role of intrinsic motivation, perceived homework utility, and personal homework attitude as precursors of student homework engagement (behavioral engagement) and, at the same time, how such engagement is the precursor of academic achievement. Seven hundred and thirty students of Compulsory Secondary Education (CSE) (7th to 10th grade) from fourteen schools northern Spain participated. A structural equation model was elaborated on which intrinsic motivation, perceived utility and attitude were observed variables, and student engagement (time spent on homework, time management, and amount of teacher-assigned homework done) and academic achievement (Mathematics, Spanish Language, English Language, and Social Science) were latent variables. The results reveal that (i) intrinsic motivation is a powerful precursor of student behavioral engagement (also perceived utility and attitude, although to a lesser extent), and (ii) academic achievement is closely linked to the level of student engagement, qualifying the results of many of the previous studies conducted from a task-centered perspective (as opposed to a person-centered perspective).

Keywords: homework, behavioral engagement, intrinsic motivation, perceived utility, attitude, secondary education

INTRODUCTION

In accordance with the proposal of Trautwein et al. (2006), we study herein the role of motivational variables as individual antecedents of student behavioral homework engagement and its impact on academic achievement. Assuming the principles of the theory of expectancy-value (Eccles, 1983; Pintrich and De Groot, 1990; Eccles and Wigfield, 2002), we focused this study on the role of the motivational variables related to the value attributed to homework and we addressed the construct of engagement in accordance with the contributions of the theory of school engagement (Fredricks et al., 2004).

Nowadays, it seems little debatable that the value attributed by students to academic tasks such as tests or homework is linked to their engagement and the effort dedicated to these tasks (Greene et al., 2004; Xu, 2005; Cole et al., 2008). Thus, students with high-value beliefs spend more time, devote more effort, and complete more homework than those who do not value academic activity (Bong, 2001; Miller and Brickman, 2004; Wise and DeMars, 2005; Liem et al., 2008; Eccles and Wang, 2012). This attributed value thereby indirectly influences their achievement (Pintrich and De Groot, 1990; Wolters and Pintrich, 1998; Wigfield and Eccles, 2002; Trautwein et al., 2006).

Motivation and Homework Behavioral Engagement

Compared with students who do their homework to avoid blame or to please their parents, the evidence suggests that intrinsically motivated students devote more effort, persist more, and obtain better results when they engage in an activity (Wigfield and Eccles, 2002; Hardre and Reeve, 2003; Coutts, 2004; see the review of Wigfield et al., 2009). Along with personal expectancies, the link between the value attributed to homework and the intentions of learning and devoting effort is well documented in the literature (Bandura, 1997; Wigfield and Eccles, 2000; Eccles and Wigfield, 2002; Wigfield et al., 2009; Metallidou and Vlachou, 2010). Assuming the principles of the theory of Expectancy-Value, this study aims at verifying to what extent the value students attribute to homework predicts their intentions and real decision to engage in homework and to do it (Eccles et al., 1993; Eccles, 2005; Wigfield et al., 2017).

Most of the research that supports the expectancy value models has argued that the value attributed to homework has at least three dimensions or components: the degree to which it is perceived as interesting—its intrinsic value— personally significant and important for the student—achievement value—, and useful—utility value. Thus, students who consider homework important, useful, and/or interesting hold high self-efficacy beliefs and persevere in the face of difficulties encountered when doing homework (Bandura, 1997). In fact, this value-effort relationship has been found for homework, showing the direct influence of the value attributed to dedication and engagement (Trautwein et al., 2006; Hong et al., 2009; Xu, 2017; Xu et al., 2017), and underlining the importance of the utility perception of homework in the promotion of diverse academic outcomes (Trautwein et al., 2006; Yang et al., 2016; Xu et al., 2017). The term attitude is understood as an evaluative predisposition (positive or negative) that conditions the subject to perceive and to react in a determined way in light of the objects (people, groups, ideas, situations, etc.). It is a learned predisposition, not innate, and stable although it can change (Hidalgo et al., 2004). Therefore, the attitude toward homework refers to the positive or negative predisposition of these students to do homework.

Homework Behavioral Engagement and Academic Achievement

School engagement is receiving increasingly more attention in psychological research because it has been shown to be a relevant predictor of different educational outcomes (Ladd and Dinella, 2009; Wang and Peck, 2013), and specifically, of academic achievement (Ladd and Dinella, 2009; Reeve and Tseng, 2011). Although there are significant variations in the implementation of the construct, we consider engagement as a meta-construct with affective-emotional, cognitive, and behavioral subcomponents (Fredricks et al., 2016; Rodríguez-Pereiro et al., 2019).

In this context, the review of students' behavioral engagement usually refers to their participation at school, indicators of pro-social behavior in academic contexts, compliance with rules, and/or dedication to homework (e.g., Fredricks et al., 2004; Christenson et al., 2012). Behavioral engagement, in terms of time, effort, amount of homework performed, persistence, and/or dedication (Eccles and Wang, 2012), must have an impact on adolescents' academic achievement (King, 2015; Mikami et al., 2017).

The construct student homework behavioral engagement usually includes behavioral indicators concerning the time devoted to homework, the management of that time, or the amount of homework performed (Trautwein et al., 2006).

Although among other factors, achievement could depend on students' age, the quality of the assigned homework, and/or the procedure used to measure achievement, research tends to support a positive relationship between the amount of homework carried out and academic achievement (e.g., Cooper et al., 1998, 2006; Cooper and Valentine, 2001; Epstein and Van Voorhis, 2001; Trautwein et al., 2002; Fernández-Alonso et al., 2015; Núñez et al., 2015a).

Some works have found positive relationships (see review of Cooper, 1989; Cooper and Valentine, 2001; Cooper et al., 2006; Fernández-Alonso et al., 2015), with more obvious effects in secondary education than in primary education, and some studies have shown that the time spent on homework and achievement may not be related or may even be negatively related (De Jong et al., 2000; Trautwein, 2007; Kitsantas et al., 2011). There may be a differential effect of the time devoted to homework, and also of the amount of homework performed, at the classroom and individual level.

Both students' committed effort and their good use of homework time have a positive effect on their achievement (Schmitz and Skinner, 1993; Trautwein and Köller, 2003;

Trautwein et al., 2006; Xu, 2013). In this sense, Xu (2010) concluded, for example, that a good study time management contributes to completing a greater amount of homework. Trautwein (2007) found that effort is a better predictor of achievement than time spent on homework. As proposed by Núñez et al. (2015a), the use of homework time could positively affect academic achievement insofar as it contributes to increasing the amount of homework performed.

The Present Study

According to Lawson (2017), behavioral engagement is a manifestation of internal motivational processes such as intrinsic motivation, self-efficacy, or the value attributed to homework (Becker et al., 2010; Schiefele et al., 2012; Guthrie et al., 2013), which energize and direct action. In this study, we focus on the value component in terms of the conceptual model of homework developed by Trautwein and colleagues and tested in various studies (e.g., Trautwein and Lüdtke, 2007; Dettmers et al., 2010, among others). As in other studies of this field (Hughes et al., 2008; King, 2015; Mikami et al., 2017), we propose a structural model in which *homework behavioral engagement* (i.e., the amount of time dedicated to doing teacher-assigned homework; homework time management; and the amount of homework assigned) *mediates* between certain student motivational conditions—*students' motivational conditions* (perceived homework utility; homework intrinsic motivation; and homework attitude) and their *general academic achievement* (Social Sciences, Math, Language, and English as second language). In the present study we focus on students in grades 7–10, it is the proper age in which they should begin to take importance the accomplishment of homework. Despite the large number of research on homework in secondary education, it seems interesting to begin to verify models of relationships that allow us to interpret adequately the relationships between motivation and behavioral engagement.

Figure 1 shows the model to be tested. The main hypotheses of this model are as follows:

(1). Students' homework behavioral engagement will be significantly and positively determined by their motivational conditions (homework intrinsic motivation, homework utility, and homework attitude). Based on previous studies (e.g., Trautwein et al., 2006; Hong et al., 2009; Regueiro et al., 2015, 2017, 2018; Valle et al., 2018; Yang et al., 2016; Xu, 2017; Xu et al., 2017), we expect that the intensity of this relationship (in terms of the effect size) will be medium or large.

(2). Students' homework behavioral engagement will positively and significant predict their overall academic achievement (in terms of average grades in the four core academic areas). Based on the results of previous studies of the relationship between homework and academic achievement in Secondary Education students (e.g., De Jong et al., 2000; Trautwein et al., 2002; Cooper et al., 2006; Trautwein, 2007; Kitsantas et al., 2011; Fernández-Alonso et al., 2015; Núñez et al., 2015a; Fan et al., 2017), we expect that the effect size of the relationship will be moderate (or small).

MATERIALS AND METHODS

Participants

Participants were 730 students in Compulsory Secondary Education (CSE) (aged between 12 and 16 years (M = 13.5, SD = 1.15) from 14 schools randomly selected (12 public schools and 2 private-subsidized schools) in three provinces of northern Spain. Fifty-six students were eliminated due to missing data. Half of the schools are in urban areas and the other half are in rural or semi-urban areas. Of the participants, 43.4% were boys and 56.6% were girls. Besides, 194 students (26.6%) were in 1st grade of CSE, 152 students (20.8%) were 2nd-graders, 182 students (24.9%) were in 3rd grade, and 202 students (27.7%) were 4th-graders.

Instruments

Student's Motivational Variables

The items used to measure homework intrinsic motivation, homework perceived utility, and homework attitude were obtained from the Homework Survey, an instrument already used in previous studies (e.g., Núñez et al., 2015a,b,c; Valle et al., 2015a, 2018). The fact of having chosen the questionnaire as a data collection instrument was mainly due to its characteristics of versatility, efficiency and generalizability, which have made this research instrument one of the most widespread in the educational and psychological field, as established authors such as McMillan and Schumacher (2005).

- *HW Intrinsic Motivation*. We evaluated the students' degree of enjoyment, satisfaction, and the benefits obtained by doing homework. This dimension consists of 8 items (α = 00.85), which are rated on a 5-point Likert-type scale ranging from 1 (*completely false*) to 5 (*completely true*). An example item is: "I enjoy doing homework, because it allows me to learn more."

- *HW Perceived Utility*. This variable was assessed with a single item asking students whether they considered the homework assigned by their teachers to be useful. The response scale ranged from 1 (*completely false*) to 5 (*completely true*).

- *Homework Attitude*. In this study three items to evaluate the affective dimension of the homework attitude were used: students' preference for, their willingness to (their disposal to), and their positive emotions generated and associated with doing homework (α = 0.77). Students responded on a 5-point Likert-type scale ranging from 1 (*completely false*) up to 5 (*completely true*).

Homework Behavioral Engagement

Behavioral engagement was measured through three indicators: time spent on homework, homework time optimization, and amount of teacher-assigned homework carried out by the students. The items used to obtain three measurements were taken from the aforementioned Homework Survey.

- *Homework Time Spent*. To measure the time spent on homework, students responded to two items ("How much time do you usually spend on homework every day from Monday to Friday?," and "How much time do you usually spend on homework on the weekend?), with the following response options: 1 (*less than 30 min*), 2 (*30 min to 1 h*), 3 (*1 h to an hour and a*

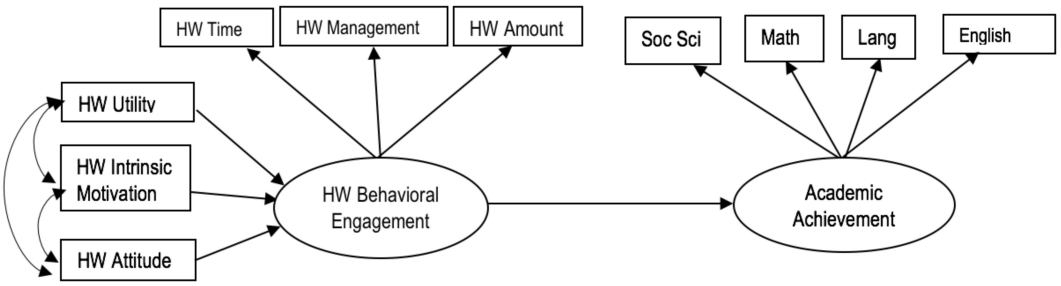

FIGURE 1 | Structural model to be tested.

half), 4 (*1 h and a half to 2 h*), and 5 (*more than 2 h*). The alpha coefficient was α = 0.72 in this study).

- *Homework Time Management*. This variable was measured through the responses to two items asking students to indicate how they managed the time normally spent doing homework (Monday through Friday, and on the weekend), using the following scale: 1 (*I waste it completely; I am constantly distracted by anything*), 2 (*I waste it more than I should*), 3 (*regular*), 4 (*I manage it pretty well*), and 5 (*I optimize it completely; I concentrate and, I don't think about anything else until I finish*). The alpha coefficient was α = 0.78 in this study.

- *Amount of Homework Done.* The estimate of the amount of teacher-assigned homework completed by students was obtained through one item rated on a 5-point Likert-type scale: 1 (*none*), 2 (*some*), 3 (*one half*), 4 (*almost all*), and 5 (*all of it*).

Academic Achievement

The evaluation of academic achievement was calculated from average grade obtained by the students at the end of the academic year they were enrolled in at that time. The subjects used to calculate the mean were Social Sciences, Mathematics, Spanish Language, and Foreign Language (English as a second language) because they have the greatest weight in the curriculum.

Procedure

The data referring to the variables under study were collected during school hours by personnel external to the school itself, after obtaining the written informed consent of the parents or legal guardians, the management team, and the students' teachers, respecting the ethical standards established in the Declaration of Helsinki. In each session, the staff give some practical indications to students on how to address those questions. Then, participants fill in all the questions of the self-report individually by themselves, and without time limit.

Data Analysis

After verifying that the distribution of the variables could be considered sufficiently normal to allow the use of the maximum likelihood procedure, a structural equation analysis, using the computer program AMOS 18, was employed to contrast a hypothesized model predicting the influence of homework motivation on homework engagement and achievement. In addition to chi-square ($\chi\chi^2$) and its associated probability (p), we used two absolute indices: the goodness-of-fit-index (GFI) and the adjusted goodness-of-fit-index (AGFI). We also provide a relative index, the comparative fit index (CFI) (Bentler, 1990); and a close-fit parsimony-based index, the root mean square error of approximation (RMSEA), including 90% confidence intervals (Hu and Bentler, 1999). The model fits well if GFI and AGFI >0.90, CFI >0.95, and RMSEA ≤ 0.05.

The effect sizes were calculated using Cohen's d ($d < 0.20$ = non-significant effect; $d \geq 0.20$ and $d < 0.50$ = small effect; $d \geq 0.50$ and $d < 0.80$ = medium effect; $d \geq 0.80$ = large effect).

RESULTS

Preliminary Analysis

Table 1 shows the means, standard deviations, skewness, kurtosis, and bivariate Pearson correlations. In general, the relationship between the variables included in the study was as expected. Specifically, the three motivational variables considered— intrinsic motivation, utility, and homework attitude—significant and positive correlations with the time spent doing homework, time optimization, and the amount of homework done. These three variables that constitute the construct of homework behavioral engagement correlated positively and significantly with each other and with the grades obtained by the students in the four subject areas considered.

We observed moderate correlations between the utility perception and the intrinsic value of homework and students' grades, whereas the interrelationship between homework attitude and academic achievement was lower. Statistically significant correlations were also observed among the three homework motivational variables, as well as among the grades obtained in the subjects that constitute the academic achievement measures.

Structural Model Fit

In **Figure 1**, the relationships expressed in the formulation of the hypothesis of the contrasted model are made explicit. With the exception of $\chi^2(31) = 75.548$; $\chi^2/df = 2.43$, $p < 0.001$, all the fit indices suggest that the hypothesized model adequately represents the relations of the empirical data matrix: GFI = 0.980; AGFI = 0.964; TLI = 0.980; CFI = 0.986; and RMSEA = 0.044, 90% CI [0.032, 0.057], $p > 0.05$. As a result, the model does not

need any changes. In addition, as can be seen in **Table 2**, the factor loadings as well as the corresponding estimation errors of the three measurement variables corresponding to student homework behavioral engagement (time spent; homework time management; amount of homework done) and to the academic achievement areas (Social Sciences, Mathematics, Spanish Language, and English as Second Language) suggest that both latent variables were reliably constructed.

Assessment of Model Hypotheses

Correlations between the three independent variables, standardized regression weights, and their statistical significance are presented in **Table 2** and **Figure 2**.

In the present study, two general hypotheses were formulated. First, we hypothesized that students' homework behavioral engagement would be significantly and positively determined by their motivational personal variables. In addition, based on previous studies, we expected that the intensity of this relationship would be medium or large. In general terms, the results confirm this hypothesis. As a whole, the effect is statistically significant and positive: students who perceive greater homework utility have a more positive attitude toward homework and consider it an opportunity to learn. They also engage more in their homework than students who express low utility, a poor attitude, and low intrinsic motivation. However, the effect sizes suggest that students' homework behavioral engagement depends

TABLE 1 | Descriptive statistics and Pearson correlations (N = 730).

	1	2	3	4	5	6	7	8	9	10
1. HWUT	—									
2. HWIM	0.612**	—								
3. HWAT	0.459**	0.520**	—							
4. HWBE_1	0.266**	0.227**	0.174**	—						
5. HWBE_2	0.390**	0.450**	0.321**	0.397**	—					
6. HWBE_3	0.331**	0.381**	0.337**	0.193**	0.396**	—				
7. AAch_1	0.137**	0.221**	0.089*	0.183**	0.327**	0.221**	—			
8. AAch_2	0.119**	0.167**	0.104	0.172**	0.313**	0.156**	0.664**	—		
9. AAch_3	0.149**	0.224**	0.096	0.171**	0.304**	0.159**	0.807**	0.691**	—	
10. AAch_4	0.119**	0.198**	0.066	0.119**	0.297**	0.161**	0.715**	0.667**	0.751**	—
M	3.49	3.51	2.11	3.03	3.97	3.23	6.42	5.64	6.06	5.93
SD	1.074	0.793	0.863	1.151	1.119	1.066	2.283	2.325	2.111	2.385
Skewness	−0.517	−0.523	0.667	0.014	−0.922	−0.247	−0.304	−0.139	0.032	−0.109
Kurtosis	−0.289	−0.004	−0.105	−0.821	−0.229	−0.495	−0.468	−0.639	−0.615	−0.743

*HWUT, Homework Utility; HWIM, Homework Intrinsic Motivation; HWAT, Homework Attitude; HWBE_1, Homework Behavioral Engagement: Time Spent; HWBE_2, Homework Behavioral Engagement: Amount of Teacher-assigned Homework Done; HWBE_3, Homework Behavioral Engagement: Homework Time Management; AAch_1, Social Science Achievement; AAch_2, Mathematics Achievement; AAch_3, Language Achievement; AAch_4, English Achievement as Second Language. **$p < 0.01$. *$p < 0.05$.*

TABLE 2 | Assessment of the hypothesized homework model.

	SRW	SE	CR	*p*	*d*
Structural Model					
HW Utility → HW Behavioral Engagement	0.212	0.039	4.397	0.000	0.330
HW Attitude → HW Behavioral Engagement	0.117	0.045	2.628	0.009	0.195
HW I. Motivation → HW Behavioral Engagement	0.414	0.056	8.125	0.000	0.631
HW Behavioral Engagement → Academic Achievement	0.418	0.099	8.696	0.000	0.680
HW I. Motivation ↔ HW Attitude	0.345	0.028	12.423	0.000	1.035
HW I. Motivation ↔ HW Utility	0.517	0.037	14.052	0.000	1.218
HW Attitude ↔ HW Utility	0.424	0.038	11.267	0.000	0.918
Measurement Model					
HW Behavioral Engagement → HW Time Spent	0.475	0.060	10.463	0.000	0.840
HW Behavioral Engagement → HW Time Management	0.534	0.057	11.499	0.000	0.941
HW Behavioral Engagement → Amount HW Done	0.776	—	—	—	—
Academic Achievement → Social Sciences	0.877	0.044	25.635	0.000	6.007
Academic Achievement → Mathematics	0.772	—	—	—	—
Academic Achievement → Spanish Language	0.909	0.040	26.633	0.000	11.712
Academic Achievement → Second Language (English)	0.829	0.046	23.986	0.000	3.857

HW, Homework; SRW, Standardized Regression Weights; SE, Standard Errors; CR, Critical Ratio; p, Probability; d, Effect Size.

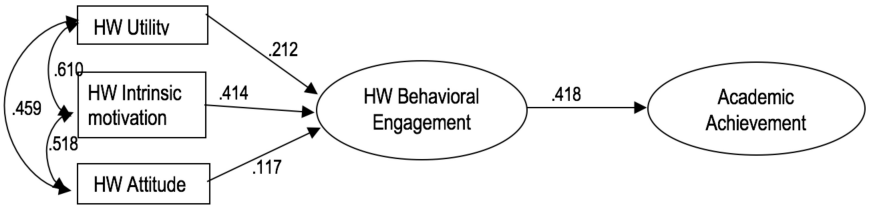

FIGURE 2 | Correlations and standardized regression weights for the final model. All coefficients are statistically significant at $p < 0.001$, except for HW Attitude on HW Behavioral Engagement ($p < 0.01$).

little on perceived homework utility and homework attitude, although it does depend on intrinsic homework motivation (interest in working on homework to achieve learning and gain competence), with an effect size between medium and large. The three motivational variables explain 17.5% of students' homework behavioral engagement.

Secondly, we formulated the hypothesis that students' homework behavioral engagement would significantly and positively predict their overall academic achievement, and that the effect size of that relationship would be moderate, or even small. The data obtained confirm this hypothesis, both in the intensity (the mean effect size) and the sign (positive). The higher the students' homework behavioral engagement, the greater was their academic achievement, and vice versa. The amount of total explained academic achievement variance was 41%.

DISCUSSION

The role of students' behavioral homework engagement is a highly controversial issue. For example, prior studies indicate that spending more time on homework is no guarantee of higher academic achievement. Also, there is not sufficient empirical evidence about the determinants of such engagement. This research intended to provide some information about these two large gaps. On the one hand, we wondered whether the motivational factors could be important determinants of student homework engagement (as derived from the motivational theories of academic learning) and, on the other hand, we wished to confirm the predictive power of student homework engagement for academic achievement when using latent variables (instead of specific measures of engagement or achievement).

The results confirm the contribution of motivation and, specifically, of its value component, on students' academic engagement (Bong, 2001; Eccles and Wang, 2012). Moreover, according to our results, the value attributed to homework in terms of enjoyment and satisfaction, utility perception, and positive attitude moderately explain students' dedication to and engagement with homework.

Specifically, when students approach homework due to their interest, in order to learn and acquire competence, they spend more time, optimize the time spent, and also do more homework (Trautwein et al., 2006; Hong et al., 2009; Xu et al., 2017). As defended from different theoretical frameworks, interest would contribute to achievement to the extent that, in general, it increases behavioral engagement, dedication, management of the learning process, and the attentional resources that are implemented (Lee et al., 2014; Trautwein et al., 2015; Harackiewicz et al., 2016). The prescription and correction of homework can become an instructional strategy for the learning promotion and academic performance, as teachers manage to adjust to the needs and interests of their students (e.g., Akioka and Gilmore, 2013). Beyond the interventions focused on self-monitoring and self-management (e.g., Breaux et al., 2019) or the use of reinforcements (Reinhardt et al., 2009), homework that are prescribed from classroom must be meaningful and purposeful if we want the apprentices to actively engage with them (Kalchman and Marentette, 2012).

Likewise, it seems that homework utility perception contributes somewhat to helping students spend more time on homework, better manage that time, and do more homework (Cooper et al., 2006; Yang et al., 2016; Fan et al., 2017). Intrinsic motivation and perceived utility also guarantee a more positive attitude toward doing homework. Given the strong association found, if students perceive the utility of the assigned homework, they could improve their more intrinsic reasons for engaging in homework, which would promote more positive attitudes toward such engagement.

The value students attribute to homework, a key aspect of motivation in self-regulated learning models (Pintrich and Zusho, 2007; Wigfield and Cambria, 2010), should be understood as a multidimensional construct that integrates students' personal interests and the interest aroused by the situations, but also their estimates of its importance or usefulness. As learners will probably engage intrinsically in their homework if they perceive its utility, and in view of the fact that direct intervention in the intrinsic value of homework is not always easy and could even undermine students' sense of autonomy (Deci and Ryan, 1985), homework utility value becomes a core support in the educational intervention with students who show little interest in homework.

Thus, as Epstein and Van Voorhis (2001, 2012) concluded, when teachers explicitly present the meaning and utility of the homework they assign, they could be affecting students' behavioral engagement and homework time management. In general, the research seems consistent, suggesting that student homework engagement could be optimized if the teacher assigns quality homework, that is, homework perceived as useful

and interesting, which enables students' progress (adapted to the potential of each student or group of students) and is causally linked to academic success (e.g., Trautwein et al., 2006; Trautwein and Lüdtke, 2009; Dettmers et al., 2010, 2011; Rosário et al., 2018).

In any case, we should not lose sight of the fact that the explanatory potential of the motivational variables considered herein is relatively low and, in fact, more than 80% of the variability of homework behavioral engagement would be explained by variables that were not included in this work. In this regard, we acknowledge that we did not address the expectancy component of motivation, which, as defended from different theoretical frameworks (Eccles, 1983; Pintrich and De Groot, 1990; Bandura, 1997; Eccles and Wigfield, 2002), can be considered a predictor of homework behavioral engagement, at least in terms of effort and persistence (Trautwein et al., 2006; Nagengast et al., 2013). On the other hand, although we must assume that motivation energizes cognitive engagement (Greene et al., 2004; Greene, 2015), in this case, we did not study the resources and learning strategies implemented by students when approaching homework. However, the research of Valle et al. (2015b) allows us to hypothesize the importance of intrinsic motivation and attitude in the decision to engage more or less deeply in homework, and thereby related to homework behavioral engagement.

On another hand, as has already been stated by many previous studies (Cooper et al., 1998, 2006; Cooper and Valentine, 2001; Epstein and Van Voorhis, 2001; Trautwein et al., 2002; Xu, 2010; Fernández-Alonso et al., 2015; Núñez et al., 2015a), the time spent on homework along with good time management the amount of homework done largely contribute to students' grades in different curricular subjects. Compared with other studies that found null or negative relationships (e.g., see De Jong et al., 2000; Trautwein, 2007; Kitsantas et al., 2011), the results of this research not only corroborate the positive relationship between behavioral engagement measures and academic achievement, but also show that the effect size is higher than that reported in most of the previous studies. High school students who spend more time, manage that time well, and do all the homework clearly perform better than those who dedicate little time, are easily distracted, or do not finish their homework.

If, indeed, the more students engage in their homework, the better grades they obtain, then doing homework is better than not doing homework, and assigning homework in class will therefore contribute to improving students' academic achievement. In this regard, no doubt, students' competence and abilities will mediate their management of resources like time, the environment, or help (Du et al., 2016; Xu et al., 2017), as well as the role of parents, teachers, and peers (Núñez et al., 2015b,c).

Finally, as student engagement and dedication to homework impact on their academic results and depend to some extent on homework utility perception, parents and teachers need to converge so we can sustain the utility perception of homework as a society. In this sense, there is a risk that the increasing and recurrent loss of prestige of homework will end up diminishing students' intrinsic motivation and promoting a negative attitude toward homework.

Limitations of the Work and Future Research

Although the results of the study seem to be robust (consistent effects of the predictions, estimation errors within normal parameters, etc.), they should be taken with some precaution due to some limitations inherent in the nature of the data of the study, the sample used, or the measuring instruments.

The research is cross-sectional, so any causal inferences are seriously compromised. Although we used a powerful multivariate strategy to analyze the data, which could lead us to think in terms of causality, this is not possible because, for this purpose, we should have used a longitudinal design (three repeated measures could be sufficient for this model) or an experimental design. Although in the present investigation, we chose a cross-sectional strategy, we accept and appreciate the suggestion of Xu et al. (2017) about the need to develop causal research where the effects of homework assignment—type of tasks, frequency, etc.—and teacher feedback on students' motivation and homework engagement are confirmed. In line with different works of research within the framework of the expectancy-value models (e.g., Durik et al., 2006; Simpkins et al., 2006), it also seems interesting to begin to develop longitudinal follow-up studies that allow us to determine whether, indeed, students' attitudes and motivation have a greater explanatory potential for homework behavioral engagement throughout their schooling and to observe the extent to which we can assume evolutionary changes in the influence of homework on academic achievement.

Another limitation has to do with the student sample used in this study. We must admit that the results could vary significantly if the sample had been obtained randomly and were representative of the population from which it comes (educational stage, types of educational centers, sociometric features of the families, etc.). However, we are confident that the procedure used is sufficiently sensitive to the variables and that it has strengthened the reliability of the results described.

Finally, data collection regarding homework was done through self-reports. Although this methodology is commonly used in psychology and education, possibly essential to measure thoughts and behaviors that are otherwise hardly observable, it is necessary to replicate the findings using complementary strategies and measuring instruments (of various types). In addition, some variables of this study were assessed with a relatively low number of items, which may compromise the robustness of these measures (although consistency coefficients higher than 0.70 are usually considered reliable). In relation to this type of measure, a matter which we must not forget when interpreting the data and drawing conclusions and implications for educational practice, is that the information obtained is self-reported, which may be more or less subjective, depending on the individual's variables and the variables of the context. For example, homework utility in itself was not considered, but

instead students' utility perception. Reality and perception of reality may not coincide completely.

Finally, we emphasize that, in this investigation, like in many others carried out within the field of education, we used students' grades at the end of course as an indicator of academic achievement. However, it should not be forgotten that the magnitude of the relationship between student homework engagement and academic achievement could be significantly different if we had used a more objective measure of achievement (for example, the result of a standardized achievement test). Nevertheless, this study used the final grades as a measure of achievement due to its markedly ecological nature (compared to the standardized test).

This work allows us to suggest the need to incorporate motivational variables such as interest, usefulness and attitude toward homework in research agendas given the incidence found for active participation and student dedication. It is also important to emphasize the need to develop improvement programs, integrated into the school curriculum and implemented from schools with the involvement of parents.

ETHICS STATEMENT

Does the study presented in the manuscript involve human or animal subjects: Yes.

This study was carried out in accordance with the recommendations of Research and Teaching Ethics Committee of the University of A Coruña and the Declaration of Helsinki. The protocol was approved by the Research and Teaching Ethics Committee of the University of A Coruña and the Declaration of Helsinki.

Data about the target variable were collected in accordance with the recommendations of the ethical standards established in the Research and Teaching Ethics Committee of the University of A Coruña and the Declaration of Helsinki. This study was carried out with the written informed consent from parents or legal guardians.

AUTHOR CONTRIBUTIONS

NS, BR, and IE contributed to conception and design of the study. MdMF organized the database. MG and SR performed the statistical analysis. NS, BR, and IE wrote the first draft of the manuscript. MdMF, MG, and SR wrote the sections of the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

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Relationship Between Students' Prior Academic Achievement and Homework Behavioral Engagement: The Mediating/Moderating Role of Learning Motivation

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The interest of assigning homework is frequently discussed due to its alleged low impact on student achievement. One of the current lines of research is to emphasize the quality of student homework engagement rather than the amount of time spent on homework. The aim of this study was to determine (a) the extent to which students' prior achievement affects their homework engagement (i.e., time spent, time management, and amount of teacher-assigned homework done), and (b) how students' intrinsic motivation toward homework may mediate or moderate the relationship between prior achievement and the homework engagement variables. A large sample of students from the first 4 years of Secondary Education (N = 1899) completed questionnaires. The results showed that intrinsic motivation partially mediates, but does not moderate, the effect of prior achievement on the three variables related to homework engagement (time spent, time management, and amount of teacher-assigned homework done). These results highlight the importance of considering both students' current level of achievement and their motivation toward homework engagement when assigning homework.

Keywords: homework, prior academic achievement, behavioral engagement, motivation, secondary education

INTRODUCTION

Homework assignment is used regularly as an instructional strategy to optimize students' learning and academic achievement (Cooper et al., 2006; Ramdass and Zimmerman, 2011). In general, there seems to be a positive relationship between homework and academic achievement (Trautwein et al., 2006; Núñez et al., 2015b; Fan et al., 2017), although this relationship will vary in magnitude and direction depending on variables such as students' age, the amount of time spent, the management of that time, the motivational orientation or cognitive engagement, as well as the quality of parental involvement, or the quality of the teacher-assigned homework.

Current academic achievement, in turn, seems to be associated with student engagement in the future performance of homework. Moreover, based on the responses of a broad sample of students aged between 9 and 16 years old, Regueiro et al. (2015) found that prior achievement

was significantly related both to students' subsequent motivation to do homework (i.e., intrinsic motivation, interest, and perception of utility) and to their homework engagement (time spent on homework, homework time management, amount of homework done).

This relationship between prior achievement and homework engagement can be explained by different pathways, external (through parental or teacher involvement) and internal (different levels of knowledge, expectations of future achievement, perceived competence, motivation, etc.). From this point of view, students with good prior achievement may also meet the internal and external conditions that lead to favorable personal homework engagement, whereas if prior achievement is not good, the external and internal conditions will certainly not be as favorable for good homework engagement. Thus, for example, when family involvement becomes more controlling and there is lower motivational and emotional support (Núñez et al., 2015c, 2017; Regueiro et al., 2017a), teachers develop low expectations about the students' engagement and future achievement (Kloomok and Cosden, 1994; Pitzer and Skinner, 2017; Zhu et al., 2018), and the students develop more negative expectations about their competence and future performance, and become discouraged and cease to engage progressively. These unfavorable affective-motivational conditions, in turn, are an added handicap to the already poor personal conditions (low academic achievement) when facing the next learning experiences (Ben-Naim et al., 2017). All of this often leads to a new academic failure, either partial (Klassen et al., 2008) or generalized to the entire academic area (Shifrer, 2016).

The present study analyzes the mediator or moderator role of intrinsic motivation regarding the effect of prior achievement on student homework engagement (time spent on homework, homework time management, and amount of homework done). Although there is abundant information available with regard to student engagement, the same cannot be said regarding the area of homework. The data from this study can contribute to better understanding the way in which past achievement can condition students' future homework engagement.

Prior Achievement and Motivation

Motivational variables determine student homework engagement; that is, students' reasons for doing homework significantly influence their degree of engagement (e.g., time spent, optimization of that time, and amount of homework done) and their academic achievement (Pan et al., 2013).

However, the nature of the relationship between motivation and academic achievement is bi-directional, such that the latter is also a significant antecedent of relevant motivational factors in the academic field such as self-concept or self-efficacy (Marsh et al., 2005; Schöber et al., 2018). From this viewpoint, students' learning failures, experienced not so much due to their skills as to their lack of motivation, lead them to developing beliefs of lack of competence, which, in turn, lead to low expectations of achievement and, as a consequence, low homework engagement and poor school performance. Therefore, the data derived from past research suggest including students' prior achievement as an important variable to understand their homework engagement (Cool and Keith, 1991; Trautwein et al., 2002; Zimmerman and Kitsantas, 2005; Fast et al., 2010; Chen et al., 2013; Garon-Carrier et al., 2016).

A study carried out by Hong (2001) pointed out that high-performing students are more self-motivated to do homework than low-performing students. As a result, students who have already been successful in tasks like homework, compared to less successful students, feel more confident to perform tasks successfully in the future. Believing in their capabilities to achieve set goals influences students' motivation and effort to learn and, therefore, their engagement (Schunk and Ertmer, 2000; Ormrod, 2003). In addition, academic achievement also maintains a positive relationship with other motivational variables, such as interest in the homework and the perception of its usefulness (Wigfield and Cambria, 2010).

Motivation and Behavioral Engagement

The expectancy-value theory (Eccles et al., 1984; Wigfield and Eccles, 2000) is especially appropriate to explain the motivational aspects of behavior regarding homework (Trautwein and Köller, 2003). It indicates that students are more willing to engage in homework they perceive as emotionally rewarding and valuable, and where their effort is rewarded.

As shown in their work Ben-Eliyahu et al. (2018), we think about motivation as a pre-existing learner characteristic that produces engagement and self-regulated learning as part of engagement process. Schunk and Mullen (2012) describe this commitment as "the manifestation of students' motivation." Like various authors, Pekrun and Linnenbrink-Garcia (2012) suggest that commitment is a mediator between emotion and achievement, whereas Ainley (2012) argues that motivation leads to achievement through commitment. For other authors, motivation is a predictor of engagement (Lazowski and Hulleman, 2016) and, for Ben-Eliyahu et al. (2018), motivation triggers commitment. In previous studies, it was also found that different forms of motivation predict commitment (Patall et al., 2016; King and Datu, 2017).

Research suggests that students' type of motivation for a task is significantly related to their engagement (Ryan and Deci, 2000). There is evidence indicating that many students do homework for extrinsic reasons, such as getting good grades, for their desire to please or to avoid punishment (Walker et al., 2004). However, this kind of motivation is associated with low levels of engagement, learning, and achievement (Vallerand et al., 1997). On another hand, students who perform homework driven by intrinsic reasons tend to show high levels of persistence, creativity, achievement, positive emotions, interest, and engagement (Flink et al., 1992; Bouffard et al., 2001; Coutts, 2004). Motivation is therefore considered a very influential variable in the process of doing homework and, specifically, in students' homework behavioral engagement (Xu and Corno, 1998; Corno, 2000).

Goal of This Study

Homework assignment without taking into account the diversity of the classroom is a habitual practice. This instructional strategy ends up being successful for some students, but is clearly inappropriate for others. Homework assignment should

be adapted to the needs and potentials of the students. Otherwise, rather than helping them to develop, homework assignment progressively undermines their motivation and interest. In the present study, prior achievement and all that this entails (knowledge, perceived competence, expectations, etc.) were considered to constitute a potential determinant of student homework engagement (in terms of amount of time spent on homework, time management, and the amount of teacher-assigned homework done). In addition, we expect to answer the question of whether motivation mediates or moderates the relationship between prior achievement and homework engagement.

Therefore, we examined (a) the extent to which students' prior achievement conditions their homework engagement, and (b) how students' interest in doing homework (i.e., intrinsic motivation) may mediate and/or moderate that relationship. The initial hypotheses are as follows:

(1) Firstly, although the relation between time spent on homework and subsequent student achievement is clearly inconsistent (Cooper et al., 2006; Trautwein et al., 2006; Trautwein, 2007; Trautwein and Lüdtke, 2009; Dettmers et al., 2009; Fernández-Alonso et al., 2015; Núñez et al., 2015a,c), previous research argues that prior achievement significantly influences students' academic engagement (e.g., Trautwein et al., 2002; Chen et al., 2013; Garon-Carrier et al., 2016). Under these precedents, it was hypothesized that the relationship between prior achievement and student homework behavioral engagement would be positive and statistically significant, suggesting that high-performing students would spend more time on homework, better optimize that time, and would do more teacher-assigned homework than low-performing students.

(2) Secondly, some data suggest that prior academic achievement positively influences students' academic motivation (Valentine and Dubois, 2005; Schöber et al., 2018). In turn, students' motivation is positively associated with the time spent on homework (Dettmers et al., 2009; Regueiro et al., 2015), the amount of homework done (Regueiro et al., 2017b), the management of homework time (Núñez et al., 2015a), and academic achievement (Valle et al., 2016). Therefore, we hypothesized that the relationship between prior achievement and student homework behavioral engagement would be partially mediated by students' intrinsic motivation. In this way, intrinsic motivation would act as a mediator if the influence of prior achievement on student homework behavioral engagement were conditioned, at least partially, by the influence of students' motivation. As well as the direct effect, the indirect effect of prior achievement on the variables of student behavioral engagement would also be positive (indicating that higher prior achievement is related to higher intrinsic motivation and greater student behavioral engagement).

Whereas mediation attempts to explain how and why certain effects occur, moderation provides information about when such effects will take place. In statistical terms, there is moderation when the interaction between the independent variable (in our case, prior achievement) and the third variable (intrinsic motivation) significantly affects the dependent variable (student behavioral engagement in homework). As there are no data from previous studies that have addressed this issue, we will not offer any hypothesis about the moderator role of intrinsic motivation. The question to explore here will be: is the effect of prior achievement on student homework behavioral engagement significantly different (e.g., in intensity or direction) as a function of students' motivational level?

MATERIALS AND METHODS

Participants

Participants were 1899 students (51.2% girls) of Compulsory Secondary Education (CSE) from 17 schools of four provinces in the north of Spain, of which 13 are public schools and 4 are subsidized. In terms of distribution by grade, 28.5% are enrolled in 1st grade of CSE (7th grade), 25.2% are in 2nd grade of CSE (8th grade), 22.2% are in 3rd grade of CSE (9th grade), and 24.1% are in 4th grade of CSE (10th grade). Participants' age ranged between 12 and 16 years.

Instruments

The variables time spent on homework, homework time management, amount of homework done, and homework intrinsic motivation were measured with several items of the *Homework Survey* (e.g., Núñez et al., 2015a,b,c; Valle et al., 2015a,b, 2018).

Time Spent on Homework

The students responded to two items (usually/during a typical week) with the following general formulation: "How much time do you usually spend each day on homework?" with the response options 1 = *less than 30 min*, 2 = *30 min to 1 h*, 3 = *1 h to an hour and a half*, 4 = *1 h and a half to 2 h*, 5 = *more than 2 h*. The reliability is acceptable ($\alpha = 0.78$).

Amount of Homework Done

This information was obtained from students through their responses to two items related to the amount of teacher-assigned homework usually done. The two items were worded as follows: "Some students complete all their homework, and others only complete some of it. What about you? How much of your homework do you do. . .? (usually/during a typical week)." The students chose an answer from a 5-point Likert-type scale ranging from 1 (*I didn't do any of my homework*) to 5 (*I did all my homework*). The reliability is acceptable ($\alpha = 0.82$).

Homework Time Management

This was evaluated through the response to two items worded as follows: "Students often spend a lot of time doing homework, although most of the times, they don't use that time properly,

as they waste it (e.g., talking on the phone, being distracted by intrusive thoughts, procrastinating). And you, how do you manage the time you spend doing your homework (usually/during a typical week)?," on which they were requested to rate their level of perceived quality of homework time management on a 5-point Likert-type scale ranging from 1 (*I don't optimize it at all: "I am continually distracted by everything"*) to 5 (*I optimize it completely: I concentrate, and until I finish doing homework, I don't think about anything else*). The reliability is acceptable ($\alpha = 0.77$).

Intrinsic Motivation for Homework

Interest in learning by doing homework was assessed by students' responses to eight items (*e.g., "I enjoy doing homework, because it allows me to learn more and more"; "Doing homework helps me understand what is being taught in class" and "Doing homework helps prepare me for the next day's lesson/develop good self-discipline/learn how to plan my time or to be more responsible"*), which were rated on a 5-point scale ranging from 1 (*totally false*) to 5 (*completely true*). The reliability is acceptable ($\alpha = 0.86$).

Prior Achievement

Prior achievement was evaluated according to the average academic grades obtained in the last year in Spanish, Math and foreign language (English). These grades were ranged from 1 to 5 (1 = insufficient, 2 = sufficient, 3 = good, 4 = notable, 5 = outstanding).

Procedure

The procedure employed in this investigation followed the ethical standards of the Helsinki Declaration and was approved by the Research and Teaching Ethics Committee of the University of A Coruña. First of all, the prior written informed consent was obtained from the management team and the teaching staff of the participating schools. Subsequently, the written informed consent was obtained from the participants and their parents or legal guardians. Data collection was carried out during school hours. The instruments were administered by staff who collaborated in the research.

Data Analysis

The data were analyzed with the SPSS 22 program. Twelve students were eliminated because they had a large amount of missing data or presented outlier values. No significant amount of missing data was found in any of the variables. The missing values were treated through the multiple imputation procedure. Prior to the study of the hypotheses, as preliminary analysis, we analyzed the correlation matrix and the distribution of the variables included in the study (prior achievement, intrinsic motivation, time spent on homework, time management, and amount of teacher-assigned homework done). With the help of the PROCESS (Hayes, 2013) module implemented in the SPSS, we analyzed whether intrinsic motivation mediated and/or moderated the effect of prior achievement on the three variables of student behavioral engagement considered. **Figure 1** shows the mediation and moderation schema corresponding to hypotheses.

Gender and age (grade) were included in the design to statistically control for their potential effect. The effect sizes were calculated with Cohen's (1988) *d*: $d < 0.20$ = minimum effect size; $d > 0.20 < 0.50$ = small effect size; $d > 0.50 < 0.80$ = medium effect size; $d > 0.80$ = large effect size.

RESULTS

Descriptive Statistics

In **Table 1** are summarized the descriptive statistics and Pearson correlations corresponding to the variables included in the study. The variables included in the study were significantly correlated, and the skewness and kurtosis data suggested an acceptable normal distribution. According to the relationship between the variables, we observed that: (i) females, compared to males, tended to spend more time on homework, reported better time optimization, and they did more assigned homework, had higher intrinsic motivation toward homework, as well as higher academic achievement; (ii) students' motivation and interest and homework engagement decreased as they progressed through the school grades (7th to 10th grade); (iii) prior achievement had a significant and positive relationship with intrinsic motivation and student behavioral homework engagement; (iv) and homework time spent, homework time management, and amount of homework done were positively interrelated and positively related to intrinsic motivation.

Mediation Analysis

In **Table 2** are summarized the results of the mediation analysis of the intrinsic motivation of the effect of prior achievement on student homework behavioral engagement (homework time spent, homework time management, and amount of homework performed).

Mediation Model (Dependent Variable: Homework Time Spent)

The data obtained suggested that homework intrinsic motivation almost completely mediated the effect of prior achievement on homework time spent. Specifically, whereas the indirect effect of prior achievement on homework time spent was positive and statistically significant ($b = 0.034$, $p < 0.001$, $d = 0.274$), the direct effect was minimal ($b = 0.054$, $p < 0.05$), with a small effect size ($d = 0.119$). The overall effect was $b = 0.088$ ($p < 0.001$, $d = 0.193$). The mediational model explained 9% of the variability of the time spent on homework. The data also showed that gender was related to the prediction of time spent on homework ($b = 0.366$, $p < 0.001$), although the effect size was small ($d = 0.332$). Grade was not a predictor in this model.

Mediation Model (Dependent Variable: Homework Time Management)

Intrinsic motivation acted like a partial mediator of the effect of prior achievement on homework time management (indirect effect: $b = 0.049$, $p < 0.001$), although it had a small effect size ($d = 0.323$). Prior achievement also maintained a statistically significant but small direct effect on homework time management

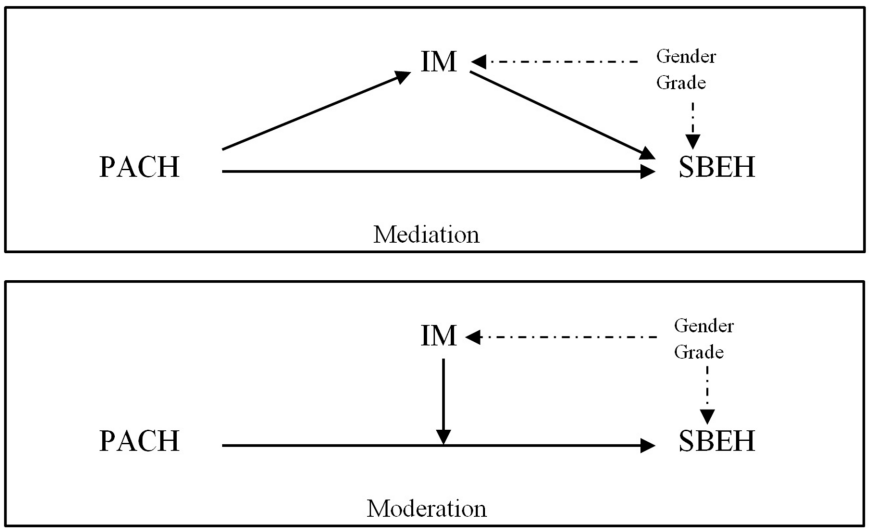

FIGURE 1 | A simple mediation and moderation conceptual models of intrinsic motivation (IM) in the effect of prior achievement (PACH) on student behavioral engagement in homework (SBEH).

TABLE 1 | Descriptive statistics (mean, standard deviation, skewness, kurtosis) and Pearson correlation matrix.

	Gender	Grade	PACH	TSHW	TMHW	AHWD	IMHW
Gender	–						
Grade	0.037	–					
PACH	0.156**	−0.011	–				
TSHW	0.192**	−0.080*	0.128**	–			
TMHW	0.016	−0.158**	0.223**	0.168**	–		
AHWD	0.120**	−0.314**	0.352**	0.415**	0.384**	–	
IMHW	0.108**	−0.214**	0.189**	0.246**	0.368**	0.409**	–
M	1.510	4.420	2.790	3.140	3.220	4.079	3.440
SD	0.500	1.140	1.240	1.150	1.069	1.028	0.820
Skewness	−0.047	0.159	0.149	−0.088	−0.248	−1.121	−0.515
Kurtosis	−2.000	−1.397	−1.247	−0.798	−0.502	0.472	−0.043

*Gender (2 = females; 1 = males); Grade (3 = 7th; 4 = 8th; 5 = 9th; 6 = 10th); PACH, Prior Achievement; TSHW, Time Spent on Homework; TMHW, Time Management of Homework; AHWD, Amount of Homework Done; IMHW, Intrinsic Motivation toward Homework. PACH, TSHW, TMHW, AHWD, and IMHW (minimum = 1, maximum = 5). *$p < 0.05$. **$p < 0.01$.*

($b = 0.149$, $p = 0.001$), ($d = 0.186$). The overall effect was almost intermediate ($b = 0.198$, $p < 0.001$, $d = 0.486$), explaining a total of 16.7% of the variability of homework time management. Gender and grade significantly predicted homework time management, although the effect size was minimal (no effect) (see **Table 2**).

Mediation Model (Dependent Variable: Amount of Homework Done)

The data provided by the mediational analysis indicated that intrinsic motivation was a partial mediator of the effect of prior achievement on amount of homework done (indirect effect: $b = 0.042$, $p < 0.001$), with a small effect size ($d = 0.323$). The direct effect was intermediate ($b = 0.237$, $p < 0.001$, $d = 0.729$), and the total effect was large ($b = 0.279$, $p < 0.001$, $d = 0.841$). The model explained 30.9% of the variability of the amount of homework done. Gender and grade were significant predictors, although whereas gender was hardly a predictor ($d = 0.145$), grade had an intermediate effect size ($d = 0.588$) (see **Table 2**).

Moderation Analysis

Table 3 provides a summary of the moderation analysis of the intrinsic motivation of the effect of prior achievement on student homework behavioral engagement. The data derived from the analysis shows that intrinsic motivation does not have a moderating effect either in the relationship between prior achievement and time spent on homework ($b = 0.002$, $p > 0.05$, $d = 0.003$) or with homework time management ($b = -0.004$, $p > 0.05$, $d = 0.007$). This means that the effect of prior achievement on these two variables is of the same sign and intensity at any level of intrinsic motivation. However, a small moderator effect was observed in the relationship between prior achievement and amount homework done ($b = -0.062$, $p < 0.01$, $d = 0.153$). As can be observed in the last three rows

TABLE 2 | Summary of the mediation model.

	Coeff.	*SE*	*t*	*p*	*LLCI*	*ULCI*	*d*
Homework intrinsic motivation							
Constant	3.578	0.079	36.820	0.000	3.387	3.768	
Prior achievement	0.116	0.015	7.791	0.000	0.087	0.145	0.369
Gender	0.142	0.037	3.869	0.000	0.071	0.216	0.181
Grade	−0.152	0.016	−9.435	0.000	−0.184	−0.120	0.450
Homework time spent							
Constant	1.596	0.179	8.905	0.000	1.244	1.947	
Homework intrinsic motivation	0.290	0.033	8.893	0.000	0.226	0.354	0.423
Prior achievement	0.054	0.021	2.559	0.011	0.013	0.096	0.119
Gender	0.366	0.052	7.036	0.000	0.264	0.468	0.332
Grade	−0.033	0.023	−1.420	0.156	−0.078	0.012	0.066
Homework time management							
Constant	1.818	0.159	11.427	0.000	1.506	2.130	
Homework intrinsic motivation	0.418	0.029	14.452	0.000	0.362	0.475	0.714
Prior achievement	0.149	0.019	7.497	0.000	0.113	0.186	0.376
Gender	−0.094	0.046	−2.045	0.041	−0.185	−0.004	0.095
Grade	−0.068	0.021	−3.312	0.001	−0.108	−0.028	0.155
Amount of homework done							
Constant	2.958	0.136	21.681	0.000	2.690	3.225	
Homework intrinsic motivation	0.361	0.025	14.527	0.000	0.312	0.409	0.718
Prior achievement	0.237	0.016	14.712	0.000	0.206	0.269	0.729
Gender	0.123	0.040	3.106	0.002	0.045	0.201	0.145
Grade	−0.213	0.018	−12.114	0.000	−0.247	−0.178	0.588

Gender (2 = women; 1 = men); Grade (3 = 7th; 4 = 8th; 5 = 9th; 6 = 10th); Prior achievement, homework time spent, homework time management, amount of homework done, and homework intrinsic motivation (scale: minimum = 1, maximum = 5); LLCI, lower confidence interval; ULCI, upper confidence interval.

of **Table 3**, depending on the level of intrinsic motivation, the effect size of prior achievement on amount of homework done was different in intensity (but not in direction). In general terms, the greater the intrinsic motivation, the lower the effect of prior achievement, and vice versa.

DISCUSSION

Doing homework is an instructional strategy frequently used by the vast majority of teachers, from all educational stages and all the countries belonging to the OECD. However, in the last report of this international organism, some concern was expressed about using this instructional strategy, as the data seem to indicate that countries using less homework are obtaining better achievement in PISA. They also indicated that the use of this strategy is negatively associated with children's mental health. However, it is clear from the reviewed literature that the most rigorous studies suggest that such claims are not entirely true because other variables must be taken into account besides the time spent on homework, both extrinsic to the student (family involvement, teacher involvement) and those related to the students (level of prior knowledge, motivation, attitude, effort, self-regulation skills in the process of doing homework, etc.).

In this line, the present investigation sought to shed some light on this issue, focusing on the relative importance of the level of prior achievement in student homework engagement. Specifically, first, we studied the predictive capacity of prior achievement in student homework engagement in terms of the amount of time spent weekly, time management, and amount of teacher-assigned homework done. Secondly, we analyzed in greater depth how that relationship might be mediated, moderated, or both, by students' intrinsic motivation (i.e., intention to engage in homework in order to learn and progress academically). The interest of the work was formulated in terms that if this relationship were significant, student's current level of achievement should be taken into account by teachers when elaborating and assigning homework. And if motivation mediated or moderated the relationship, it should also be known and taken into account at this time. The main reason is that, if the hypotheses of the study were correct, the unadapted assignment of homework would be an inappropriate instructional strategy, partly responsible for students' ambiguous relationship with achievement, and even for adverse consequences.

The results confirmed the first and second hypotheses, but not the third one entirely. These results will be discussed below in detail.

In the first hypothesis, we expected that the relationship between prior achievement and student behavioral engagement would be positive. The data partially confirmed this hypothesis. In particular, as expected, high-performing students, compared to low-performing ones, managed homework time better (although the effect size is small) and did more teacher-assigned homework (with an almost large effect size). On the contrary, the amount

TABLE 3 | Summary of the moderation of intrinsic motivation of the effect of prior achievement on student homework behavioral engagement (interaction effects).

Dependent variables	*Coeff.*	*SE*	*t*	*p*	*LLCI*	*ULCI*	*d*
Homework time spent	0.002	0.025	0.070	0.944	−0.047	0.051	0.003
Homework time management	−0.004	0.022	−0.160	0.873	−0.047	0.040	0.007
Amount of homework done	−0.062	0.019	−3.283	0.001	−0.100	−0.025	0.153
Intrinsic motivation							
2.628	0.290	0.023	12.731	0.000	0.245	0.335	0.620
3.449	0.239	0.016	14.857	0.000	0.207	0.271	0.737
4.269	0.188	0.022	8.535	0.000	0.145	0.231	0.405

LLCI, lower confidence interval; ULCI, upper confidence interval.

of time spent on homework was barely explained by students' prior achievement (the size of the effect is practically non-existent). These results are in the line of those obtained in other studies, which also found that the amount of time spent on homework is of little interest (Trautwein, 2007; Dettmers et al., 2009; Regueiro et al., 2015).

The second hypothesis was also confirmed. In particular, it was found that the relationship between prior achievement and student homework behavioral engagement is partially mediated by students' intrinsic motivation, indicating that higher prior achievement is related to higher intrinsic motivation and greater student behavioral engagement. As in other studies, the data from this research indicate that students' motivation is positively associated, on the one hand, with academic achievement (Valle et al., 2016) and, on the other, with student homework engagement: the time spent on homework (Dettmers et al., 2009; Regueiro et al., 2015), homework time management (Núñez et al., 2015a), and the amount of teacher-assigned homework done (Regueiro et al., 2017b). This research found that the greater the prior achievement, the higher is students' motivation and, finally, the greater their homework engagement. However, the amount of variance explained in each of the three variables of engagement is substantially different. Whereas only 9% of the time spent doing homework and 16.7% of time management are explained, 30.9% of the amount of teacher-assigned homework done is explained. But, while the data from this study refer to the importance of prior achievement and intrinsic motivation in the explanation of student homework engagement, they also raise some questions such as, for example, what personal variables are responsible for the amount of the remaining variance? what relevance do the family and school contexts have?

In terms of the moderation hypothesis, the results of the analysis of this study suggest that the effect of prior achievement on the time spent on homework and on time management does not change according to students' motivational level. This means that the relationship described above has the same force and sign whether the student is little or very intrinsically motivated to work on homework. In the case of these two variables (time spent and time management), students' motivation only facilitates an indirect pathway through which prior achievement would influence student homework engagement. However, some moderation was observed when the dependent variable was the amount of teacher-assigned homework done. In this case, and in general terms, when intrinsic motivation is high, the effect of prior achievement on the amount of homework done is smaller than when motivation is medium or low. These results can be interpreted in the sense that the higher the motivation, the lower is the capacity of prior achievement to determine student engagement in teacher-assigned homework. These findings offer a less deterministic vision: when students' motivation is high, homework engagement is less determined by past conditions that we cannot influence. Therefore, high intrinsic motivation seems to be an important protective factor.

Educational Implications

The results of this study have some implications for educational practice, which should be taken into account when designing and developing homework.

Firstly, we should assume that student homework engagement is determined by multiple factors that should be taken into account to ensure quality engagement. Students do not engage deeply in their homework just because it is their obligation (this may be the least powerful reason). As seen in this study, intrinsic motivation is an important determinant, mainly in terms of homework time management and the amount of teacher-assigned homework done, which in terms of the effect size, is close to large. As a result, and if only for this reason, it seems clear that it is not just is question of designing and assigning homework, but that homework and the contexts must be of quality, which invite the student to engage with them in order to learn. And it is not enough that the homework and the context are of quality, it is also necessary for students to perceive such quality so their deep engagement takes place (Rosário et al., 2018). Therefore in order to motivate students, an interesting practice when assigning homework might be to consider the relevance of each task with a view to students' learning and personal autonomy.

Also, secondly, students' prior achievement is shown as another important determinant of student homework engagement, mainly in terms of the amount of teacher-assigned homework done, and to a lesser extent, with regard to time management. However, as confirmed in the moderation analyses, in relation to the amount of homework done, this effect decreases when intrinsic motivation is high. Thus, insofar as we can highly motivate students to do homework with a deep focus, the determining effect of prior achievement will be lower and, therefore, low-performing students will be less vulnerable.

However, even in this case, it is relevant to take this into account when developing and assigning homework to the students. In general terms, from our data, poor achievement will lead to a decrease in intrinsic motivation (less interest in deep homework engagement), which will lead to a less effective behavioral engagement. In the end, this lower engagement could contribute to subsequent lower achievement, and so on. This loop would have obvious negative consequences. Therefore, it is necessary to significantly adapt the assignment of homework to this group of students, so that, taking into account these limiting initial conditions, the homework will involve real opportunities of personal engagement and success. This will facilitate student engagement – effective engagement – and, over time, the change of direction of that negative loop that makes them so vulnerable.

As previous research suggests, homework should be adapted to students' potential and explicitly linked to academic success, but should also be perceived as useful by learners (Epstein and Van Voorhis, 2001, 2012; Trautwein et al., 2006; Trautwein and Lüdtke, 2009; Dettmers et al., 2010, 2011; Rosário et al., 2018). Teachers must face the challenge of linking homework characteristics to their students' learning needs and interest. In this sense, it seems interesting that teachers explicitly state the competences and knowledge that is expected to be optimized with homework and that the instrumental, personal and/or professional use of the tasks that are sent home from the classroom are specifically agreed upon.

Limitations

Although the results seem to be consistent, this research has some limitations that should not be ignored. Firstly, given that gender and grade were relevant in the explanation of student engagement, and although their effect was statistically controlled by including them as covariates, due to the characteristics of the statistical design, the data from this study do not provide information on how gender or grade might be moderating the effects found. Further studies could primarily examine this issue of undeniable relevance.

Secondly, it could be important to analyze the hypotheses of this study using data obtained with measurement instruments other than self-report measures, as this would allow us to determine the validity of the results of the scope of this study. Thirdly, would be of undoubted interest to study the objectives of this research in younger students, from Elementary Education, as the results of this research might not be generalizable to younger ages. Finally, although the procedure to study mediation/moderation is well established with data derived from cross-sectional designs, even with simple models of mediation/moderation, like those used in this investigation, the data obtained might have differed significantly if we had chosen a longitudinal data collection strategy (or repeated measures). For the design of future studies, this issue of particular relevance should be taken into account.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Research and Teaching Ethics Committee of the University of A Coruña, with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Research and Teaching Ethics Committee of the University of A Coruña.

AUTHOR CONTRIBUTIONS

SR, AV, CF, and MF collected the data and wrote the manuscript. JN analyzed the data and wrote the manuscript. CR-L collected the data and helped revision of the manuscript.

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Antecedents and Outcomes of Parental Homework Involvement: How Do Family-School Partnerships Affect Parental Homework Involvement and Student Outcomes?

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Recent studies have demonstrated that parental homework involvement may not always foster students' desired school outcomes. Such studies have also concluded that the quality of parental homework involvement matters, rather than the quantity. Most importantly, previous studies have shown that strong family-school partnerships (FSPs) may help to improve parental involvement. However, there is little research on how FSP is related to homework involvement. The aim of the present study is to examine the link between an effective family-school communication (EFSC) – as one aspect of FSP – and the quality of parental homework involvement in the German context. For this purpose, we developed a new measure of EFSC. Taking a self-determination theory perspective on parental need support, the quality of parental homework involvement was differentiated into two dimensions of parental *supportive* behavior: autonomy support and competence support. We analyzed the data of 309 parents (82% mothers) of school students (52% girls) who participated in an online survey. The structural equation model revealed a positive relation between EFSC and the quality of parental homework involvement, which in turn was positively associated with school performance and well-being. Moreover, we found that the quality of parental homework involvement mediated the relations of EFSC with achievement and well-being. The results of our study highlight the role of EFSC as a key performance factor that helps to improve the quality of parental homework involvement, thereby promoting student achievement and well-being.

Keywords: homework, parental involvement, family-school communication, achievement, well-being

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INTRODUCTION

Across the globe, students are set homework assignments on a regular basis since homework is generally believed to improve achievement (Paschal et al., 1984; Cooper, 1989). In their meta-analysis of school effectiveness studies, Scheerens and Bosker (1997) found a mean effect size across 13 studies of Zr = 0.06 (Fisher's *Z*) for homework, indicating that this variable might indeed enhance school effectiveness. However, recent studies have provided evidence that homework assignments are not per se performance-enhancing. For instance, the effectiveness of homework seems to depend on the quality of the tasks assigned. Homework assignments that are perceived to be well selected and cognitively challenging are positively associated with students' achievement (Dettmers et al., 2010).

A further potential predictor of the effectiveness of homework assignments is parental homework involvement. Parental involvement in homework completion is commonly expected by schools, teachers, and parents (Patall et al., 2008), all of whom believe that parental homework involvement is vital for students' school performance (Epstein, 1986; Trautwein et al., 2009). Thus, numerous guidelines for parents exist, aiming to improve parents' abilities to successfully support homework completion (e.g., U.S. Department of Education, 2005). In the US, more than 80% of parents believe that homework is important for learning. Even though 51% of parents reported that students should do their homework on their own, on average, 73% of parents reported helping their child with homework completion. However, at the same time, 29% of parents perceived a negative impact of homework on family life (Markow et al., 2007). Given this high percentage of parents who become involved in their children's homework completion and a substantial number of parents who complained about family stress due to homework, the question arises concerning whether and under which conditions parental homework involvement is beneficial. Parental homework involvement is one facet of parental involvement in schooling, which is believed to be one of the key promoters of students' school-related outcomes such as achievement, motivation, and well-being (e.g., Fan and Chen, 2001; Epstein, 2005; Hill and Tyson, 2009; Ma et al., 2016). The importance attached to parental behavior in their children's education becomes apparent in the development of significant educational policies [e.g., U.S. Department of Education, 2002] and projects fostering educational partnerships [e.g., teachers involve parents in schoolwork (TIPS, Van Voorhis, 2003), and teachers involving parents (TIP, Hoover-Dempsey et al., 2002)], which stresses the role that parents play in their children's education. Indeed, meta-analyses have provided evidence that regardless of their socioeconomic background and race, students' school achievement can be improved if their parents become involved in their education (e.g., Fan and Chen, 2001; Hill and Tyson, 2009; Ma et al., 2016). However, parental involvement represents a multifaceted behavior that can take place in school (school-based involvement: e.g., community services at school) or at home (home-based involvement; Grolnick and Slowiaczek, 1994, Hoover-Dempsey and Sandler, 1997). Previous studies analyzing the effectiveness of parental homework involvement have demonstrated mixed results about the link between this type of involvement and students' school performance, with some studies having found a positive link (e.g., Van Voorhis, 2003; Xu, 2004; Silinskas and Kikas, 2011) while others have found a negative link (e.g., Xu et al., 2010; Dumont et al., 2012). These studies have suggested that one should consider how homework involvement is assessed. Most importantly, it is the quality (and not the amount) of homework involvement that is crucial for student outcomes (e.g., Knollmann and Wild, 2007a,b; Dumont et al., 2014; Gonida and Cortina, 2014; Moroni et al., 2015).

The present study was built upon these previous studies, aiming to shed light on factors that might improve the quality of parental homework involvement and thereby student outcomes (achievement and students' well-being). In recent years, the concept of FSP has become well known, as it is believed to foster parental abilities to help their children with learning. Studies have proven that a positive contact between schools and parents is related with higher parental school involvement (Ames et al., 1993; Kohl et al., 2000; Patrikakou and Weissberg, 2000). The aim of the present study was threefold. Our first research question concerned the relationship between the quality of parental homework involvement and four student outcomes: achievement in mathematics and reading as well as well-being at home and school. Second, we analyzed the association between effective family-school communication (EFSC) on the one hand and parental homework involvement and the four student outcomes on the other hand. Third, we investigated the interplay between our variables, namely whether parental homework involvement mediates the association between EFSC and the four student outcomes.

PREDICTORS AND OUTCOMES OF PARENTAL HOMEWORK INVOLVEMENT

Past research has suggested that parental homework involvement is a multidimensional construct including two distinct types of help: quantitative help (e.g., doing homework with the child, providing answers) and qualitative help (e.g., avoiding distractions, providing rules for homework completion, providing support for finding answers) (e.g., Gonida and Cortina, 2014). Although the general term of parental involvement is accepted to be one of the key promoters of learning, parental homework involvement is not always positively related with desired school outcomes such as achievement. For example, Xu et al. (2010) found the frequency of parental homework help to be negatively related with student reading achievement and raised the question of how parents should help with homework. The authors concluded that parents should provide a suitable learning environment for homework completion to foster self-regulated learning and children's autonomy. Moroni et al. (2015) operationalized parental involvement as a multidimensional construct in terms of quantity and quality and examined how the quantity and different qualities of homework involvement were associated with student achievement. Controlling for prior achievement and parental socioeconomic background, they found the frequency of help to be negatively associated with the development of student achievement. However, in terms of homework quality, the authors found opposing effects depending on how homework quality was operationalized. While supportive homework help had positive effects on students' achievement, intrusive homework help was negatively related with later achievement. Dumont et al. (2014) analyzed longitudinal data of 2,830 student-parent dyads (grades 5 and 7) who reported about the quality of parental homework involvement, their socioeconomic background, and desired student outcomes (e.g., reading achievement, reading effort). Adopting the perspective of self-determination theory (SDT, Deci and Ryan, 1987, 2000), parental homework involvement was conceptualized by three dimensions: parental control, parental responsiveness, and parental provision of structure.

The analyses revealed a reciprocal relationship between parental homework involvement and student outcomes. Low achievement in grade 5 predicted higher later parental homework control in grade 7, while high parental control in grade 5 was related with lower achievement in grade 7. A positive reciprocal relationship was found for parental involvement in terms of structure and responsiveness on the one hand and desired student outcomes – such as high achievement – on the other hand. Types of parental involvement did not depend on parental socioeconomic background.

Supportive parental homework involvement – such as the parental provision of autonomy support or structure – is not only positively associated with students' academic performance, but it is also believed to be beneficial for students' well-being (e.g., Hoover-Dempsey et al., 2002; Pekrun et al., 2002). It is assumed that supportive parental behavior fulfills students' basic needs proposed by SDT, namely the need for autonomy, relatedness, and competence (Grolnick, 2009). Basic needs satisfaction may result in an internalization of uninteresting and boring activities such as doing homework into personally important activities, thereby fostering performance and well-being (Deci and Ryan, 2000). To date, few studies have provided evidence of this linkage. Knollmann and Wild (2007b) conducted a survey with 181 German students concerning their parents' provision of autonomy support, emotional support, and support for competence during parental instruction at home. The authors found autonomy and emotional support to be positively associated with joy. By contrast, lower levels of autonomy and emotional support predicted higher rates of students' anger. Moreover, according to Kenney-Benson and Pomerantz (2005), greater autonomy-supportive homework help of mothers was found to be associated with less depressive symptoms compared to controlling mothers.

To sum up, the quality of parental homework help seems to be related with differences in students' well-being and academic achievement. In line with the assumptions of SDT, numerous studies suggest that autonomy- and competence-supportive parental homework involvement may increase students' experiences of autonomous and competent learning experiences, which in turn fosters desired (learning) outcomes. Hence, the question arises about factors that may influence the quality of parental homework involvement. Gonida and Cortina (2014) investigated predictors and consequences of parental homework involvement. The authors asked Greek parents to rate different types of parental homework involvement (autonomy-supportive homework involvement, controlling homework involvement, and interference). Moreover, parents and their children provided information on achievement goals, academic efficacy, and school grades. Structural equation models revealed that autonomy-supportive homework involvement was predicted by parent mastery goals while parent performance goals predicted controlling homework involvement. Moreover, the authors provided evidence that parental beliefs for children's self-efficacy were negatively associated with parent control and interference, but positively related with parent encouragement for cognitive engagement as supplementary to homework. Furthermore, this study demonstrated that low parent beliefs in their children's abilities to complete homework successfully may result in an inappropriate way of homework involvement in terms of control and interference.

However, to our knowledge, little is known about further factors that might promote the quality of parental homework involvement. Given the important role of parents in their children's education, the present study addressed this research deficit and aims to shed light on potential predictors of parental homework involvement. Students and their parents spend a lot of time with homework, although parents report barriers to their homework involvement in the sense that – for instance – they sometimes feel unable to provide appropriate help and they tend to require recommendations from teachers about how to help with homework (Kay et al., 1994). In the present study, we assume EFSC to be a potential predictor of the quality of parental homework involvement. A welcoming school climate and recommendations for homework involvement might act as an invitation to involve as they indicate that parental involvement is desired and important (Becker and Epstein, 1982; Epstein, 1986; Epstein and Van Voorhis, 2001). In the next section, we present a theoretical model of parental involvement in schooling and corresponding empirical studies.

DEFINING PARENTAL INVOLVEMENT IN SCHOOLING

Parental involvement in schooling is seen as a key strategy to improve students' success in school. Indeed, a strong body of evidence suggests that parental involvement in schooling is positively associated with various desired school-related outcomes such as school performance and positive affect (e.g., Fan and Chen, 2001; Hill and Tyson, 2009; Ma et al., 2016). According to Epstein (1995), supportive and event-independent communication between parents, school principals, and teachers may result in a deepened mutual understanding about school as well as improved support of students by their parents and teachers. Hoover-Dempsey and Sandler (1995, 1997, 2005) developed a theoretical model of parental involvement process that describes the antecedents and consequences of parental involvement in schooling. The model proposes five sequential levels to explain factors that might influence parents' choice to become involved, their resulting forms of involvement and their consequences. The *first level* identifies three reasons for parents to become involved in their children's schooling: parents' perceived role construction (e.g., whether they feel obliged to help), their perceived invitations to involvement from the school, the teacher, and their child, as well as their sense of efficacy for helping their children. *The second level* suggests two forms of parental involvement, namely home- and school-based involvement, both of which include encouragement, modeling, reinforcement, and instruction. At the *third level*, children's perceptions of the four types of parental involvement (encouragement, modeling, reinforcement, and instruction) are described. The *fourth level* describes mediating variables, namely child attributes and use of developmentally appropriate parental involvement. Finally, the *fifth level* focuses on school achievement

(for a more detailed description, see Hoover-Dempsey et al., 2005; Hoover-Dempsey and Sandler, 2005). The focus of the present study was on the first level of the model, which deals with the question of why parents become involved in their children's schooling. Hoover-Dempsey and Sandler's model identifies three sources of invitations for parents to become involved in schooling: invitations from the school, the child, and the child's teachers. Invitations from the school might include a welcoming school climate and the perception that parental involvement is crucial and desired in supporting children's learning and achievement. Teachers can foster parental involvement through direct requests for involvement in children's education; for instance, by encouraging parents to talk about school activities with their child. Finally, children's attributes (e.g., prior achievement in school) might act as an invitation to become involved. Numerous previous studies have provided evidence regarding the relationship between level 1 variables (reasons for becoming involved) and the amount of involvement in school and at home (e.g., Green et al., 2007). For example, Green and colleagues used the data of 853 parents of elementary and middle school students to examine associations between antecedent factors (level 1) and different forms of parental involvement (level 2) proposed in the theoretical model by Hoover-Dempsey and Sandler. Regression analyses revealed that parental self-efficacy, child invitations, and parents' time and energy were positively associated with the amount of home- and school-based involvement. Moreover, teacher invitations predicted the quantity of parents' school-based involvement. Yotyodying and Wild (2014) examined whether parental perceptions of invitations for involvement from the school and teachers in a German and Thai sample as one among other predictors variables would predict two distinct forms of home-based parental involvement: authoritative (greater autonomy support and responsiveness) and authoritarian (greater control and structure). In the German sample, the significant results showed that parental perceptions of invitations from the school and teachers were negatively associated with both authoritative and authoritarian ways of involvement. This means that parents who prefer either authoritative or authoritarian ways of involvement tend to neglect becoming involved if they feel less invited by the school and teachers.

However, it should be critically noted that Hoover-Dempsey and Sandler's model as well as most related empirical studies have focused particularly on the quantity (how often parents become involved) of parental involvement, while the quality (the ways in which parents become involved) of parental involvement has been neglected in many studies.

The present study aims to expand the existing body of knowledge by taking the quality (instead of the quantity) of parental involvement into account. In order to gain deeper insights into the mechanisms of parental involvement, we concentrated on one subdimension of parental involvement in schooling: parental homework involvement. Adopting a self-determination perspective on parental need support, the quality of parental homework involvement was differentiated into two dimensions of parental supportive behavior: autonomy support and competence support. The following research questions arise from the above explanations: is high-quality parental homework involvement positively associated with students' achievement and well-being? Moreover, how can high-quality parental involvement be fostered?

FAMILY-SCHOOL PARTNERSHIPS IN GERMANY

Given the importance of improving parental involvement, scholars have attempted to identify variables that increase beneficial parental involvement. In recent years, the concept of family-school partnerships (FSPs) has become well known as an instrument that might foster parental choice to become involved in their children's education and parental abilities to help their children with learning. Indeed, studies have proven that successful FSPs are positively associated with students' performance (see Henderson and Mapp, 2002; Sheldon, 2003). A positive contact between teachers and parents increases the probability that parents become involved in their children's education (Ames et al., 1993; Kohl et al., 2000; Hoover-Dempsey and Walker, 2002). Moreover, information from teachers about classroom learning and instruction shape parental strategies to become involved (Ames et al., 1993). In order to strengthen successful FSP, in 1997, the National Parent Teacher Association (PTA) published the National Standards for Family-School Partnership for the US context. These standards build upon Epstein's typology of parental involvement (see Epstein, 2001) and provide a practical guideline to implement FSP. The PTA proposed six standards: (1) welcoming all families into the school community, (2) communicating effectively, (3) supporting student success, (4) speaking up for every child, (5) sharing power, and (6) collaborating with community (for more information, see Parent-Teacher Association, 2009). Compared to the US, to our knowledge, in Germany, much less is known about the concept and the benefits of well-functioning FSP (Wild and Yotyodying, 2012). To date, contacts between schools and parents are rare and not very effective and mostly take place at parent evening events (Wild and Hofer, 2002; Sacher, 2008). Moreover, conversations between teachers and parents mainly concern learning problems and students' grades (Wild and Lorenz, 2010; Wild and Yodyodying, 2012). For this reason, the Vodafone Foundation in collaboration with a scientific expert committee (see Sacher et al., 2013) recently proposed a compass for family-school partnerships for the German context comprising four different standards. The development of the four indicators is based on the six PTA standards described above, although the standards were adapted to the German context and the sixth standard "collaborating with community" was excluded for Germany. Standard A "Welcoming and Meeting Culture" describes a welcoming and friendly school climate that can be characterized by mutual respect and the inclusion of all stakeholders. Standard B "Various and Respectful Communication" is characterized by a regular and routine information exchange between the

school, teachers, and parents, the use of various ways of information, and a regular information exchange between all stakeholders. Standard C "Educational Cooperation" focuses on parental participation in school life, the encouragement of parents to support their children with learning, the information about external school-related offers, and it emphasizes the role of parents as interceders of their child. Finally, Standard D "Parent Participation" describes the provision of information about parents' participatory rights, the possibility for parents to participate in school decisions, and the inclusion of social, political, and external networks in school life. To our knowledge, little is known about whether the proposed standards would be met in German schools and whether they would help to ensure parental involvement, especially parental help with homework. For this reason, we developed and validated a parental questionnaire to assess parental perceptions on different aspects of FSP based on the proposals of Vodafone's scientific committee.

The aim of the present study was to identify factors that might promote the quality of parental homework involvement. In consideration of Hoover-Dempsey and Sandler's model, which identifies three reasons for parents to become involved (their role construction, their perceived invitations, and their sense of competence to help) and previous studies (e.g., Becker and Epstein, 1982; Epstein, 1986; Epstein and Van Voorhis, 2001), we proposed that EFSC would foster the quality of parental homework involvement. In order to operationally characterize EFSC, we relied on three indicators of Standard B "Various and Respectful Communication" and developed three scales (15 items) assessing EFSC. B1 "Information Exchange" describes a regular and routine information exchange between the school, teachers, and parents. Standard B2 "Various Forms of Communication" focuses on the use of the variety of ways of communication between the school and parents (e.g., email, homepage, etc.). B3 "School Transitions" refers to a regular knowledge transfer and information exchange between schools, teachers, and parents during school transitions.

THE PRESENT STUDY

The present study addresses three research deficits. *First*, parental school involvement is a multidimensional construct comprising both parental involvement at school and parental involvement at home. Research findings on parental school-based involvement are not transferable to home-based involvement, given that the context of the two forms of involvement differs. The present study concentrates on home-based involvement, more precisely on homework involvement as one facet of it. Research on parental homework involvement has provided evidence for the need to distinguish between the quality and quantity of parental involvement, whereby it is the quality (rather than the quantity) of involvement that matters for desired student outcomes (e.g., Dumont et al., 2014; Moroni et al., 2015). Adopting a self-determination perspective on parental need support, the quality of parental homework involvement was differentiated into two dimensions of parental *supportive* behavior: autonomy support and competence support. Our first research question concerned the relationship between parental homework involvement and four different student outcomes: well-being at school, well-being at home, mathematics achievement, and language achievement. *Second*, the concept of FSP is well known and has been much studied in the US context. There is clear consensus that parental involvement in schooling is beneficial and that a successful implementation of FSP fosters parental involvement, thereby promoting student achievement (Ames et al., 1993; Kohl et al., 2000; Fan and Chen, 2001; Henderson and Mapp, 2002; Hoover-Dempsey and Walker, 2002; Sheldon, 2003; Epstein, 2005; Hill and Tyson, 2009; Ma et al., 2016). However, theoretical models and much FSP research have concentrated on the effects of FSP on the quantity (the amount) of involvement, while the relationship between FSP and the quality of parental school involvement and student outcomes remains unclear. Moreover, to our knowledge, in Germany, much less is known about effects of the implementation of successful FSP. The four standards of FSP proposed by the Vodafone Foundation and a scientific expert committee (Sacher et al., 2013) are the first theoretical compass for FSP in the German context. To date, the concept has not been empirically analyzed in Germany and it is unclear whether a successful implementation of FSP is related to parental school- and home-based involvement. Our second research question thus concerned the relationship between EFSC (as one facet of FSP) and parental homework involvement and the different student outcomes. Finally, our *third* research question focuses on the mediating role of parental homework involvement for the relationship between EFSC and the four student outcomes. In order to investigate these relationships, we assumed that socioeconomic status and student gender may act as barriers to parental homework involvement (e.g., Hornby and Lafaele, 2011). Thus, there is a need to control for both variables.

MATERIALS AND METHODS

Data Source and Sample

Between winter 2015 and spring 2018, we conducted an online survey with parents of primary and secondary school students. The sample included 309 parents (82% mothers; *M* age = 42 years) of school students. Of the participants' children (*M* age = 12 years, SD = 3.58), 55% were girls and 44% attended elementary schools. Parents were asked to rate the amount of EFSC and their homework support. Moreover, parents rated children's well-being and school achievement. The percentage of missing data was low for the variables analyzed here (on average 0.91%).

Instruments

Effective Family-School Communication

EFSC was assessed with three indicators of Standard B "Various and Respectful Communication" and comprises: (1) "Regular

and event-independent information exchange" [five items, e.g., "If I am (or my child is) concerned about something, I can discuss this with the teachers, the school principal, or other parents."], (2) "various forms of communication" [six items, e.g., "The school communicates with parents in different ways (e.g., email, telephone, and website)."], and (3) "school transitions" [five items, e.g., "The school management and teachers actively inform parents and children about the possibilities when making their school decisions."]. All items were rated on a 4-point Likert scale ranging from 1 = "strongly disagree" to 4 = "strongly agree." Cronbach's alpha for EFSC was 0.91. The psychometric properties of the subscales are shown in **Table 1**.

Parental Homework Involvement

Adopting a self-determination perspective on parental need support, the quality of parental homework involvement was differentiated into two dimensions of parental supportive behavior (Katz et al., 2011): (1) *autonomy-supportive homework involvement* was assessed with five items (e.g., "While working on homework, I am willing to hear my child provide answers that are different from mine."); and (2) *competence-supportive homework involvement* comprised three items (e.g., "I am glad if my child provides an answer in homework that is different from what is expected but is interesting."). Items were rated on a 4-point Likert scale ranging from 1 = "strongly disagree" to 4 = "strongly agree." Cronbach's alpha for parental homework support was 0.83.

Well-Being

In the present study, we differentiated between student well-being at home and in school. Using two different 10-point ladders (Cantril, 1965) ranging from 1 (*they are doing really poorly in school/at home*) to 10 (*they are doing really well in school/at home*), parents were asked to rate how their children feel about their lives in school (well-being at school) and at home (well-being at home).

School Achievement

School achievement was assessed with two indicators. Parents were asked to rate their children's *mathematics achievement* in mathematics with three items on a 4-point Likert scale: (a) my child is (1) *not good*...(4) *very good* in arithmetic, (b) my child makes (1) *many mistakes*...(4) *very few mistakes* in arithmetic, (c) arithmetic is (1) *difficult*...(4) *easy for my child*. Cronbach's alpha of this scale was 0.95. *Language achievement* comprised six items about the reading and writing abilities of their children. Parents were asked to judge the items on a 4-point Likert scale, e.g., (a) my child makes (1) *so many mistakes*...(4) very few mistakes when reading, (b) writing is (1) *difficult*...(4) *easy for my child*. Cronbach's alpha of this scale was 0.92.

TABLE 1 | Means, standard deviations, and internal consistencies for all study variables.

Study variables	*M*	SD	*α*
B1: Information exchange	2.87	0.57	0.74
B2: Various forms of communication	2.90	0.69	0.86
B3: School transitions	2.94	0.68	0.78
Autonomy-supportive homework involvement	3.30	0.55	0.74
Competence-supportive homework involvement	3.51	0.58	0.77
Mathematics achievement	3.27	0.73	0.95
Language achievement	3.34	0.67	0.92
Well-being school	7.60	0.91	
Well-being at home	8.70	0.49	

Socioeconomic Status

Parental socioeconomic status (SES) was assessed using the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations; König et al., 1988), a comparative educational scale. Parents provided information on their school education (e.g., A-level) and their professional education (e.g., university degree). In order to build a CASMIN index, both variables of each parent were combined and then distinguished into three different educational levels (elementary, intermediate, and higher level). According to this classification, 2% of the parents reported having a SES at the elementary level, 15% at the intermediate level, and 83% at the higher level. We created a dummy variable for the SES, coded as 1 if participants reported a CASMIN at the higher level, and 0 if participants reported a lower CASMIN.

Statistical Analyses

In order to test our hypotheses empirically, structural equation modeling (SEM) analyses were performed. SEM allows testing the relationships postulated in the present study. All analyses were performed using MPlus 7.4 (Muthén and Muthén, 2012–2014). EFSC was operationalized as a latent construct, measured by three manifest indicators (regular and event-independent information exchange, various forms of communication, and school transitions). Parental homework involvement was measured by two indicators: autonomy- and competence-supportive homework involvement. In order to control for parental SES and student gender, we estimated the links between both variables and the mediator (parental homework involvement), as well as the outcomes (achievement and well-being). Standardized parameter estimates of models with good fit were reported. Model fit was evaluated by considering the χ^2 test, the comparative fit index (CFI), the Tucker Lewis Index (TLI), the standardized root mean square residual SRMR, and the root mean square error of approximation RMSEA. According to Schreiber et al. (2006), a nonsignificant χ^2 test, and a value of 0.95 or higher for the GFI and CFI indicates an acceptable model fit. The average percentage of missing data ranged from 0 to 3.2%. Since the proportion of missing values was low and could be assumed to be missing at random (MAR), it was dealt with the full information maximum likelihood estimation (FIML) implemented in MPlus. In FIML, all information available is considered to estimate the parameters. FIML produces

unbiased parameter estimates and standard errors and is superior to traditional deletion methods (e. g., listwise and pairwise deletion) (Schafer and Graham, 2002).

RESULTS

Descriptive Statistics and Zero-Order Correlations

Table 1 presents means, standard deviations, and Cronbach's alpha for the study variables. Parents' average ratings of EFSC were moderately above the scale midpoint, indicating a rather frequent contact between schools and parents and a "well-functioning information flow." Parents report a regular and routine information exchange between the school, teachers, and parents. Moreover, as perceived by parents, most schools used various forms to communicate with parents, e.g., email, homepage, etc. Finally, parents perceived a regular knowledge transfer and information exchange between schools, teachers, and parents during school transitions. Parental ratings of homework support were significantly above the scale midpoint. Hence, from a self-determination perspective on parental need support, parents reported a rather high quality of parental homework involvement. They reported being autonomy- and competence-supportive during homework completion. Achievement was rated on a 4-point Likert scale. As shown in **Table 1**, on average, parents rated their children's achievement in mathematics and reading high. While well-being was also rated high. On a 10-point ladder with high values indicating high well-being, parents perceived their children to feel rather well in school and very well at home.

In order to gain insights into the association between the research variables, **Table 2** presents the Pearson's correlation coefficients between all analyzed variables. The significant correlations ranged from $r = 0.14$ ($p < 0.05$) to $r = 0.53$ ($p < 0.01$). As expected, EFSC was positively associated with supportive parental homework involvement ($r = 0.39$, $p < 0.01$), indicating that a well-functioning contact and information flow between schools, teachers, and parents is related with autonomy- and competence-supportive parental homework behavior. Moreover, high values in EFSC were related with well-being at school ($r = 0.35$, $p < 0.01$) and home ($r = 0.14$, $p < 0.05$). Finally, EFSC was positively associated with achievement in mathematics ($r = 0.20$, $p < 0.01$) and language ($r = 0.20$, $p < 0.01$). The same holds for autonomy- and competence-supportive parental homework behavior. The variable was positively related with well-being at school ($r = 0.16$, $p < 0.01$) and home ($r = 0.42$, $p < 0.01$) and with school achievement (mathematics: $r = 0.24$, $p < 0.01$; language: $r = 0.47$, $p < 0.01$). In sum, the intercorrelations revealed that our research variables are related to each other in the expected way. In order to draw further conclusions about their relationship and answer our research questions, we estimated regression analyses and a structural equation model to predict parental homework involvement, school achievement, and well-being, as well as to test the mediating role of parental homework involvement for the potential association between EFSC and our outcome variables.

The Relationship Between Parental Homework Involvement and Student Outcomes

In the first step, we performed a regression analyses to predict students' well-being at school and home and their achievement in mathematics and language. The results are shown in **Table 3**, model 1. Model fit was rated based on the χ^2 test, the CFI, the TLI, the SRMR, and the RMSEA. The model revealed good model fit to the data, χ^2 (522, $N = 309$) = 5.03, CFI = 1.00, TLI = 1.00; SRMR = 0.01, RMSEA = 0.01. As can be seen in **Table 3**, controlling for socioeconomic status and gender (female), parental homework involvement predicted well-being at school ($\beta = 0.15$, $p < 0.05$), well-being at home ($\beta = 0.42$, $p < 0.01$), mathematics achievement ($\beta = 0.24$, $p < 0.01$), and language achievement ($\beta = 0.46$, $p < 0.01$). Hence, according to their parents, students whose parents are autonomy- and competence-supportive during homework completion feel more well at school and home and achieve better results in mathematics and language compared to other students. The variance explained was between 3% (for well-being at school) and 23% (for language achievement).

TABLE 2 | Intercorrelations among study variables.

			Well-being		Achievement		
	EFSC	Support	At school	At home	Math	Language	Female
EFSC							
Parental homework involvement	0.39**						
Well-being at school	0.35**	0.16**					
Well-being at home	0.14*	0.42**	0.53**				
Mathematics achievement	0.20**	0.24**	0.26**	0.25**			
Language achievement	0.20**	0.47**	0.25**	0.30**	0.35**		
Female	0.03	0.01	0.08	–0.04	–0.03	0.01	

*Note: EFSC = Effective family-school communication, N = 309, *p < 0.05, **p < 0.01*

TABLE 3 | Associations among effective family-school communication, parental homework involvement, well-being at school, well-being at home, mathematics achievement, and language achievement after controlling for child gender and parental SES.

	Well-being at school		Well-being at home		Mathematics achievement		Language achievement	
Model 1	β	**SE**	β	**SE**	β	**SE**	β	**SE**
Parental homework involvement	0.15*	0.06	0.42***	0.06	0.24***	0.06	0.46***	0.05
Female	0.08	0.06	–0.08	0.05	–0.10	0.06	0.11*	0.05
SES	0.05	0.06	0.10*	0.05	0.05	0.06	–0.01	0.05
R^2	0.03		0.19***		0.07*		0.23***	

	Parental homework involvement		Well-being at school		Well-being at home		Mathematics achievement		Language achievement	
Model 2	β	**SE**	β	**SE**	β	**SE**	β	**SE**	β	**SE**
Effective family-school communication	0.40***	0.06	0.34***	0.06	0.16**	0.06	0.22***	0.06	0.19**	0.06
Female	0.00	0.06	0.05	0.05	–0.08	0.06	0.08	0.06	0.12*	0.06
SES	0.04	0.06	0.10	0.05	0.12*	0.06	–0.12*	0.06	0.01	0.06
R^2	0.16**		0.14**		0.04		0.06*		0.06*	

*Note: N = 309, *p < 0.05, **p < 0.01, ***p < 0.01*

The Relationship Between Effective Family-School Communication and Parental Homework Behavior and Student Outcomes

The next section presents the findings of regression analyses to empirically test the assumed relationships between EFSC and the other variables of this study. **Table 3**, model 2, shows the results for the prediction of parental homework involvement, well-being at school and home, as well as achievement in mathematics and language. The model revealed good model fit to the data, χ^2 (22, N = 309) = 32.21, CFI = 0.99, TLI = 0.97; SRMR = 0.02, RMSEA = 0.04. As can be seen in **Table 3**, after controlling for socioeconomic status (CASMIN) and gender (female), regression analysis indicated that EFSC predicts parental homework support (β = 0.40, $p < 0.01$). Thus, parents whose children visit schools with a well-functioning EFSC reported being more autonomy- and competence-supportive during homework completion. The variance explained was 16% for this model.

The next two columns show the results for the prediction of students' well-being. After controlling for socioeconomic status and gender, the results revealed a positive relationship between parental homework support and well-being at school (β = 0.34, $p < 0.01$), as well as well-being at home (β = 0.16, $p < 0.01$). Hence, the results indicate that children whose parents perceive themselves as being autonomy- and competence-supportive during their children's homework completion feel more well at school and home compared to other children. The variance explained was 14% for well-being at school and 4% for well-being at home. The last two columns in **Table 3** present the results for the prediction of mathematics and language achievement. Mathematics achievement was predicted by EFSC (β = 0.22, $p < 0.01$) and female gender (β = –0.12, $p < 0.05$). Language achievement was predicted by EFSC (β = 0.19, $p < 0.05$) and female gender (β = 0.12, $p < 0.05$). The results thus indicate that a well-functioning communication between schools, teachers, and parents may improve students' achievement in mathematics and the language domain. The percentage of variance explained was 6% for mathematics achievement and 6% for language achievement. In sum, the study provided first evidence for the German context that EFSC may improve the quality of parental homework support in terms of autonomy and competence support. Moreover, EFSC proved to be beneficial for students' well-being at home and may foster mathematics and language achievement.

Mediating Role of Parental Homework Help

In order to gain deeper insights into the mechanisms of the relationships found in the previous section, our third research question concerned the mediating role of parental homework involvement in the relationship between EFSC and well-being as well as school achievement. **Figure 1** shows the results of a structural equation model. For the sake of easier readability, only significant pathways are shown. Overall, the model shows excellent model fit to the data: χ^2 (22, N = 309) = 32.21, CFI = 0.99, TLI = 0.97; SRMR = 0.02, RMSEA = 0.04.

After controlling for socioeconomic status and female gender, EFSC was found to be positively associated with parental homework involvement (β = 0.40, $p < 0.001$). Compared with the regression coefficients found in regression analyses (see **Table 3**, model 2), the relationship between EFSC and well-being at school remained at a substantial level (β = 0.35, $p < 0.001$). However, the coefficient for the relationship between EFSC and mathematics achievement slightly decreased from β = 0.19 to β = 0.15 ($p < 0.05$). Moreover, the inclusion of parental homework involvement in our analyses led to reduced coefficients for the relationship

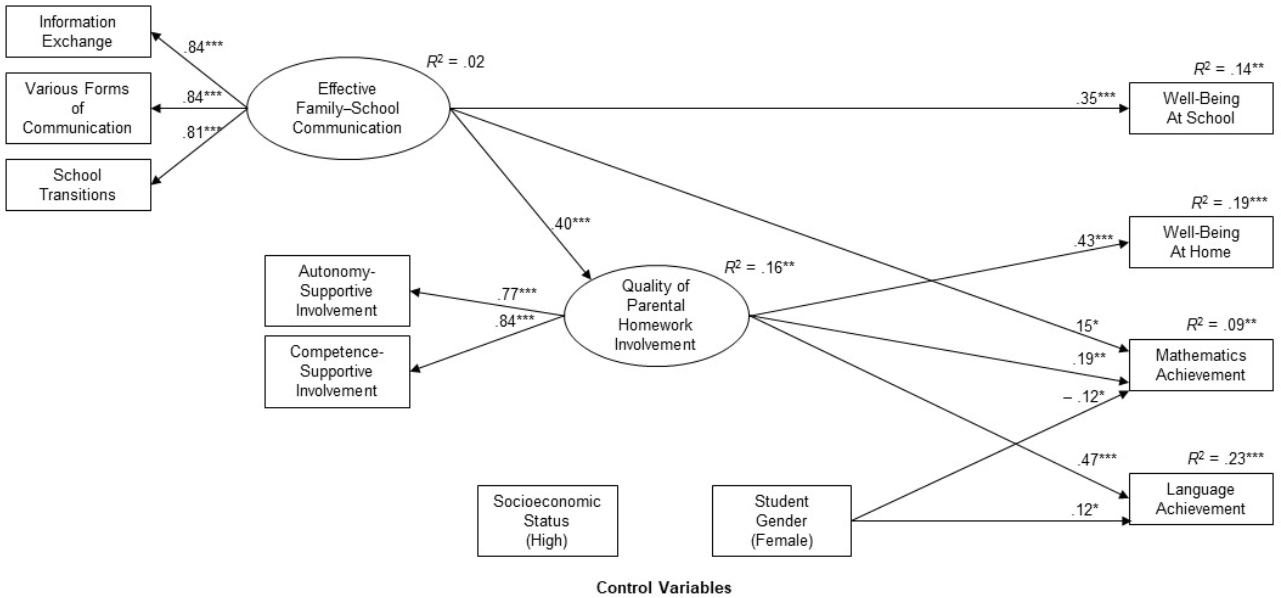

FIGURE 1 | Structural model for the associations between effective family-school communication, quality of parental homework involvement, and students' desired outcomes after controlling for parental SES and student gender. Note: N = 309, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. For reasons of simplification, only significant path coefficients are shown.

between EFSC and well-being at home (β = −0.01) and language achievement (β = 0.00). These relationships were no longer statistically significant.

In addition to the direct effects, indirect effects of the predictor EFSC on well-being and achievement as mediated by parental homework support were examined. The inclusion of the mediator variables partly led to different regression coefficients for EFSC, indicating the mediating role of parental homework involvement. The indirect effect of EFSC on well-being at home was statistically significant (β = 0.17, $p < 0.01$), indicating a full mediation of the relationship. The indirect relationship between EFSC and mathematics achievement was statistically significant (β = 0.07, $p < 0.01$), indicating a partial mediation. Furthermore, the indirect effect of EFSC on language achievement was statistically significant (β = 0.19, $p < 0.001$), indicating a full mediation. Because the link between parental homework involvement and well-being at school was not found, the indirect effect was not examined.

Together, the results demonstrated that the quality of parental homework support fully mediated the relations of EFSC with well-being at home and language achievement, while it partially mediated the relations of EFSC with mathematics achievement. Hence, EFSC had significant positive indirect effects on well-being at home and student's achievement.

DISCUSSION

The primary aim of the present study was to analyze predictors and consequences of high-quality parental homework involvement. More precisely, we tested whether EFSC would predict the quality of parental homework involvement and in turn students' well-being and school achievement. The participants of the study were 309 parents of primary and secondary school students in Germany who participated in an online survey. Three research questions were addressed. Our first research question addressed the role of parental homework involvement. With respect to the SDT, parental homework involvement was operationalized as autonomy- and competence-supportive. Based on regression analyses, we tested the relationship between parental homework involvement and four different student outcomes: well-being at school, well-being at home, mathematics achievement, and language achievement. Our second research question focused on the associations among EFSC, the quality parental homework involvement, students' well-being, and school achievement in two domains. Our third research question concerned the mediating role of parental homework involvement for the relationship between EFSC and the four student outcomes.

In line with our assumptions made for the first research question, we found high-quality parental homework involvement to be positively associated with students' well-being at school and at home, as well as with students' achievement in mathematics and language. This result supports the results of earlier studies concluding that the effectiveness of parental homework involvement depends on its quality (e.g., Knollmann and Wild, 2007a,b; Dumont et al., 2014; Gonida and Cortina, 2014; Moroni et al., 2015).

Past research has suggested that (the quantity of) parental involvement in schooling is beneficial for different student outcomes (e.g., Fan and Chen, 2001; Hill and Tyson, 2009; Ma et al., 2016). Building upon Hoover-Dempsey and Sandler's model of parental involvement process (Hoover-Dempsey and Sandler, 1995, 1997, 2005) and recent studies (e.g., Green et al., 2007), we assumed an EFSC to be positively associated with parental

homework involvement and different student outcomes. Using a recently developed instrument to assess parental perceptions of EFSC, our second research question focused on the relationship between EFSC and parental homework involvement and the four student outcomes. Our results of regression analyses provided evidence for the predictive power of EFSC for the quality of parental homework involvement and all four different student outcomes. As previously mentioned, Hoover-Dempsey and Sandler's model underlines specific invitations from school (teachers' attempt to invite parents to become involved) as one of crucial predictors of the quantity of parental involvement. Our results added to this model in the sense that EFSC – which might function as a reason to become involved – predicts the quality of parental involvement in schooling. Our study extends previous research on the model as it considers the need to distinguish between the quantity and quality of involvement. To our knowledge, our study is the first to provide evidence of the predictive power of EFSC for high-quality parental homework involvement. Contrary to our results, Yotyodying and Wild (2014) found teacher invitations to be related with the amount of parental home-based involvement but not with differences in the quality of home-based involvement. The authors concluded that teachers presumably increase parents' awareness of the importance to become involved in schooling, but that they possibly do not provide information about how parents might help their children in school-related topics. In their study, the authors asked parents to rate the extent to which they perceive that their school involvement is expected and requested. In the present study, parents were asked to rate an EFSC in a way that a regular and event-independent information exchange exists, that the schools and teachers use various forms of communication and that information about school transitions is provided. An EFSC might not only act as an invitation to help but it also possibly provides parents with information concerning how to help their children in school-related topics. In addition, our results indicated that EFSC positively contributed to all four student outcomes. These results were also in line with previous studies finding that successful FSPs help to improve students' performance (e.g., Henderson and Mapp, 2002; Sheldon, 2003).

In order to address our third research question, we examined the mediating role of the quality of parental homework involvement. Controlling for socioeconomic status and students' gender, SEM analyses showed that the associations between EFSC and three of the four student outcome variables (well-being at home, mathematics achievement, and language achievement) were (partially) mediated by the quality of parental homework involvement. The results of the present study thus highlight the role of EFSC as a key performance factor that helps to improve the quality of parental homework involvement, thereby promoting student outcomes. In addition, our findings on the crucial mediating role of parental homework involvement in the associations between EFSC and well-being at home and school achievement were in line with the assumptions of self-determination theory (SDT: Deci and Ryan, 1987, 2000). Accordingly, the parental provision of autonomy and competence support tend to satisfy the basic needs of their children (autonomy and competence), and in turn it might thus result in improved well-being. Indeed, earlier studies (Chirkov and Ryan, 2001; Niemiec et al., 2006; Yotyodying, 2012) have provided evidence for the relationship between parental autonomy support and well-being (e.g., life satisfaction, positive affect, school satisfaction, positive academic emotions). Our results suggest that an EFSC results in a higher quality of parental homework involvement (in terms of autonomy and competence support), which in turn leads to increased well-being at home compared to other children. Concerning achievement, our results were in line with previous studies providing evidence of a positive relationship between parental involvement in schooling and students' achievement (e.g., Fan and Chen, 2001; Hill and Tyson, 2009; Ma et al., 2016), although they extend these studies by showing the mediating role of parental homework involvement for this relationship. Hence, EFSC results in high-quality parental homework involvement and is in turn related to achievement.

Practical and Scientific Implications of the Study

Recent studies have shown that strong family-school partnerships (FSPs) may help to improve parental involvement. From a scientific view, the findings of the present study supplement this research in two aspects: first, to our best knowledge, to date only little is known about the relationship between FSP and parental homework involvement. We were able to confirm that EFSC (as an indicator of FSP) may help to improve the quality of parental involvement at home, which in turn supports well-being and school achievement of students. Second, compared to the US, in Germany, much less is known about the benefits of FSP (Wild and Yotyodying, 2012). We have been able to show that German parents evaluate the communication between families and schools positively. However, according to Hoover-Dempsey and Walker (2002), various barriers might hinder well-functioning FSP such as parents having a low level of education, inflexible working hours, or low language skills. For schools, structural elements such as personnel resources influence FSP. Hence, our results of the present study hold strong importance for different groups. Administrators may use our results to implement teacher and parent training programs aiming to promote the awareness of teachers and parents about the consequences of parental involvement. Such programs should accentuate the need to become involved in an autonomy- and competence-supportive manner, as this study and recent studies (Knollmann and Wild, 2007a,b; Dumont et al., 2014; Gonida and Cortina, 2014; Moroni et al., 2015) have provided evidence of the need to particularly promote the quality rather than quantity of involvement. Hence, teachers should not only learn how to encourage parents to become highly involved; moreover, they should also learn how to assist parents to be more autonomy- and competence-supportive during homework completion. Moreover, parent training programs might help parents to be informed about different parenting styles and their effects on students' learning and achievement.

Limitations of the Present Study

First, the generalization of our results is limited due to different attributes of the sample. All analyses were based on parental self-reports. Future studies should assess the study variables by taking other perspectives into account (e.g., school principals, teachers, and students). In these studies, teachers and school principals should be investigated as an additional source of information on EFSC. Their perspectives might differ from parents' perspectives as teachers and school principals may consider other aspects of EFSC as particularly important than parents. Moreover, in order to improve EFSC in the school, there is a need to identify possible barriers from the school (e.g., teachers' characteristics) or family (e.g., available time to effectively communicate, etc.) that may undermine teachers' and parents' abilities to communicate effectively with each other. Finally, students should rate their well-being in school and at home in future studies. In addition, the generalization of our results is limited due to the high socioeconomic status and the high proportion of mothers in our sample. In our study, the socioeconomic status was not related with parental homework involvement. However, previous studies suggest that high-SES parents tend to be more involved in schooling than other parents. Compared with low-SES parents, their higher education might be associated with feelings of being competent to help leading in higher amounts of involvement (Lee and Bowen, 2006). In the present study, the participants reported on average a comparatively high socioeconomic status. Future studies should take this limitation of the analyzed sample into account and investigate a more representative sample of parents. In future studies, also children with different achievement levels should be considered, as parents of low achieving children or children with special needs might employ other parenting strategies in face of difficulties in school. For these parents and their children, strong FSP might be particularly important. In Germany, cooperation between schools and parents often takes place in the form of short meetings during parent-teacher conferences in school (Sacher, 2008). Commonly, teachers and parents discuss learning problems and children's grades (Wild and Lorenz, 2010; Yotyodying, 2012). Strong FSP and effective communication might result in a deeper understanding of children's needs for learning and how parents might support their children's learning at home. Second, no conclusions on the causality could be drawn due to a cross-sectional research design. Hence, a longitudinal research design should be employed in future studies. Third, the study has exclusively focused on functional ways of parenting (autonomy- and competence-supportive homework involvement), while other parenting styles were not considered here. For instance, according to the SDT perspective on parenting, other forms of parenting such as responsiveness (providing emotional support) and structure (providing clear guidelines and expectations) are related with desired students' outcomes (for an overview, see Grolnick, 2009) and should thus be analyzed in future studies. Finally, future studies should investigate both qualitative and quantitative ways of parental homework involvement to gain deeper insights into the mechanisms and differences between the two dimensions of involvement.

ETHICS STATEMENT

An ethics approval for this research was not required as per the ethical guidelines of the Faculty of Psychology at FernUniversität in Hagen and regulations of the German Psychological Society due to the noncontroversial nature of the content and the administration of the study. All subjects were parents (adults aged above 21 years). Before their participation, all subjects were informed about the research purposes. Also, they were informed that participation in this research is anonymously and voluntarily. Furthermore, they were informed about the applicable data protection guidelines and the possibility to quit participation whenever they wanted without any disadvantages. Informed consent of the participants was implied through survey completion.

AUTHOR CONTRIBUTIONS

SD contributed to the design of the study and the data collection, carried out the analyses and data interpretation, drafted and finalized the manuscript. SY and KJ contributed to the design of the study, parts of the analyses, and data interpretation and provided input for revisions of the manuscript draft.

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Student Perception of Teacher and Parent Involvement in Homework and Student Engagement: The Mediating Role of Motivation

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Currently, there is much debate about the value of assigning homework. Organizations such as the OECD have concluded that doing more homework is not synonymous with better performance. This study was designed to analyze the mediating role of student motivation in the relationship between the involvement of parents and teachers in homework and the engagement of students in these tasks. Seven hundred and thirty students in Compulsory Secondary Education (7th–10th grade) participated from 14 schools in the north of Spain. Three competing models were developed and tested to study motivational mediation: a non-motivational mediation model (direct effects model); a total motivational mediation model (indirect effects model); and a partial motivational mediation model (mixed effects model). The best model was adjusted according to gender and school year variables. The total mediation motivational model demonstrated the best fit (indirect effects model). The results suggest the total mediation of student motivation in the relationship between the perception of parents' and teachers' involvement in homework and student cognitive engagement in these tasks. Some differences, albeit slight, were observed with respect to gender and school year. The results have clear theoretical and educational implications.

Keywords: student homework motivation and engagement, perceived parental homework involvement, perceived teacher homework involvement, secondary education, homework engagement

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INTRODUCTION

Homework has been a very common topic in educational research in recent decades (Trautwein, 2007; Fernández-Alonso et al., 2015; Valle et al., 2015; Baş et al., 2017; Fan et al., 2017), most of which has tended to analyze its relationships and its real impact on student academic achievement. Past research has often focused more on aspects related to the amount of homework done and the time spent on it than on the quality of the homework process, its precursors, and its effects on learning.

The homework process is what students do when dealing with homework; how they approach their work and how they manage their personal resources and settings when they do homework. Research and theory suggest that students' intentions and reasons for doing homework influence how they cope with it; in other words, the quality of their engagement (Ryan and Deci, 2000). Some students approach homework with the intention of learning and reinforcing the knowledge acquired in class, trying to resolve questions that may arise while doing homework, and relating the homework to what they have previously learned. It therefore involves an intrinsic purpose of understanding the ideas and using strategies to create meaning. In this context, intrinsic motivation has been associated with a host of positive outcomes such as persistence, performance, interest, and positive emotions (Bouffard et al., 2001; Hardre and Reeve, 2003; Coutts, 2004; Valle et al., 2016). Most studies have shown that the deeper students' approach to learning, the better their learning outcomes. When students are involved in academic tasks mainly for the purpose of understanding, they do those tasks more profoundly and meaningfully, they use self-regulation strategies in their learning process and exhibit better well-being (Bouffard et al., 2001; Midgley, 2002; Vansteenkiste et al., 2005). Conversely, if students work on homework because they feel compelled by their teachers, and perhaps by their parents, a sense of duty or avoidance of punishment (Walker et al., 2004), it is very likely that the student will exhibit poor persistence and little significant learning (Vallerand et al., 1997).

Various theoretical approaches have been used as frameworks for research in the past: Self-Determination Theory (SDT- Deci and Ryan, 2000), Expectancy-Value Theory (EVT- Eccles, 2005), Goal Orientation Theory (Elliot, 2005) and the Student Engagement Framework (Reschly and Christenson, 2012). These theoretical frameworks, in various ways, agree in assuming that academic motivation is context-dependent. The support provided by context (mainly parents and teachers) is fundamental in explaining the type of, and changes in, motivation (Katz et al., 2010). In Connell and Wellborn's (1991) model of self-system processes, motivation was viewed as a mediator between context and outcomes. In our study, as in recent research (e.g., Feng et al., 2019), we attempted to analyze the extent to which this model can be applied to the field of homework. The student engagement framework seems to be a good theoretical model to pursue this objective.

In this study we investigate to what extent students' homework motivation mediates between the support of the context (i.e., parental and teacher homework involvement) and student homework engagement.

Motivation and Student Homework Engagement

Engagement and motivation to learn are highly interrelated. Some researchers use the terms engagement and motivation interchangeably (e.g., Martin, 2007), others have proposed that the meta-construct of student engagement subsumes motivation (e.g., Fredricks et al., 2004), while others argue that they are different, but closely related constructs. As different constructs, motivation represents intention and engagement represents action (e.g., Russell et al., 2004). In our study we follow this third line of thought: motivation and student engagement are understood as related, but different constructs.

Student engagement has been significantly associated with contextual factors (Lam et al., 2012). Parent and teacher involvement are two of the main variables responsible for student motivation and homework engagement. Research has identified parent involvement in homework as one way that parents and families can influence student motivation and school engagement. Parents who provide assistance with homework play a critical role not only in fostering learning, but in scaffolding strategies for time management and problem-solving (Moè et al., 2018). Furthermore, their interest in and help with homework predicts their children's self-perceptions of competence (Hoover-Dempsey et al., 2001; Pomerantz et al., 2006).

So, how does parent and teacher involvement in homework impact children's engagement and achievement? To answer this primary question, we bring the proposal from Grolnick and Slowiaczek (1994) to the homework field. They suggest two models: (i) a direct effects model, and (ii) an indirect or motivational model.

Focusing on the field of parental involvement in homework, the direct effects model would suggest that parental involvement in children's homework helps children by teaching them the academic skills they need to do good homework. The indirect effects model suggests that parental homework involvement affects children by promoting their motivation to engage with their homework and school tasks and do them well. According to this indirect or motivational model, when parents place importance on homework, children themselves come to value homework and develop the sense of competence that enables them to make efforts in learning activities, such as homework. Thus, the motivational homework model suggests that parental involvement in homework facilitates the motivational resources that enhance children's homework engagement (Raftery et al., 2012). Both models would have similar explanations in the case of teacher involvement in homework.

Teacher Involvement in Homework

Setting homework is an extremely widespread instructional practice (OECD, 2014). And, although the reasons for setting homework may be different depending on variables such as the type of culture (Moorhouse, 2018), teachers play absolutely critical roles in the homework process (Murillo and Martinez-Garrido, 2014). They play these important roles at two points in the homework process. In the first phase by setting the objectives of homework assignments and designing tasks; and in the final phase by implementing classroom follow-up practices (Cooper, 2001; Epstein and Van Voorhis, 2001; Rosário et al., 2015).

Some researchers found that middle and high school students who perceived their homework assignments as well-selected or well-prepared by their teachers reported higher motivation and effort at student and at class level (Trautwein and Lüdtke, 2007; Dettmers et al., 2010). As Trautwein et al. (2006) stated in

their theoretical homework model, the perceptions of homework quality influence homework expectations and the value ascribed to it, which predicts homework effort. In a recent study with elementary students, Rosário et al. (2019) concluded that what seemed to explain achievement was the students' perception of the quality of homework (i.e., assignments which are well-chosen by the teacher, which are interesting, related to the material taught in class, and useful for understanding the material covered in class), more than the type of homework set (see also, Fredricks, 2011).

Cunha et al. (2018a) explored teachers' conceptions of homework feedback (47 teachers from elementary and middle schools participated in six focus groups) focusing on definition, purpose, types, and perceived impact. Teachers conceptualized homework feedback in three directions (i.e., teacher feedback to students, student feedback to teachers, and homework self-feedback). The most common purpose reported by most teachers was teacher monitoring of student learning, with checking homework completion and checking homework on the board being the most commonly used type of homework feedback in class. In another study at middle school level, Rosário et al. (2019) found that teachers' purposes for homework follow-up practices in class were focused on identifying students' learning strengths and weaknesses, promoting students' engagement, and addressing students' difficulties in mathematics. The follow-up practices included homework feedback provided in class: oral or written praise, criticism, written comments (highlighting right and wrong answers), rewards, general review of homework in class, and grading (e.g., Elawar and Corno, 1985; Corno, 2000; Cooper, 2001; Medwell and Wray, 2018).

These homework feedback practices are an important instructional tool for teachers in their teaching processes (e.g., helping identify students' difficulties, errors or misconceptions in homework; approaching the learning content accommodating students' lack of prior knowledge, and redesigning homework to match student needs) (Corno, 2000; Epstein and Van Voorhis, 2001; An and Wu, 2012). However, feedback provided by the teacher is also important for students because it is a way for the students to perceive the quality of their progress and help them to overcome difficulties they may have when doing homework (Trautwein et al., 2009; Núñez et al., 2015a). To be effective, feedback should provide information on the progress achieved and on how to act in the future. Providing feedback about a particular task should include information about how successfully it was done, providing an opportunity to improve and expand knowledge.

Previous research has shown that teacher homework feedback, as perceived by students, is positively related to student interest in homework (Xu, 2008), quality of student motivation toward homework (Katz et al., 2010), homework management strategies (Xu et al., 2017), and amount of homework completed and academic achievement (Núñez et al., 2015a). For example, the study by Núñez et al. (2015a), with students from various school years (grades 5–12), concluded that the better the student perception of teachers' homework feedback, the greater the amount of homework completed and the better the homework time management. When students perceive their homework as of higher quality, they are more likely to put in more effort, complete homework more frequently, perform better on assignments, and achieve higher grades in mathematics. Moreover, these authors found that students' academic achievement is indirectly and positively associated with teacher homework feedback through students' homework behaviors and self-regulation (i.e., amount of homework completed; quality of homework time management), highlighting the importance of student engagement in the homework process. Research also shows engagement to be higher in students who have developed strong relationships with their teachers, in which the teachers support students' autonomy, have high expectations, and give consistent and clear feedback.

Parental Involvement in Homework

Patall et al. (2008) found positive effects in relation to parental involvement in homework, among other variables, in student attitudes to homework, and Pomerantz et al. (2007) found that parental behavioral involvement improves student achievement because it promotes student motivation and encourages student commitment. However, relationships between parental involvement in homework and academic achievement have been extensively debated and frequently researched (Gonida and Cortina, 2014; Gonida and Vauras, 2014) with inconsistent results. Some studies have found a positive relationship (e.g., Cooper et al., 2001; Pomerantz and Eaton, 2001), others have reported a negative relationship (Schultz, 1999), and others mixed results (e.g., Dumont et al., 2012).

In three longitudinal studies, Van Voorhis (2011) found a positive relationship between parental involvement, guided by a systematic intervention, and student achievement in mathematics, science, and language. Although some studies using structural equation models (SEM) have also reported a positive relationship between parental involvement and achievement (Cooper et al., 2001; Pomerantz and Eaton, 2001), others have found a negative relationship, and some, mixed results (Dumont et al., 2012). In particular, Dumont et al. (2012) found both positive and negative relationships depending on the quality of parental involvement and the different measures of the educational outcome (achievement, self-concept, and attitudes).

The mixed results may be due to multiple factors. Results vary depending on factors such as research design (Patall et al., 2008); content domain (e.g., subject-specific vs. general homework and academic achievement, Epstein and Van Voorhis, 2012); different dimensions of the construct measured (Dumont et al., 2012, 2013; Karbach et al., 2013); student school year (Cooper and Valentine, 2001), etc. Of all of those, the type of parental involvement may be one of the most determining factors (Ng et al., 2004; Pomerantz et al., 2007; Patall et al., 2008; Karbach et al., 2013; Gonida and Cortina, 2014; Suárez et al., 2014; Núñez et al., 2015b). Dumont et al. (2012, p. 64) suggested that "it is therefore crucial to distinguish between different dimensions of parental homework involvement and not to focus only on its quantity. Because different forms of parental homework involvement may have contrasting effects, an exclusive focus on the extent of parents' involvement may lead to erroneous conclusions about its effectiveness."

Different types of parental involvement in homework have been reported in the literature. For example, Hoover-Dempsey et al. (2001) describe eight ways in which parents can be involved in their children's homework. From a more precise perspective, Pomerantz et al. (2007) indicated four qualitatively different dimensions of parent involvement in homework: autonomy support vs. control, process vs. person focus, positive vs. negative affect, and positive vs. negative beliefs about children's potential. At a more systematic and operational level, Lorenz and Wild (2007), proposed four different types of parental involvement: autonomy supportive practices (i.e., parents encourage self-initiated homework activities), control (i.e., parents pressure children to complete their homework assignments and issue instructions that undermine autonomous behavior), structure (i.e., parents organize the homework environment), and emotional involvement (i.e., parents acknowledge children's feelings about homework). Gonida and Cortina (2014), basing their work on various ideas from previous research, developed and validated a self-report scale that provides information directly through parents' responses on four different forms of parental involvement in homework: (i) autonomy support and promotion of self-regulated learning, (ii) control, (iii) interference, and (iv) cognitive engagement related to schoolwork as supplementary to homework. Recently, Cunha et al. (2018b) validated the Parental Homework Management Scale (PHMS) for parents of elementary and junior high school children (ages 9–13 years) in the domain of mathematics, based on the responses of a sample of 2,118 parent–child dyads. The PHMS scale was originally constructed to measure four common types of parental involvement: (1) environment, (2) time, (3) motivation, and (4) emotion management. However, the results showed that at such early ages the PHMS is composed of two different but related factors: (1) environment-time management and (2) motivation-emotion management.

Different types of parental homework involvement have different implications for the student's engagement with homework. Dumont et al. (2012) found both positive and negative relationships, depending on the nature or quality of the involvement. For example, whereas perceived parent–child conflicts about homework were negatively associated with educational outcomes, perceived parental competence and support for students' self-direction were positively related to achievement. Similar results were reported by Karbach et al. (2013), who found that academic achievement was significantly and negatively associated with parental control and strict structure (i.e., excessive control and pressure on children to complete assignments, consistent guidelines and rules about homework and school work). Gonida and Cortina (2014) saw different patterns of student gain depending on the type of parental involvement in homework: autonomy support was the most positive (parents who are involved giving support and favoring the autonomy of the child promote the development of a motivational orientation directed to learning and mastery), while interference was the most damaging (because it undermines mastery goal orientation and reduces perceived competence). Data from the study by Cunha et al. (2018b) showed a similar picture to that of previous studies (e.g., Dumont et al., 2012; Karbach et al., 2013; Gonida and Cortina, 2014): the two dimensions of the PHMS (i.e., environment-time and motivation-emotion management) were positively associated with homework self-regulation strategies and positive homework emotions. Finally, Silinskas and Kikas (2019) found that perceived parental control negatively and significantly predicts mathematical performance, student self-concept and student persistence. However, perceived parental support positively predicts student task persistence.

So, the results from past research show without a doubt that autonomy support is the most advisable form of parental involvement in children's homework. Parental homework autonomy support can encourage the development of intrinsic motivation toward homework (see also Katz et al., 2011; Madjar et al., 2016; Moè et al., 2018; Feng et al., 2019), increased perceived competence and homework management (Xu et al., 2017; Moè et al., 2018), and task persistence (Silinskas and Kikas, 2019), as well as reducing procrastination (Katz et al., 2014). In general, all of this suggests that parental homework involvement may play a valuable role in student homework management.

Role of Student Age and Gender

The association between parental homework involvement and student achievement proved to be mediated by school year (Skaliotis, 2010), happening less frequently as students grow older (Hoover-Dempsey and Sandler, 1997), although the data we have available seem to suggest greater consistency in middle and high school than in elementary school (see Chen, 2008; Patall et al., 2008). Silinskas and Kikas (2019) reported mixed results from their study with elementary school students. On the one hand, the results showed that perceived parental support was positively related to student task persistence, but the relationship disappeared when the sample was split by gender. Differences related to school year in the relationship between parental homework involvement and student homework management were also found by Núñez et al. (2015b). The data from that study indicated that perceived parental homework support and control was not related to student homework behaviors at the elementary school level, there was considerable association at the junior high school level, and more targeted association at the high school level. Finally, the study by Gonida and Cortina (2014), found differences associated with school year (elementary and junior high school years) in parental homework involvement. However, those differences were related to the mean scores for some of the variables (i.e., parent autonomy homework support and control), but no differences were seen in the structural part of the full mediation model tested.

Findings from Núñez et al. (2015b) suggested that higher school years (Grades 5–12) were associated with lower levels of perceived homework feedback from teachers. This coincides with data from other studies (e.g., Katz et al., 2010).

With respect to student variables (homework motivation and homework engagement), the available data suggest that as students move from elementary to high school, motivation and engagement decrease. For example, Katz et al. (2010) found school-year-related differences in student homework autonomous motivation: junior high school students have lower

motivation than elementary school students. Similar data has been seen in studies carried out in different cultures and environments. Hong et al. (2009), analyzing Chinese students' (7th and 11th graders), concluded that older students were less engaged, persisted less, and expressed less enjoyment doing homework than younger students did. This pattern of devaluing school work, and exhibiting less effort and persistence when completing homework is in line with other studies and analyses in western cultures (e.g., Epstein and Van Voorhis, 2012; Regueiro et al., 2018). The data from samples of European students gives us the same picture: statistically significant differences as a function of school year in student homework motivation and engagement. For example, the study from Regueiro et al. (2015) with fourth to tenth grade students found that students in the higher grades, compared with the youngest, are less interested in homework, find it less useful, and have a more negative attitude toward homework.

Finally, several studies have looked at gender. For example, in a recent study, Madjar et al. (2016) did not find statistically significant differences in boys and girls in goal orientation toward homework, although Xu (2006) had found such differences. In middle school students, Feng et al. (2019) found that boys reported higher homework autonomy motivation than girls. On the other hand, in contrast to the data from Xu and Corno (2006), Núñez et al. (2015a), reported the absence of gender differences in the perception of teacher homework feedback.

The Current Study: Goals and Hypotheses

In this study we intend to analyze the validity of the indirect effects model (or motivational model) of student homework engagement, in students from two different school levels (middle and junior high school students), and by gender. We will analyze the extent to which motivation mediates the effect of the involvement of parents and teachers on student homework engagement (i.e., use of SRL strategies). In general terms, we intend to test the hypothesis that students' autonomous motivation to do quality homework mediates the relationship between perceived teacher and parental involvement on homework and the students' homework engagement. For a mediating effect to occur, the mediator variable must be significantly related to both the independent variable and the dependent variable. Based on the results of previous research (e.g., Katz et al., 2010; Feng et al., 2019), which support a model of indirect effects or motivational model (Raftery et al., 2012), in this study we hypothesize that (i) student's perceptions of the involvement of their parents and teachers in their homework significantly influences their motivation toward homework, and (ii) that this in turn influences their engagement (Bouffard et al., 2001) in the realization of quality homework (i.e., use of self-regulated learning strategies in homework).

Data from previous research lead us to specify both hypotheses in the following terms (see **Figure 1**). First, we expect that the perception of involvement of both parents and teachers in homework will significantly and positively affect student homework motivation. The greater the perception of the involvement of teachers and parents in homework, the more motivated the student, and vice versa (e.g., Epstein and Van Voorhis, 2001; Patall et al., 2008; Karbach et al., 2013; Núñez et al., 2015a,b, 2017; Rosário et al., 2015, 2018). However, given the more direct relationship between teachers and homework, as reported in other studies (e.g., Feng et al., 2019), we expect teachers' behavior to be a more powerful predictor than parents' behavior. Secondly, we also expect the use of self-regulation strategies for working on homework to be significantly and positively conditioned by student's motivation for homework engagement (e.g., Midgley, 2002; Vansteenkiste et al., 2005; Valle et al., 2015). Students who are more motivated toward the task

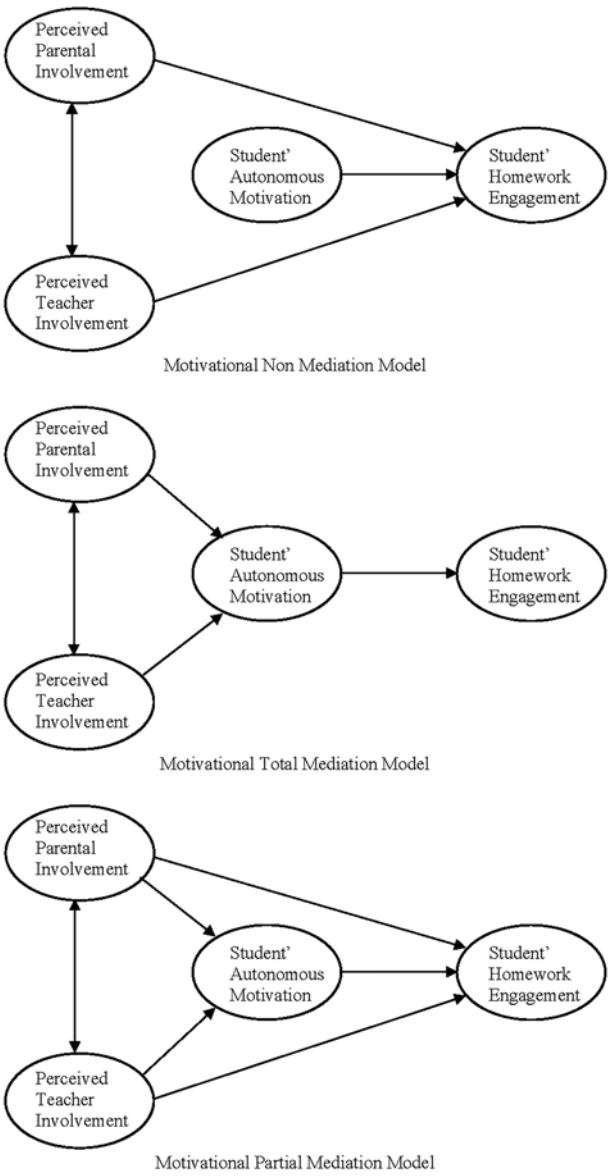

FIGURE 1 | Three versions of the motivational mediation model of homework (non, total and partial mediation).

(with the intention of learning) will tend to use more self-regulation strategies in their homework than students with less task-oriented motivation.

In order to examine these hypotheses, we formulated a model of structural equations with three variants: (i) a no motivational mediation model, or the direct effects model; (ii) a total motivational mediation model, or indirect effects model; and (iii) a partial motivational mediation model, or mixed effects model. In the total motivational mediation model, the effect of the perception of involvement of parents and teachers in homework on the use of self-regulation learning strategies occurs entirely through student homework autonomous motivation (there is an indirect effect, but not direct). However, there is partial mediation when, at the same time, both an indirect (mediation) and a direct effect occur. Finally, non-mediation takes place when the perception of involvement of parents and teachers in homework is not related to the mediating variable (i.e., homework autonomous motivation), and instead they directly influence the use of self-regulated learning strategies when working on homework.

Previous research leads us to assume a total motivational mediation hypothesis (although partial mediation could also occur). According to a model of total motivational mediation (see **Figure 1**), we hypothesize that:

H1: Perceived parental involvement (i.e., parental content-oriented support) has a positive and statistically significant effect on student's motivational involvement in homework (i.e., homework autonomous motivation), but not on student's homework engagement (i.e., student homework engagement).

H2: Perceived teacher involvement (i.e., teachers' homework management) has a positive and statistically significant effect on student's motivational involvement in homework (i.e., homework autonomous motivation), but not on student's homework engagement (i.e., student homework engagement).

H3: Student's motivational homework involvement (i.e., homework autonomous motivation) is positively and statistically significantly related to subsequent homework engagement (i.e., student homework engagement).

H4: Perceived teachers homework involvement (i.e., teachers' homework management) determines students' motivational involvement in their homework (i.e., homework autonomous motivation) to a greater extent than perceived parents' involvement (i.e., parental content-oriented support).

H5: Taking the results of the study from Gonida and Cortina (2014) as a reference, we expect no significant differences in the homework motivational model (structural part of the model) between boys and girls.

H6: In relation to school year, although this model has not been tested at different ages (the study by Feng et al., 2019, only used middle school students), based on the data provided by other researchers that have worked with different academic levels with respect to effects of parental involvement (e.g., Cooper and Valentine, 2001; Núñez et al., 2015b) and teacher involvement (e.g., Trautwein and Lüdtke, 2007; Katz et al., 2010; Xu et al., 2017) in students' homework, we hypothesize the existence of statistically significant differences in the structural part of the established model.

MATERIALS AND METHODS

Participants

The sample included 730 students in 4 years of Compulsory Secondary Education (CSE) in Spain who were enrolled in one of the 14 public schools participating in the study (located in three provinces in northern Spain). Approximately half of the schools are located in urban areas, and the other half are in rural or semi-urban areas. Just over half (56.6%) of the students were girls. The distribution of participants by year is similar: 26.6% in 7th grade; 20.8% in 8th grade; 24.9% in 9th grade; and 27.7% in 10th grade. The ages of the participants ranged between 12 and 16 years old.

Instruments

The variables Perceived Parental Homework Involvement and Perceived Teacher Homework Involvement were obtained from various items of the *Homework Survey* (see **Appendix**), used in previous research (e.g., Núñez et al., 2015a,b; Valle et al., 2015).

Perceived Parental Homework Involvement (PPHWI)

This measures parents' supportive behavior (as perceived by the students) when their children do homework (see **Appendix**). The three items in this subscale were taken from the Parental Homework Support Scale (Xu et al., 2017). The measure mainly has to do with perceived parental content-oriented support, rather than parental homework autonomy as such. The students' responses are rated on a five-point Likert-type scale ranging from 1 (*totally false*) to 5 (*absolutely true*). Taking into account the small number of items (three), the measure shows good reliability in the current study ($\alpha = 0.84$).

Perceived Teacher Homework Involvement (PTHWI)

This evaluates the teacher's feedback perceived by students when the students do homework in the classroom (see **Appendix**). It requests information about teachers' behavior in adapting homework to students' difficulties and supervising their level of comprehension, as well as errors made. In this study it is understood in the sense of teacher homework management (homework handling). Responses are rated on a 5-point Likert-type scale ranging from 1 (*totally false*) to 5 (*absolutely true*). Although the number of items is small (three), the reliability of the measurement in this study is moderate ($\alpha = 0.60$).

The variables Student Homework Autonomous Motivation and Student Homework Engagement were provided by the students' responses to the "Inventario de Procesos de Estudio"

[(Study Process Inventory) Rosário et al., 2013], after adapting it to the process of doing homework. Respondents rate each one of the six items on a five-point Likert-type scale ranging from 1 (*totally false*) to 5 (*absolutely true*).

Student Homework Autonomous Motivation (SHWAM)

We estimated students' greater or lesser motivational involvement through their intention to master the homework and learn (task orientation). This instrument evaluates students' interest in homework, their satisfaction when doing it, as well as their positive feelings about working that way. The three items offer a measure of students' autonomous motivation for homework similar to that provided by the scale from Katz et al. (2011) and used in Moè et al. (2018). Taking into account the small number of items (three), the reliability of the measurement in this study is acceptable ($\alpha = 0.73$).

Student Homework Engagement (SHWE)

Students' engagement in homework was measured with three items that asked them about the self-regulated learning strategies used when doing homework (planning, monitoring, and evaluation). The three items were extracted from the Self-Regulation Learning Strategies Inventory (Rosário et al., 2012), and provide information about the use of a macro-SRL strategy consisting of the three phases described by Zimmerman's Model (e.g., Zimmerman, 2011). The reliability of the measure is modest in this study ($\alpha = 0.70$), but if we take into account the number of items (three), it can be considered acceptable.

Procedure

The target variable data were collected during regular school hours, after obtaining the consent of the school directors and the students' parents. The questionnaires were administered in a single session by specialized staff that collaborated in the investigation. Participants completed all the questionnaires individually and without a time limit. The procedures followed in the study were in accordance with the ethical standards of the Research and Teaching Ethics Committee of the University of A Coruña, the University of Oviedo, and the Helsinki Declaration.

Data Analysis

The structural equation model (SEM) was adjusted with the AMOS 22 program in SPSS (Arbuckle, 2013). Students with a large number of missing values were removed from the database (1.23%), while the rest of the missing values were imputed.

The data were analyzed in three steps. Firstly, we calculated and reviewed the descriptive statistics and the Pearson correlation matrix. Secondly, considering that the variables exhibited a normal distribution, we estimated the goodness of fit of three versions of the structural equation model using robust maximum likelihood (RML): (i) no mediation (direct effects model), (ii) total mediation (indirect effects model), and (iii) partial mediation (mixed effects model). Thirdly, based on the AIC and BIC statistics, the best model of the three was identified and adjusted for the total population, for boys and girls, and for the two school levels. While we initially used data from 4 years (7th–10th grade) for the analysis of the effect of this variable, we regrouped the 4 years into two groups: middle school (7th and 8th grade) and junior high school (9th and 10th grade). In the Spanish educational system, 7th and 8th grade correspond to the first cycle of CSE and 9th and 10th grade to the second cycle of CSE. In the Spanish system these educational stages have different motivational, affective, cognitive and behavioral requirements at the student and context level. The first stage (7–8th) in which students "feel older" (e.g., greater autonomy, less parental control) also involves difficulties in adapting to a very different situation from the one they have left behind (new classmates, new friends, new teachers, etc.), and is more demanding. In contrast, in the second stage (9–10th) the students are more confident (of themselves and of the context), and have greater perceived control. Similarly, parents and teachers expect more autonomy from them but also more responsibility. This second stage also represents the end point of compulsory education. Taking all that into account, it seemed appropriate to adjust the homework motivational model in the two stages separately.

Model fit was evaluated using the most important indexes and statistics from AMOS 22 [i.e., χ^2, χ^2/df, the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA)]. Evidence of a good fit is when χ^2 has a $p > 0.05$, $\chi^2/df < 5$, AGFI ≥ 0.90, CFI ≥ 0.95, and RMSEA ≤ 0.05. The smallest values of AIC and BIC indicate the best model. The effect size of the regression coefficients were calculated using Cohen's (1988) *d* statistic.

RESULTS

Following the data analysis strategy above, the results are described in three sections: (a) descriptive statistics; (b) selecting the best model; and (c) fit of the selected model and parameter evaluation.

Descriptive Statistics

Table 1 gives the descriptive statistics for the total sample of students. The data show: (1) that the variables were significantly correlated with each other (all the correlation coefficients were statistically significant), and (2) that the symmetry and kurtosis of the variables indicated a sufficiently normal distribution.

Selecting the Best Model

Table 2 shows the results of the adjustment of the three models in competition. The data indicates that the two models that include mediation (total and partial mediation models in **Figure 1**) have excellent indexes of fit. The small difference in the values of the fit indexes of the two models is due to the fact that the two direct effects that made partial mediation possible (perceived involvement of parents and teachers on the student's engagement in homework) are not statistically significant (perceived parental involvement → student homework engagement = 0.061, $p > 0.05$; perceived teacher involvement → student homework engagement = 0.036, $p > 0.05$). However, because the AIC

TABLE 1 | Pearson correlations, mean, standard deviation, skewnes, and kurtosis of observed measures.

	PPHWI1	PPHWI2	PPHWI3	PTHWI1	PTHWI2	PTHWI3	SAM1	SAM2	SAM3	SHWE1	SHWE2	SHWE3
PPHWI1	–											
PPHWI2	0.604	–										
PPHWI3	0.584	0.704	–									
PTHWI1	0.216	0.201	0.234	–								
PTHWI2	0.130	0.162	0.178	0.354	–							
PTHWI3	0.187	0.201	0.219	0.418	0.251	–						
SAM1	0.182	0.166	0.216	0.296	0.185	0.275	–					
SAM2	0.171	0.192	0.227	0.262	0.200	0.278	0.563	–				
SAM3	0.210	0.230	0.319	0.243	0.196	0.180	0.478	0.401	–			
SHWE1	0.192	0.196	0.268	0.321	0.167	0.257	0.531	0.535	0.424	–		
SHWE2	0.227	0.214	0.254	0.242	0.178	0.180	0.390	0.338	0.427	0.414	–	
SHWE3	0.223	0.208	0.209	0.233	0.155	0.237	0.446	0.402	0.434	0.476	0.434	–
M	3.17	3.21	3.21	3.50	2.07	4.20	3.28	3.69	2.45	3.29	2.63	2.89
SD	1.46	1.52	1.43	1.24	1.24	0.98	1.20	1.13	1.26	1.15	1.19	1.14
Skewness	−0.21	−0.21	−0.21	−0.50	0.92	−1.15	−0.26	−0.63	0.47	−0.30	0.28	0.04
Kurtosis	1.46	1.52	1.43	1.24	1.24	0.98	1.20	1.13	1.26	1.15	1.19	1.14

PPHWI1 to PPHWI3 are observed measures of Perceived Parental Homework Involvement; PTHWI1 to PTHWI3 are observed measures of Perceived Teacher Homework Involvement; SAM1 to SAM3 are observed measures of Student Autonomous Motivation; SHWE1 to SHWE3 are observed measures of Student Homework Engagement. All variables have the same scale: minimum = 1, maximum = 5. All correlation coefficients are statistically significant at $p \leq 0.01$.

TABLE 2 | Results of the fit of the three competing motivational mediation models.

	Non-mediation model (NMM) (Direct effects model)	Partial mediation model (PMM) (Mixed effects model)	Total mediation model (TMM) (Indirect effects model)
χ^2 (*df*)	255.398 (50)	103.963 (48)	106.847 (50)
p	<0.001	<0.001	<0.001
χ^2/df	5.108	2.166	2.137
AGFI	0.918	0.961	0.961
CFI	0.926	0.980	0.980
RMSEA [LO, HO]	0.075 [0.066, 0.084]	0.040 [0.029, 0.051]	0.039 [0.029, 0.050]
AIC	311.398	163.963	162.847
BIC	440.003	301.754	291.452

TABLE 3 | Goodness-of-fit statistics for the Motivational Total Mediation Model of homework in the overall sample, and by gender and grade.

Sample	$\chi^2(p)$	χ^2/df	AGFI	CFI	RMSEA [LO, HO]
Total	106.85 (0.000)	2.139	0.96	0.98	0.039 [0.029, 0.050]
Girls	94.45 (0.000)	1.889	0.94	0.97	0.048 [0.033, 0.063]
Boys	60.70 (0.143)	1.214	0.95	0.99	0.027 [0.000, 0.047]
7th–8th grade	63.03 (0.102)	1.261	0.95	0.99	0.028 [0.000, 0.048]
9th–10th grade	84.75 (0.002)	1.695	0.94	0.97	0.043 [0.026, 0.058]

The models have 50 degrees of freedom.

and BIC values of the total mediation model are lower than those of the partial mediation model, and because the total mediation model is more parsimonious than the partial mediation model, we selected the total mediation model as the model with best fit.

Evaluation of the Total Mediation Model of Homework

The Total Mediation Model was adjusted for the total sample, for boys and girls, and for school years, grouped into two levels [middle (7th–8th) and junior high school (9th–10th)]. **Table 3** presents the corresponding fit statistics. The data show an excellent fit of the model in all cases for the total sample and for the four specific samples. These results suggest that the Total Mediation Model does not require additional modifications.

Table 4 shows the standardized regression coefficients, statistical significance, and effect size corresponding to the fit of the model in the four specific samples and in the total sample. In general, the data support the motivational total mediation model, both for girls and boys and for the two school levels analyzed. The data in **Table 4**, relative to the total sample give good support to the hypotheses that produce the motivational model of total mediation.

H3 was confirmed: motivation was a powerful determinant of the use of self-regulated learning strategies doing homework (student homework engagement), both in the total sample and as a function of gender and school level (the regression coefficients were higher than $b = 0.90$), except for the junior high school sample (9th–10th grade), which was slightly lower ($b = 0.89$). The effect sizes were very large (see the *d* statistic in **Table 4**). Likewise, H1 and H2 were confirmed in the total sample.

TABLE 4 | Standardized regression coefficients of the Motivational Total Mediation Model of homework.

Standardized direct effects	Standardized regression weights	Standard error	Critical ratio	Probability *P*<	Effect size *d*
Total sample					
PPHWI → SAM	0.192	0.041	4.038	<0.000	0.302
PTHWI → SAM	0.501	0.065	7.860	<0.000	0.608
SAM → SHWE	0.953	0.054	16.913	<0.000	1.605
PPHWI ↔ PTHWI	0.399	0.051	7.096	<0.000	0.544
Gender samples					
Females (*n* = 383)					
PPHWI → SAM	0.250	0.050	4.001	<0.000	0.417
PTHWI → SAM	0.461	0.071	5.701	<0.000	0.536
SAM → SHWE	0.950	0.072	12.450	<0.000	1.649
PPHWI ↔ PTHWI	0.331	0.071	4.652	<0.000	0.489
Males (*n* = 294)					
PPHWI → SAM	0.116	0.076	1.429	0.153	0.167
PTHWI → SAM	0.501	0.126	4.659	<0.000	0.564
SAM → SHWE	0.942	0.084	10.278	<0.000	1.497
PPHWI ↔ PTHWI	0.449	0.079	4.678	<0.000	0.567
Grade samples					
7th–8th (*n* = 346)					
PPHWI → SAM	0.129	0.065	1.724	0.085	0.186
PTHWI → SAM	0.596	0.164	4.965	<0.000	0.554
SAM → SHWE	0.951	0.078	12.150	<0.000	1.725
PPHWI ↔ PTHWI	0.386	0.060	4.202	<0.000	0.463
9th–10th (*n* = 384)					
PPHWI → SAM	0.212	0.057	3.345	<0.000	0.346
PTHWI → SAM	0.402	0.077	4.927	<0.000	0.519
SAM → SHWE	0.886	0.076	10.730	<0.000	1.308
PPHWI ↔PTHWI	0.272	0.067	3.782	<0.000	0.393

PPHWI (Perceived Parental Homework Involvement), PTHWI (Perceived Teacher Homework Involvement), SAM (Student Autonomous Motivation), SHWE (Student Homework Engagement). Effect (→), relationship (↔).

The data also support the hypothesis about the association between perceived teacher involvement on homework and student autonomous motivation, with a moderate effect size (d = 0.608), and the hypothesis about the relationship between perceived parental involvement in homework and student autonomous motivation, which was significant, albeit with a small effect size (d = 0.302). Confirming the fourth hypothesis (H4), that perceived teacher involvement in homework has a greater relationship than perceived parental involvement in homework with students' autonomous homework motivation. The confirmation of the first three hypotheses (along with the fourth) allow us to conclude that student autonomous motivation mediates the relationship between the involvement of parents and teachers perceived by students and student homework engagement.

Student homework engagement is explained to large degree (90.9%) by the direct effect of student autonomous motivation, but also due to the indirect effect of perceived teacher and parent homework involvement through student autonomous motivation. More specifically, of the total explanation of student homework engagement, the unique effect of student autonomous motivation is 24.79%; the effect corresponding to perceived parental homework involvement on student homework engagement through student autonomous motivation is 18.29%; and the effect corresponding to perceived teacher homework involvement on student homework engagement through student autonomous motivation is 47.74%. As it is a model of total mediation of student motivation, the direct effect of teacher and parent on student homework engagement is zero. Finally, parent and teacher homework involvement explain 36.4% of student autonomous motivation, directly (28.78%: 3.68% parents and 25.10% teachers) and indirectly (7.62%; one through the other: r = 0.399, d = 0.870).

The data support only a partial confirmation of the fifth hypothesis (H5). There are no significant differences in terms of two of the three direct effects of the model: both girls' and boys' perception of teacher homework involvement is statistically and significantly related to student autonomous motivation, to a similar extent (with a moderate effect size, slightly higher than d = 0.50). On the other hand, girls and boys exhibit positive, statistically significant and similar relationships between student autonomous motivation and student homework engagement (with a very large effect size, around d = 1.5). However, there are differences between the two groups in the association between perceived parental homework involvement and student autonomous motivation: while it is positive and statistically significant for girls (with a moderate effect size), it is not statistically significant in the sample of boys. Therefore, the data suggest that in the sample of girls there is mediation of student autonomous motivation in the relationship between perceived parental homework involvement and student homework engagement, while this is not so in the sample of boys. In other words, boys' homework engagement is not explained by perceived parental homework involvement.

Finally, the data related to school year (H6), indicate that the relationship between student autonomous motivation and student homework engagement does not vary according to whether the students are in middle or junior high school. Likewise, they are not significantly different in the association between perceived teacher homework involvement and student autonomous motivation. However, as with gender, significant differences were found in the association between perceived parental homework involvement and student autonomous motivation. In particular, while the relationship is statistically significant in junior high school (although the effect size is small, d = 0.346), it is not in middle school ($p > 0.05$). Also in this case, the data suggest that there is no mediation at middle school: perceived parental homework involvement does not directly or indirectly determine student homework engagement.

Ancillary Analyses

The data in **Table 4** indicate that the association between student autonomous motivation and student homework engagement is very strong, both for the total sample (b = 0.953) and for girls (b = 0.950), boys (b = 0.942), middle school students (b = 0.951),

and junior high school students (b = 0.886). This adds fuel to the fire of the dispute over whether they are similar or different constructs. Although in this study we have assumed the theoretical position that motivation and engagement are different constructs, and were treated that way in the formulation of the model and the treatment of the data, there is no doubt that the two variables are intimately related, as the aforementioned data demonstrates. Are they different constructs (e.g., Russell et al., 2004; Reeve, 2012) or are they two dimensions of a macro-construct (e.g., Fredricks et al., 2004; Martin, 2007)?

To answer this question, we produced two models by confirmatory factor analysis, with one and two factors, taking observed measures as the answers to the three items that theoretically measure student homework autonomous motivation and the three that theoretically measure student homework engagement. If the unifactorial model has the best fit, we could say we are faced with a macro-construction where motivation and engagement are two sides of the same coin. However, if the bifactorial model offers the best fit, then we may conclude that these are related but different constructs.

The data provided by the CFA seems to support a two-factor model. Although the fit of both models is good [one factor model: $\chi^2_{(9)} = 48.014$, $p < 0.001$, GFI = 0.977, AGFI = 0.946, TLI = 0.950, CFI = 0.971, RMR = 0.046, RMSEA = 0.078; two factor model: $\chi^2_{(8)} = 41.455$, $p < 0.001$, GFI = 0.980, AGFI = 0.946, TLI = 0.954, CFI = 0.980, RMR = 0.045, RMSEA = 0.076], the two factor model fits significantly better than the one factor model since the AIC is smaller (AIC one factor model = 72.014; AIC two factor model = 67.455). Therefore, the data seem to suggest that student motivation and student engagement are closely related but distinct constructs. The results of this research do not solve the question at all, so it may be a good idea to design a highly controlled study with zero threats to the validity.

DISCUSSION

In this study, we wanted to analyze the mediating role of students' autonomous homework motivation in the relationship between perceived parental and teacher involvement in homework and the students' homework engagement (i.e., use of SRL strategies in homework). In order to examine this hypothesis, we produced a structural equation model, and three versions (no motivational mediation, partial motivational mediation and total motivational mediation) were tested, for the total sample, and by gender and school year (middle and junior high school). Below, we discuss the results and their educational implications. We also describe some limitations of the study that could influence the data.

From a general point of view, the data suggest a total motivational mediation model, with some differences by gender and by school year. Despite the differences, we can conclude that motivation completely mediates the effect of teacher and parental involvement on students' homework engagement (i.e., the use of self-regulated learning strategies).

The results of this study are largely in line with those from Feng et al. (2019), in that autonomous motivation mediates the relationship between perceived teacher homework management and perceived parent homework content-oriented support and student homework engagement. However, in our study, autonomous motivation mediated completely between perceived parent content-oriented support and student homework engagement, whereas the study by Feng et al. (2019) reported partial mediation.

As in previous research (e.g., Valle et al., 2016), in this study students' homework engagement is directly predicted by student autonomous motivational engagement (interest in learning and/or gaining competence and autonomy). As in other studies (e.g., Midgley, 2002; Vansteenkiste et al., 2005; Valle et al., 2015; Veas et al., 2018), the results suggest that student engagement in homework depends greatly on being motivated to acquire competence and autonomy. However, the dependence of autonomous motivation and student engagement in our study is even stronger than in previous studies. Our data seem to suggest that the three variables considered as predictors of student homework engagement really are predictors, and do not vary by gender or student age. Our data from secondary education students (7th–10th grade) complement the data from Valle et al. (2016), although that was from students in 4th, 5th, and 6th grades.

Likewise, the results in this study about the relationship between parent and teacher homework involvement and student homework autonomous motivation are in accordance with the initially proposed hypotheses in the case of the total sample, but not when gender or school year are considered.

More specifically, when it comes to parents' involvement in their children's homework (i.e., content-oriented support), in line with other studies (e.g., Epstein and Van Voorhis, 2001; Van Voorhis, 2001; Pomerantz et al., 2007; Patall et al., 2008; Karbach et al., 2013; Gonida and Cortina, 2014; Gonida and Vauras, 2014; Suárez et al., 2014; Núñez et al., 2015b; Cunha et al., 2018b; Moè et al., 2018; Feng et al., 2019; Silinskas and Kikas, 2019), when children perceive that their parents provide support (i.e., oriented to content), their interest grows due to increased competence and autonomy through their engagement in homework. However, the size of this association is weaker than expected. Although some studies have reported a moderate effect size (e.g., Katz et al., 2011; Moè et al., 2018; Feng et al., 2019), the data from our study, without looking at student age or gender, have a modest (e.g., Gonida and Cortina, 2014) to small (e.g., Silinskas and Kikas, 2019) effect size.

Looking at the responses of 5th and 8th grade students, Gonida and Cortina (2014) found a positive relationship between parent autonomy and student mastery (b = 0.18, $p < 0.01$), with a modest effect size. Despite finding differences between 5th and 8th grade in mean scores for some of the latent variables, they found no differences in the relationship between the variables. However, as in the study from Silinskas and Kikas (2019), in our study we also saw differences between girls and boys in the effect of perceived parental content-oriented support on student autonomous motivation. In addition, our study also found a link between middle and junior high grades. In terms of gender, the size of the effect of girls' perceptions of parental content-oriented homework support on

their autonomous motivation toward homework is moderate, in boys this relationship is not statistically significant. In other words, the girls' autonomous motivation for homework is much more sensitive to variations in the perception they have of the involvement of their parents in homework than in boys. In terms of age, our data indicate that the effect of perceived parental content-oriented support on student autonomous motivation is higher in junior high school (although the effect size is small) than in middle-school (the size of the effect is null). If we combine these results with those from other investigations in which parent homework support and student autonomous motivation for homework was seen to decrease as students age (e.g., Hong et al., 2009; Katz et al., 2010; Gonida and Cortina, 2014; Núñez et al., 2015b; Regueiro et al., 2018), the result seems somewhat paradoxical. As less student autonomous motivation is reported and less parental content-oriented support is perceived as the student gets older, the greater the impact of perceived parental content-oriented support on student autonomous motivation for homework. In other words, as one goes from 7th to 10th grade, there is less autonomous motivation for homework, lower perceived parental content-oriented support but nevertheless, a stronger relationship between the two variables (i.e., student autonomous motivation depends more on perceived parental content-oriented support). The explanation could lie in the child's own development. It is possible that this happens because as the child grows in competences (cognitive, motivational and affective) they find it logical for their parents to require them to be more autonomous while at the same time they have a better understanding of the importance of their parents' involvement in their homework.

The data on the effect of perceived teacher homework management on student autonomous motivation were completely in accordance with the hypothesis, both with and without controlling for gender and age. These results are consistent with previous research (e.g., Cooper, 2001; Epstein and Van Voorhis, 2001; Trautwein and Lüdtke, 2007; Trautwein et al., 2009; Dettmers et al., 2010; Katz et al., 2010; Xu et al., 2017; Feng et al., 2019), highlighting the important role of the association between teacher involvement in homework (e.g., feedback, follow-up practices, and designing homework) and student homework engagement (e.g., homework management strategies, time spent, amount of homework completed, and homework effort), and disengagement (Bempechat and Shernoff, 2012).

The impact of perceived teacher homework management on student autonomous motivation in our study is rather significant (with a moderate effect size in all cases), both in middle and junior high school, although perceived teacher content-oriented support decreases as students get older, both in our study [$t_{(728)} = 9.441$; $p < 0.001$; medium effect, $d = 0.70$] and in previous studies (e.g., Katz et al., 2010; Núñez et al., 2015a). We believe that both results have a reasonable explanation. Perhaps the decrease in student perceptions of teacher involvement in homework management as they go up the grades may be a true reflection of what actually happens (as students get older, teachers support more student autonomy). And in relation to the effect of perceived teacher homework management on student homework management, it is well understood that the strength of the association is maintained, since in both middle and junior high school it can be equally important for students to perceive that their teachers (i) make sure students understand the assigned tasks, (ii) consider the students when deciding the type of homework, or difficulty and (iii) what homework they see in class to correct mistakes. This seems to be an acceptable explanation for the similar effect sizes in girls and boys.

Although in this study there were gender differences in the mean scores of perceived teacher homework management in favor of girls [$t_{(675)} = 2.90$, $p < 0.01$, small effect size: $d = 0.22$], gender was not a factor related to the intensity of the effect of perceived teacher homework management on student homework engagement (a very similar effect size, see **Table 4**). This suggests that the autonomous motivation for homework is equally affected by perceived teacher homework management in boys and girls.

Limitations of the Study

The study has some limitations which must be taken into account in the interpretation of the results, comparison with other studies, and generalization to other educational levels, contexts or cultures. Three are particularly important.

Firstly, the measures used to construct the latent variables of the homework motivational model were taken only through self-report scales. The importance of self-report methodology in educational research is undeniable (Zimmerman, 2011), but so are the associated problems of validity and reliability (Pike and Kuh, 2005), and incongruence with other innovative methods of assessment (Winne and Perry, 2000; Azevedo et al., 2017). In addition, in this research only three items per variable were used, which could be associated with some of the problems we indicated. For example, the internal consistency of three of the four scales is within the limits of what is acceptable (i.e., perceived teacher homework involvement, student homework autonomous motivation, and student homework engagement). Likewise, three items may be too few to adequately capture everything we wanted to measure. This is the case, for example, of the measure of perceived teacher homework management: three items are used that purport to provide information on three types of teacher actions that, while undoubtedly important, may not cover the construct "teacher homework management."

Secondly, the measures in this study regarding the involvement of parents and teachers correspond only to the perception of the students (i.e., parental homework involvement and teacher homework involvement perceived by the students). We were interested in the perception of the student, more so than that of the teacher or the parents. Although the literature supports the need to consider students' perspectives of homework assignments (e.g., Warton, 2001; Landers, 2013) because students are active players in their learning process (e.g., Trautwein and Lüdtke, 2007), it also recognizes the advantage of collecting and combining reports from different data sources (e.g., Dettmers et al., 2010; Saban, 2013; Rosário et al., 2018). However, in this study only the perception of the students was included, due to the weak relationship seen in other studies between the perception of the student and the perceptions of teachers or parents (i.e.,

Rosário et al., 2018). It is important to underline this in order for it not to be ignored if the data from this study were to be used in future studies, such as meta-analyses.

Another limitation is that the study is a cross-sectional survey. The data do not support causal analysis, even though our interpretations are based on previous findings and theoretical analysis. This issue must be addressed by future research, through repeated measure designs (e.g., Silinskas et al., 2013; Silinskas and Kikas, 2019) or using experimental or quasi-experimental designs which are as ecologically valid as possible (e.g., study 2 from Moè et al., 2018).

Educational Implications

This study has clear educational implications. First, we found that one of the most important predictors of student homework engagement is student autonomous motivation (directly) and teacher and parental homework involvement (indirectly, through autonomous motivation). This highlights the importance of parents and teachers focusing on making students see that doing homework is not a punishment, or wasted time, but an opportunity to gain competence and above all, autonomy (Pomerantz et al., 2007).

Student engagement is affected by parents not only in terms of how much they participate, but also through the style with which they relate to their children in school-related tasks and aspects (Grolnick et al., 1997), including homework (Pomerantz et al., 2007). Parental autonomy support has significant consequences for motivation and student homework engagement. However, the impact should be greater than that reported by research. Because of this, it seems urgent to design interventions with parents in order to work with them to effectively use am autonomy support parental style when helping their children with homework. It is possible that this type of training would make this behavior clearer and more visible in the eyes of their children (as with the control style). An example of this type of intervention can be seen in Moè et al. (2018). The data from Moè's study showed that the training program reduced parental negative affect, and prevented a decrease in student homework motivation and emotions.

The effect of teacher homework management on student autonomous motivation for homework (directly) and student homework engagement (indirectly) was important in terms of quantity and quality. Even if things seem to be going well, they can always improve. As with parents, it is also necessary to design evidence-based interventions that facilitate the role of the teacher in the design and monitoring of homework (Pianta et al., 2012; Rosário et al., 2015).

Given that the real involvement (of parents and teachers) may be different from students' perceptions, we must train parents and teachers in effective ways of involvement that promote students' competences and autonomy, and that facilitate student's accurate perceptions of this. It is useless for teachers and parents to become involved in student homework to promote student competence and autonomy if students cannot perceive this behavior. This is what the study from Rosário et al. (2018) suggests, concluding that preparing good tasks (homework) is important, but it is not enough. In reality, it is the students who finally have to understand the teachers' purposes, the interest of the tasks and, of course, how useful the tasks are for the development of their own competence and autonomy.

CONCLUSION

Student engagement is a very important construct for explaining student progress (and dropout) in school and extracurricular tasks (Raftery et al., 2012; Rumberger and Rotermund, 2012). Student engagement is also important for the field of homework, its relationship with learning and performance, and it is a crucial element for connecting students, schools and families (Epstein, 2011). The model developed by Connell and Wellborn (1991) clearly explains how student engagement is determined by students' motivational processes and the context. In this study we examined the mediating role of student autonomous motivation between context and student engagement.

Despite its limitations, our work provides interesting data, and some issues which may be of interest in the field of homework. For example, given the strong relationship between student autonomous motivation for homework and student homework engagement, are they different constructs or are they part of the same construct? Our data suggest that they are different constructs but there is little difference in the fit of both models. More research on this matter would be welcome. More research is also needed in order to clarify the differences between boys and girls and between middle and junior high school students regarding their perceptions of their parents' involvement in homework. Likewise, we think that the positive, significant relationship between students' perception of the involvement of parents and teachers in homework is very good news. This means that despite the difficulty of the connection between family and school, at least in the field of homework, there is a strong relationship: the better the perception of teacher homework management, the better the perception of parents' content-oriented support. Although, as we see, there is already a certain connection between school and family, schools do need to think creatively about how to involve families more in educational work with their children (Raftery et al., 2012). A good example may be the approach developed by the National Network of Partnerships Schools (NNPS).

ETHICS STATEMENT

The data of the target variables were collected during regular school hours, after obtaining the written informed consent of the school directors and the students' parents. The questionnaires were administered in a single session by specialized staff that collaborated in the investigation. Participants completed all the questionnaires individually and without time limit. The procedures followed in the study were in accordance with the ethical standards of the Helsinki Declaration, and were approved by the Research and Teaching Ethics Committee of the University of A Coruña.

AUTHOR CONTRIBUTIONS

JN, BR, NS, and AV contributed conception and design of the study. IP and MR organized the database. JN and AV performed the statistical analysis. JN, BR, and NS wrote the first draft of the manuscript. IP, MR, and AV wrote sections of the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

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APPENDIX: ITEMS USED AS OBSERVED VARIABLES

Perceived Teacher Homework Involvement (Homework Management)

- The teachers ensure that I understand the assigned homework.
- The teachers adapt the difficulty of the homework to each of us.
- In class, we correct the homework to see where we have made mistakes.

Perceived Parental Homework Involvement (Content-Oriented Support)

- My parents ask me if I need help with my homework.
- Generally, one of my parents helps me with my homework if I need it.
- When I have doubts about the homework, my parents' explanations are very useful.

Student Homework Autonomous Motivation

- I do homework with interest because it helps me to better master what the teacher explains in class every day.
- Homework is a great opportunity to check to what extent I have mastered knowledge of the subjects.
- I like doing homework because I almost always end up with a good feeling of competence and I feel proud of myself.

Student Homework Engagement (SRL Strategies Management)

- When I'm doing homework, I think about how I'm doing it to confirm whether I am applying what the teacher taught us in class, and if not, to see how I can do better.
- Before I do the homework, I tend to think whether I am clear about what was taught in class and, if not, I review the lesson before beginning.
- Before I do my homework, I think of different ways to do it, whether I understand what I am doing, and whether I know how to apply it to other similar but unresolved classroom tasks (other problems, another text commentary, etc.).

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Academic Predictors of Early Adolescents' Perceived Popularity: The Moderating Effects of Classroom Academic Norm Salience

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In order to extend our understanding of the effect of academic motivations and outcomes on the social status of adolescents in the classroom context, this study examined the predictive role of academic achievement and achievement goals on early adolescents' perceived popularity and the effect of classroom academic norm salience on these relationships. In total, 2,558 adolescents in grade 7 (mean age 12.97 years) in mainland China participated in the study. Hierarchical linear modeling (HLM) was used to examine predictive effects of within-class and between-class predictors on perceived popularity. The results showed that only girls' academic achievement and the performance-approach goals of both genders positively predicted adolescents' perceived popularity. Classroom academic norm salience strengthened the negative role of performance-avoidance goals on perceived popularity, and it seems to undermine gender differences in the effect of mastery goals on perceived popularity. The current study will not only fill the gaps in research on the relationship between academic development and social status, but also reveal the special influence and significance of collective cultures such as Chinese in this field and show a different relationship pattern from those found in previous Western studies.

Keywords: perceived popularity, academic achievement, achievement goals, classroom academic norm salience, early adolescents

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INTRODUCTION

Although the acquisition of knowledge is particularly important throughout all of adolescence, many young people show a decline in academic achievement and academic motivations beginning in early adolescence (Crosnoe and Benner, 2015). During this stage, adolescents tend to be highly concerned with their social status in peer groups (LaFontana and Cillessen, 2010), and gaining and maintaining popularity become particularly important developmental goals (Sijtsema et al., 2009). As individuals transition from elementary school to middle school, their peer groups become larger and more diverse, and they need to re-establish social status in the new groups. Meanwhile, middle school students need to put more effort into studying to adjust to challenging courses. However, the pursuit and maintainance of social status seems incompatible with—and sometimes even at the expense of—good academic performance (Mayeux et al., 2008; Troop-Gordon et al., 2011). A number of studies have shown that, from childhood to early adolescence, the relationship between

academic achievement and perceived popularity changes from one that is positively correlated to one that shows no—or even negative—correlation (e.g., Meijs et al., 2010; Galván et al., 2011; Dijkstra and Gest, 2015). Good academic performance and hard work become less appreciated (Lasane et al., 1999; Juvonen and Cadigan, 2002); instead, poor academic behaviors (such as failing to complete homework) gain approval from peers (Juvonen and Cadigan, 2002). In their pursuit of social status, adolescents change the value they place on school to greater or lesser degrees. It is reasonable to theorize that this change in attitude is likely accompanied by a change in students' intrinsic academic motivations (Juvonen and Murdock, 1993). However, previous studies have focused on the association between academic achievement and perceived popularity (Meijs et al., 2010) and have hardly taken into account the relationship between academic motivations and perceived popularity. Thus, this relationship merits greater attention. While plenty of studies have proven that peer interactions are deeply influenced by cultural context—including peer culture (Fuller-Rowell and Doan, 2010; Veenstra et al., 2018) and sociocultural background (Chen et al., 2003b; Li et al., 2012)—few studies have examined the relationship between academic achievement, academic motivation, and perceived popularity within the context of classroom norms. In addition, most studies have been carried out in Western countries, despite research showing that both academic achievement and academic motivation (e.g., achievement goals) have different meanings for adolescents in Eastern and Western cultures (Liem et al., 2008; Li et al., 2012). The first purpose of the current study was to examine the predictive effects of academic achievement and achievement goals on the perceived popularity of early adolescents in collective cultures such as China's. The second purpose was to examine the moderating role of classroom academic norms in order to reveal the unique peer effects and developmental patterns of adolescents in a non-Western context.

ACADEMIC ACHIEVEMENT, ACHIEVEMENT GOAL, AND PERCEIVED POPULARITY

Perceived popularity is an indicator of a child or adolescent's social status, which reflects the consensus of his or her status, prestige or visibility in the peer group (Cillessen and Rose, 2005). Popular adolescents play a decisive role as leaders, rule makers and decision makers in their peer group, and are observed and emulated; in contrast, unpopular adolescents are subject to others' rejection and bullying and, as a result, face more developmental risks (Cillessen et al., 2011). Cultural values and norms may play roles in the behavioral profiles that define social status (Chen and French, 2008). A comparative study indicated that academic engagement not only was more strongly associated with social status in China (vs. the United States), but it was also a stronger predictor of youth's social status over time in China. This difference was most evident for perceived popularity (vs. likability and admiration) (Zhang et al., 2018).

The relationships between academic factors (both motivations and outcomes) and perceived popularity vary in different cultural contexts. Some studies conducted in individualism cultures, such as American culture, have found that early adolescents' academic achievement is negatively or not correlated with perceived popularity (Mayeux et al., 2008; Dijkstra and Gest, 2015). However, the correlation is positive in collective cultures, such as Chinese. Comparing with the influence of academic achievement on children in American culture, which is individual-oriented, this influence is more significant in promoting popularity of children in China (Li et al., 2012). It is unclear whether the positive effects of academic achievement among Chinese children persist into early adolescence.

As for motivation of academic achievement, *Achievement goal orientations*, which include mastery goals, performance-approach goals and performance-avoidance goals, are typical indicators of academic motivation (Nicholls, 1984; Dweck and Leggett, 1988; Midgley et al., 2000). Although most research on academic achievement goals are mainly focused on the investigation of academic-related processes and outcomes, different goals may lead to differences in social outcomes because their different perceptions of situation and of others in distinct perceptual-cognitive frameworks (Poortvliet and Darnon, 2010).

Mastery-oriented students engage in tasks that emphasize learning, improving past performance, and acquiring new knowledge and skills. They are also more concerned about self-improvement rather than impression management and thus develop a self-referenced focus (Poortvliet and Darnon, 2010). Similarly, some researchers believed that mastery goals that are self-reference focused can lead to investments in exchange relationships, endorsement of reciprocity norms, and active efforts to integrate different opinions, and they will get a variety of beneficial outcomes relative to performance goals in social contexts (Poortvliet and Darnon, 2010). Mastery goals were found to be helpful for promoting positive peer relationships (Liem et al., 2008) and prosocial intentions (Barrera and Schuster, 2018), which were also proven to be positively associated with the mutual sharing of difficulties, trust, and adaptive social problem-solving between friends (Levy-Tossman et al., 2007).

Performance-approach goals aim at demonstrating high ability, and performance-avoidance goals indicate attempts to avoid demonstrating low ability. Students with performance goals pay attention to the public demonstration of their self-worth, and thus develop another-referenced focus (Levy et al., 2004; Levy-Tossman et al., 2007; Liem et al., 2008). Studies have indicated that peer relationships might be benefited by mastery goals but would be negatively influenced by performance-avoidance goals. Performance-avoidance goals indicate attempts to avoid demonstrating low ability and were found to be associated with distrust, inconsideration, and tension between friends (Levy-Tossman et al., 2007). Performance-approach goals aim at demonstrating high ability. However, studies on performance-approach goals have produced inconsistent findings. In collective cultures such as Singapore (which is greatly influenced by Chinese collective culture), both performance-approach and mastery goals were found to be directly associated with positive peer relationships (Liem et al., 2008); while in individualism cultures such as American, only mastery goals (but not performance goals) were found positively related to close friendship self-conceptions (Ben-Eliyahu et al., 2017). Israel

is a mixture of both individualism and collectivism (Carmeli, 2001), and research conducted there found that performance-approach goals were negatively related to intimate friendship (Levy-Tossman et al., 2007).

Perceived popularity is not only an indicator of peer relationships but also a power-related factor (Pellegrini et al., 2011), which is different from friendship or peer preference. There might be similarities and distinctions between the relationships of achievement goals and perceived popularity as well as the relationships of achievement goal and friendship or peer preference. Performance-oriented individuals may pay more attention to evaluating if their performance would have value in improving social status and getting more power. Levy et al. (2004) found that performance-oriented students focused on enhancing their own status during peer interactions and thus preferred to help in-group and high-status peers; mastery-oriented students, in contrast, did not show this tendency. This finding suggested that teenagers with performance goals may be more actively pursuing social status and change their behaviors according to the clues in peer contexts. The relations between the three goals and popularity are still ambiguous. Previous studies have also found the influence of academic mastery goal orientations on peer relationships have gender differences. Some presented that academic mastery goal orientations predicted course performance and responsible classroom behavior only for girls, whereas for boys, academic mastery goal orientations were positively related to close friendship self-conceptions (Ben-Eliyahu et al., 2017).

Additionally, there are gender differences in the relationship between academic factors and perceived popularity. Good academic performance has been found to have a more negative effect on boys' popularity than girls' (Adler et al., 1992), and boys with high academic achievement are more likely to be victims of bullying (Lehman, 2015). Because adolescents often perceive good performance (or efforts toward good performance) as a feminized characteristic, hard-working boys are more likely to be considered feminine, unsociable, and less socially attractive (Lasane et al., 1999), whereas those who exhibit disengagement with academics tend to be considered masculine and subsequently rewarded with high social status (Czopp et al., 1998). One study showed that, when asked about their academic performance, boys were inclined to deny their good performance or hard efforts, whereas girls tended to admit their actual performance (Zook and Russotti, 2012).

THE ROLES OF CLASSROOM ACADEMIC NORM SALIENCE

Group norms refer to the attitudes and behaviors that are accepted and recognized by peer groups (Henry et al., 2000). The classroom is the fundamental organizational unit at school where students spend most of their time in their daily life. Group norms in the classroom setting are known as classroom norms whereby students keep regular interactions with peers, share common beliefs and experiences, and build up their own rules and culture. Classroom norms are conceptualized and measured in diverse ways. Descriptive and injunctive classroom norms are typically measured by aggregating individual-level measures of behaviors and attitudes, respectively, across all individuals within a class, to generate classroom-level indices (Cialdini et al., 1991; Boor-Klip et al., 2017). Norm salience is obtained by calculating the correlation between a certain behavior and its popularity in the class (Henry et al., 2000; Dijkstra and Gest, 2015).

The classroom academic norm salience that was established reflected a group consensus of rewarding students who had certain academic performance with high social status (Dijkstra and Gest, 2015), thus conforming to classroom academic norms leading to a shared identity that provides social and emotional support, behavioral confirmation, and acceptance (Masland and Lease, 2013). High academic norms have been found to strengthen the relations between academic achievement and peer acceptance (Dijkstra and Gest, 2015), leadership (Chen et al., 2003a), and social dominance (Jonkmann et al., 2009). In addition, although the empirical evidence is limited, the process through which students with different goals pursue social status may also be influenced by classroom contexts. Students with mastery goals are self-reference focused (Poortvliet and Darnon, 2010), while students with performance-oriented goals are other-referenced focused (Levy et al., 2004; Levy-Tossman et al., 2007; Liem et al., 2008). Students with performance goals may be more sensitive than those with mastery goals to the classroom norms. Therefore, it is necessary to explore whether the effects of achievement goals on perceived popularity are moderated by classroom academic norms.

The effect of classroom academic norm salience might vary by gender. Considering that boys care more about their status and competition in a group (Schneider et al., 2005), they might be more sensitive to classroom norms. However, some studies have suggested that because girls are brought up to be obedient, cooperative and particularly concerned with others' evaluation of them, they may be particularly averse to interpersonal rejection due to disobedience to the majority and find it harder to resist the pressure of classroom norms (Rose and Rudolph, 2006). The degree to which the above-mentioned moderating effects of gender vary according to the influence of classroom academic norms is worth exploring.

THE PRESENT STUDY

Collective cultures emphasize filial devotion, sociability, harmony, and a willingness to compromise personal needs to benefit the social group. Additionally, self-identity is usually considered to be included in the shared group identity. Behaviors such as attitudes and actions toward learning are mainly governed by obligations and a sense of social norms (Triandis and Gelfand, 1998). In the collectivist cultural context of China, students associate their personal successes with others: they work hard for in-group goals (e.g., parents' expectations, teachers' expectations, peer evaluations) and place more emphasis on meeting external, rather than internal, needs in their social lives (Triandis, 2001). This orientation of valuing in-group goals may have two important implications. On the one hand,

performance-approach goals may have positive social adaptive meaning for Chinese adolescents. For example, a study based on a Chinese sample found that the performance-approach goals of Chinese adolescents were directly related to their positive sense of academic efficacy and achievement (Xu and Chen, 2011); however, the effect of these goals on their social status remains unclear. On the other hand, peer group norms may exert a stronger influence on Chinese adolescents, because in the collectivist context, Chinese children place a higher value on interpersonal harmony, cooperation, and interdependence (Forbes et al., 2011). They may pay more attention to the attitudes and behaviors of class peers and be more willing to conform to peer pressure in order to avoid interpersonal rejection.

Chinese culture is profoundly influenced by Confucianism, which attaches great importance to education (Xu, 2011). Thus, a basic principle of Chinese parenting is that children should be encouraged to study hard. Children in China are more willing to meet their parents' academic expectations than their Western counterparts (Chen and Lan, 1998), and, to some extent, hard work is accepted as a family obligation. Therefore, Chinese adolescents and adults share similar attitudes toward learning, and confrontations between Chinese adults and adolescents are not as strong as those in Western cultures. Chinese children value high academic achievement and believe that good grades are beneficial in improving their popularity (Li et al., 2012). However, in Western cultures, early adolescents consider hard work as something valued by adults rather than young persons, and they are less keen than Chinese students to learn in order to gain the social approval of their peers (Chen and Lan, 1998).

Moreover, in many Western countries, classes are flexible, while Chinese middle schools have fixed classes that are larger in size (Li et al., 2012). These distinctive cultural and educational features make class norms more likely to have a greater impact on adolescents' social lives in China, relative to the West. If a Chinese adolescent is embedded in a class with a high academic classroom norm, the combination of the peer culture and the larger sociocultural context—which both value education—might have significant influences on adolescents' development.

The aim of this study was to explore the association between adolescents' academic achievement, achievement goals and perceived popularity in the context of Chinese culture and to examine the moderating effect of classroom academic norms and gender.

In the current study, students in Grade 7 (in the Chinese education system, the first year of middle school is Grade 7) were selected as participants because they were in the new schools and facing challenges in both social status and academic achievement. After collecting data at the end of two semesters, the study assumed that: (1) after controlling for prior popularity, academic achievement would positively predict perceived popularity; (2) the three achievement goals would have different effects on perceived popularity; (3) gender would moderate the relationship between academic achievement or achievement goals and perceived popularity; and (4) classroom academic norm salience would enhance the positive effect of academic achievement on perceived popularity and moderate the effects of achievement goals on perceived popularity. It was hoped that the current study would not only fill the gaps in research on the relationship between academic development and social status, but also reveal the special influence and significance of Chinese culture in this field and show a different relationship pattern from those found in previous Western studies.

MATERIALS AND METHODS

Participants and Procedure

The study chose three regions (one urban, one suburban, and one rural) in one large city in central mainland China. Then, using the stratified sampling method, seven schools (two in the urban area, two in the suburban region, and three in the rural village) were selected according to the school scale, region characteristics (urban, suburban, and rural), and school quality level (excellent, average, and poor). A total of 2,601 students in grade 7 from 47 classrooms were assessed at the end of the first and second semesters. The questionnaires were anonymous, and all questionnaires only had ID numbers. Except students and researchers, no one was allowed to have the access to responses. Perceived popularity and other variables were collected at the second semester. Perceived popularity at the first semester was also measured as prior popularity. The average class size was 56.25 (ranging from 45 to 66). After excluding students with missing values, a final sample was 2,558 students in grade 7 (1,337 boys, 1,221 girls; mean age = 12.97 years, SD = 0.62). We obtained institutional approval and students' written informed consent. All parents or legal caregivers also provided written informed consent for the present study.

Measures

Self-report questionnaires, peer nomination forms, and achievement tests were used to examine the educational and psychological development of students and the relationship between this development and school and individual factors.

Perceived Popularity (Individual Level)

Perceived popularity was measured through peer nomination forms (Rose and Swenson, 2009). Participants were provided with the names of all students in the class and were asked to nominate up to five classmates who were considered popular ("These are the most popular kids in my class"). Self-nominations were allowed but not included in the analysis. Subsequently, all nominations for "popular" were computed for each student. This score was divided by the number of nominators in the class in order to adjust for differences in class sizes.

Achievement Goal Orientations (Individual Level)

Achievement goal orientations were measured through a Chinese revised version of the Patterns of Adaptive Learning Survey (PALS) questionnaire (Midgley et al., 2000). Five items assessed mastery goals (e.g., It's important to me that I thoroughly understand my class work.), five items assessed performance-approach goals (e.g., One of my goals is to show others that

class work is easy for me.) and four items assessed performance-avoidance goals (e.g., It's important to me that I don't look stupid in class). All ratings were made on 5-point scales ("1" not important at all, "3" moderately important, "5" very important). The alpha coefficients of the three dimensions ranged from 0.76 to 0.93.

Academic Achievement (Individual Level)

Academic achievement scores in Chinese, math, English, history, biology, geography, and civics were obtained for all participants from school records. These scores were based on final examinations (which were the same in all sample schools). As the alpha coefficient of the scores in seven subjects was 0.925, we summed the scores to form a single index of *academic achievement*.

Classroom Academic Norm Salience (Classroom Level)

Norm salience scores, representing the correlation of a particular behavior and peer-nominated popularity, were calculated separately for each class (Henry et al., 2000; Dijkstra and Gest, 2015). Academic norm salience for each class was calculated as the correlation of academic achievements and perceived popularity.

DATA ANALYSIS METHODS

We first presented the descriptive statistics and correlations, and then conducted hierarchical linear modeling (HLM) analyses using HLM 4.0. (Bryk et al., 1996). HLM is a multilevel random coefficient regression-based technique that permits simultaneous analyses of within-class and between-class sources of variance (Bryk and Raudenbush, 1992). This study was designed to examine both effects. Perceived popularity was the outcome variable; the Level 1 or individual-level predictors were gender, prior popularity, academic achievement, and achievement goals; the Level 2 or classroom-level predictor was classroom academic norm salience.

Because perceived popularity was measured by a limited number of nominations, that was most of students nominate five classmates, the averages of perceived popularity in the different classrooms were very similar. It did not make sense to explore the difference of perceived popularity in different classrooms (Chen et al., 2005). Therefore, this study did not conduct the intercept model and computed the ICC of perceived popularity. We conducted four random slope models that treated the regression slopes of Level 1 predictors as random variables at Level 2, in order to examine whether the impact of predictors varied in the different classrooms and/or was moderated by classroom factors.

Model 0 was a basis model controlling for prior popularity in order to explore the effect of other predictors on perceived popularity more precisely. The intercept and slope of the controller were fixed at Level 2. Model 1 examined the effect of academic achievement and achievement goals on perceived popularity. Gender, academic achievement, mastery goals, performance-approach goals, and performance-avoidance goals were entered into the regression equation at Level 1. The slopes of predictors were set to be random at Level 2. Because prior popularity was controlled, Model 1 explored the impact of predictors on change in perceived popularity between the first and second semesters. Model 2 examined the interaction of gender and other predictors at Level 1. On the basis of Model 1, the following interactions were entered: academic achievement × gender; mastery goals × gender; performance-approach goals × gender; and performance-avoidance goals × gender. The slopes of interactions were also set to be random at Level 2. Model 3 examined cross-level interactions—that is, whether academic norm salience moderated the impact of predictors at Level 1. For any slope of predictors and interactions that was significantly random, academic norm salience was entered into the slope equation at Level 2. Following the methods of an existing study (Dijkstra and Gest, 2015), all variables were converted into *z*-scores before they were input into the models in order to facilitate greater insight into the cross-level interactions; Level 1 predictors were centered by the group mean before they were input into the models. When interactions were significant, further simple slope tests were conducted (Preacher et al., 2006).

TABLE 1 | The difference tests of variables at level 1 for boys and girls.

Variables	Boys		Girls		t	df
	Mean	Std.	Mean	Std.		
1. Academic achievement	460.876	115.621	501.268	95.145	9.596***	2556
2. Perceived popularity	0.055	0.102	0.085	0.145	6.319***	2556
3. Prior popularity	0.047	0.090	0.072	0.132	5.688***	2556
4. Mastery goals	3.948	0.928	4.031	0.869	2.338*	2556
5. Performance-approach goals	2.537	0.861	2.207	0.771	−10.168***	2556
6. Performance-avoidance goals	2.623	0.870	2.388	0.823	−6.980***	2556

*$p < 0.05$; ***$p < 0.001$.

RESULTS

Results are presented in three parts. First, descriptive statistics were reported for key study variables. Second, multilevel regression analysis was used to explore individual- and classroom-level predictors of perceived popularity. Finally, we explored the impact of interactions with simple slope tests.

Descriptive Statistics

Mean and standard deviation of variables for boys and girls before being converted into z-scores are listed in **Table 1**. Independent *t*-tests showed that girls behaved better than boys in achievement, perceived popularity, and mastery goals. Boys pursued more performance-approach and performance-avoidance goals than girls.

TABLE 2 | Correlation coefficients of variables at level 1 and 2.

	1	2	3	4	5	6	7
1. Academic achievement	1.000						
2. Perceived popularity	0.294***	1.000					
3. Prior popularity	0.305***	0.852**	1.000				
4. Mastery goals	0.270***	0.063**	0.059**	1.000			
5. Performance-approach goals	−0.148***	−0.030	−0.042*	0.187***	1.000		
6. Performance-avoidance goals	−0.105***	−0.070**	−0.058**	0.060**	0.533***	1.000	
7. Classroom academic norm salience	0.123	0.301*	0.343*	0.116	−0.417**	−0.362*	1.000

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; the correlations of class academic norms salience with other variables are all at the class level.*

The correlation coefficients between variables were shown in **Table 2**. Almost all the predictors were correlated with perceived popularity significantly. In order to examine the complex impacts of predictors, multilevel regression analysis was conducted and the results are reported in the following text.

Multilevel Regression Analyses

Model 0 revealed that 72.4% of the variance in perceived popularity was explained by prior popularity. This was a strong effect, meaning that perceived popularity was stable throughout the school year.

In Model 1, the proportion of variance explained by academic achievement and achievement goals was 3.2% when prior popularity was controlled; this represented the incremental predictability of perceived popularity.

Model 2 examined the interactions of gender with other predictors at Level 1. The total predictability of interactions at Level 1 was 4.5%. Model 2 showed significant between-class variations in the predictive slopes of performance-avoidance goals, academic achievement, mastery goals × gender, and academic achievement × gender. Thus, academic norm salience was entered into these slope questions at Level 2 in Model 3.

All the regression coefficients of predictors, interactions at Level 1 and cross-level interactions were reported in Model 3 as the complete model (see **Table 3**). Academic achievement positively predicted perceived popularity ($\gamma = 0.0555$, $p < 0.05$), and perceived popularity was positively predicted by performance-approach goals ($\gamma = 0.0350$, $p < 0.01$) and negatively predicted by performance-avoidance goals ($\gamma = -0.0610$, $p < 0.001$).

The interaction of academic achievement and gender was significant ($\gamma = -0.0354$, $p < 0.05$). Cross-level interactions such as academic norm salience × performance-avoidance goals and academic norm salience × mastery goals × gender were significant ($\gamma = -0.0259$, $p < 0.01$; $\gamma = 0.0290$, $p < 0.001$). Other predictors and interactions were not significant.

Simple Slope Tests

In the framework of multilevel analysis, further simple slope tests were carried out for the three significant interactions. As illustrated in **Figure 1**, academic achievement showed a significant positive prediction for perceived popularity in girls ($b = 0.093$, $t = 3.126$, $p < 0.01$), but not boys ($b = 0.026$, $t = 0.818$, $p > 0.05$).

Academic norm salience showed a significant interaction with performance-avoidance goals. Performance-avoidance goals negatively predicted perceived popularity in classes with high academic norm salience scores ($b = -0.073$, $t = -3.454$, $p < 0.001$), but this prediction was not significant in classes with low academic norm salience scores ($b = -0.014$, $t = -1.057$, $p > 0.05$) (see **Figure 2**). Classroom academic norm salience accounted for 9.6% of the between-class variability in the predictive relationship between performance-avoidance goals and perceived popularity.

Furthermore, classroom academic norm salience explained 4.3% of the between-class variability in the predictive relationship between mastery goals × gender and perceived popularity. The results indicated that mastery goals positively predicted perceived popularity for girls ($b = -0.049$, $t = 2.788$, $p < 0.01$) and negatively predicted perceived popularity for boys ($b = -0.044$, $t = -2.610$, $p < 0.01$) in classes with low academic norm salience; and the interaction between gender and mastery goals was not significant in classes with low academic norm salience scores (girls: $b = -0.010$, $t = -0.473$, $p > 0.05$; boys: $b = 0.011$, $t = 0.512$, $p > 0.05$) (see **Figure 3**).

DISCUSSION

The overall goal of this study was to investigate the associations between academic achievement and achievement goals with perceived popularity in adolescents in a Chinese classroom context. According to the results, the perceived popularity of boys and girls, respectively, was differently influenced by academic achievement and achievement goals; such influences also varied in relation to different classroom academic norms. This study may have been the first to examine the relationship between achievement goals and perceived popularity from the perspective of class academic norms. The findings revealed a moderating effect of classroom academic norms in the context of collective cultures, especially those that are influenced by both collectivism and Confucianism, such as Chinese culture. Chinese Confucianism and collectivism, which reflected the combined effects of proximal and distal culture and highlighted the necessity for follow-up studies in a variety of sociocultural contexts.

Academic Achievement and Perceived Popularity of Early Adolescent Girls

A large number of Western studies have drawn the conclusion that, as children approach early adolescence, the relationship between academic achievement and perceived popularity decreases—or even reverses (Juvonen and Cadigan, 2002; Meijs et al., 2010; Dijkstra and Gest, 2015). However, a comparative

TABLE 3 | Random effect regression of perceived population on predictors and their interactions at Level 1, cross-level interactions.

	Model 0		Model 1		Model 2		Model 3	
	Fixed effect γ(SE)	**Random effect U(χ^2)**	**Fixed effect γ(SE)**	**Random effect U(χ^2)**	**Fixed effect γ(SE)**	**Random effect U(χ^2)**	**Fixed effect γ(SE)**	**Random effect U(χ^2)**
Intercept	–0.0000 (0.010)	–	–0.0035 (0.010)	–	−0.009 (0.010)	–	−0.0012 (0.010)	–
Prior popularity	0.8520*** (0.016)	–	0.8371*** (0.017)	–	0.8296*** (0.016)	–	0.8296*** (0.017)	–
Mastery goals			−0.001 (0.01)	0.0007 (49.644)	0.0025 (0.010)	0.0003 (42.317)	0.0013 (0.010)	0.0003 (42.379)
Performance-approach goals			0.0290* (0.012)	0.0004 (44.748)	0.0347** (0.013)	0.0015 (58.442)	0.0350** (0.013)	0.0015 (58.419)
Performance-avoidance goals			−0.0327* (0.013)	0.0019* (65.759)	−0.0344* (0.013)	0.0020* (68.543)	−0.0610*** (0.017)	0.0018* (65.142)
Academic achievement			0.0446*** (0.013)	0.0014 (61.585)	0.0560*** (0.013)	0.0022* (67.024)	0.0555* (0.021)	0.0023* (67.033)
Gender			0.0001 (0.012)	0.0021* (69.328)	0.0018 (0.012)	0.0021 (69.328)	0.0005 (0.011)	0.002 (55.32)
Mastery goals × gender					−0.0260 (0.014)	0.0037* (61.581)	0.0037 (0.017)	0.0035(58.299)
Performance-approach goals × gender					−0.0014 (0.013)	0.0025 (59.981)	−0.0024 (0.013)	0.0026 (59.909)
Performance-avoidance goals × gender					0.0127 (0.010)	0.005 (40.956)	0.0126 (0.010)	0.0005 (40.962)
Academic achievement × gender					−0.0449** (0.014)	0.0046** (67.476)	−0.0354* (0.02)	0.0049* (68.053)
Academic norms Salience × performance-avoidance goals							−0.0259** (0.009)	
Academic norm salience × academic achievement							−0.0003 (0.013)	
Academic norm salience × mastery goals × gender							0.0290*** (0.008)	
Academic norm salience × academic achievement × gender							0.0129 (0.012)	
Within class		0.276		0.267		0.255		0.255

*γ, the estimations of fixed effect; U, the variance components of random effect. *p < 0.05; **p < 0.01, ***p < 0.001.*

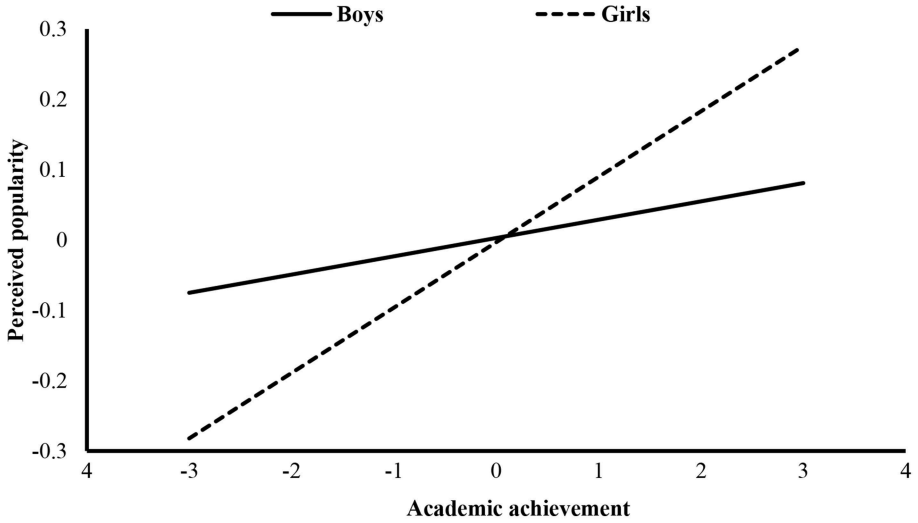

FIGURE 1 | Moderating effects of gender on relations between academic achievement and perceived popularity.

study of Chinese and American children in middle childhood found that Chinese children felt that good academic achievement was important for perceived popularity, and Chinese girls felt this more than boys; while the American girls and boys showed no difference (Li et al., 2012). However, does the stronger positive correlation between academic achievement and perceived popularity in Chinese children last to early adolescence? In this study, academic achievement significantly predicted the perceived popularity of Chinese girls (but not boys) in early adolescence, without the moderation of classroom academic norms. This finding may suggest cross-cultural similarities, as well as differences. First, similar to the trend in Western cultures, the positive effect of academic achievement on perceived popularity in the Chinese context gradually weakened from middle childhood to early adolescence. However, this speculation merits further investigation. Second, similar to Western teenagers, Chinese adolescent boys (compared with girls) tend not to emulate "feminine" behaviors of learning (Czopp et al., 1998; Lasane et al., 1999) in order to prove themselves in their peer group (Zook and Russotti, 2012). A cross-cultural difference was manifested in the relationship of "better learning, better status," which was unique to the Chinese early adolescent girls. This may be attributed to the fact that the Chinese girls were more academically successful than the boys, and traditional Chinese culture advocates that girls act in a pro-social, easygoing, academically and morally excellent manner (Chen et al., 2005). Therefore, even in early adolescence, the girls' academic achievements could still influence their perceived popularity.

The Effect of Achievement Goals on Perceived Popularity

This study discovered the different effects of two performance goals on early adolescents' perceived popularity. First, performance-approach goals played a positive role in perceived popularity, which was consistent with the results of a study conducted in Singapore, which showed performance-approach goals to be positively correlated with peer relationships (Liem et al., 2008). These findings may have emerged because performance-approach goals are more acceptable in Chinese culture, and thus Chinese people do not pay an interpersonal cost for choosing them. Moreover, since adolescents with performance goals carefully considered their behaviors with regard to their implications for social status (Levy et al., 2004), such goals were conducive to promoting their social status. The positive effect of performance-approach goals on social status may reflect the fact that, within the Confucian tradition of valuing education, the pursuit of academic success—as a cultural gene—plays a crucial role that extends beyond the academic field, exerting a spillover effect. "Academic excellence" may be an important identity tag and status symbol for Chinese adolescents. Regardless of actual academic achievements, even "pretending" to do well (via performance-approach goals) in school can be conducive to creating an image of oneself as a "good student" among peers and thereby increasing one's social status. However, whether the effect of performance-approach goals on perceived popularity is long-lasting and whether these are good or bad for adolescents' future development remain questions for further study.

Second, performance-avoidance goals were negatively correlated with perceived popularity. This finding was consistent with those of previous studies, which have found performance-avoidance goals to be associated with peer relationships, friendship quality, and a defensive avoidance strategy (Levy et al., 2004; Levy-Tossman et al., 2007; Liem et al., 2008). The present study showed that performance-avoidance goals could disrupt interpersonal relationships and reduce the visibility of individuals in a peer group, thus adversely affecting their social status. Moreover, the study discovered that the extent to which performance-avoidance goals decreased perceived popularity

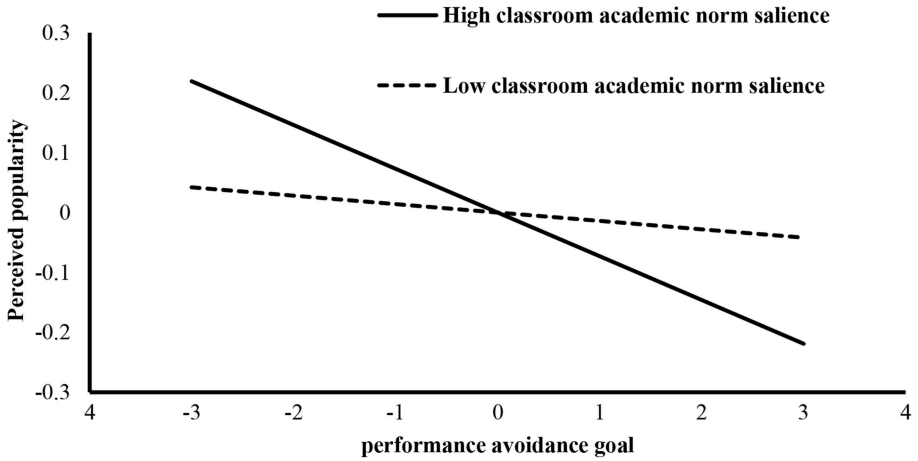

FIGURE 2 | Moderating effects of classroom academic norm salience on relations between performance-avoidance goals and perceived popularity. The high or low academic norm saliences in this, **Figure 3** refer to classes that had one standard deviation above or below their mean.

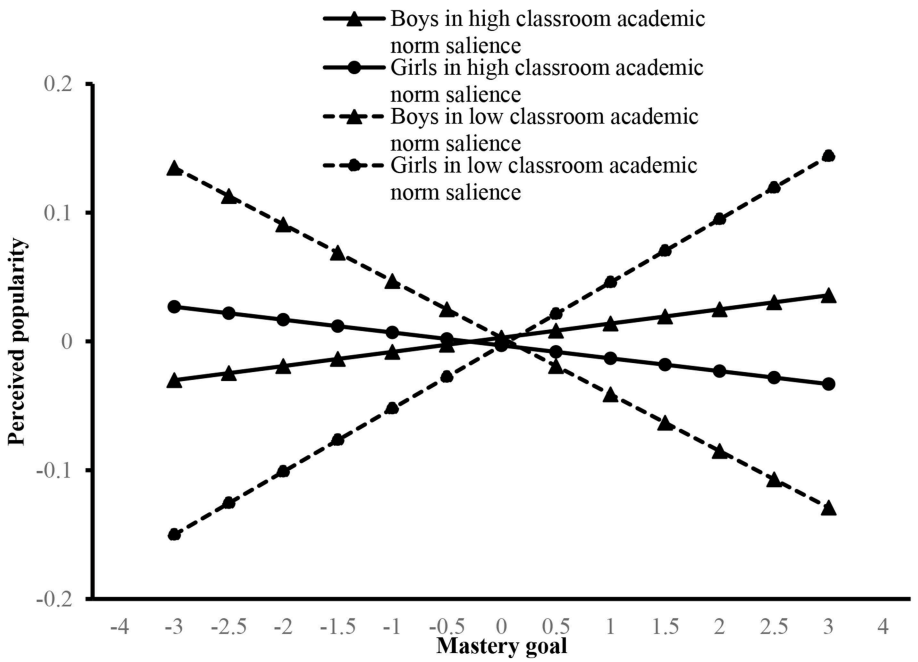

FIGURE 3 | Moderating effects of classroom academic norm salience and gender on relations between master goals and perceived popularity.

depended on classroom academic norms. With greater classroom academic norm salience, the effect of performance-avoidance goals on perceived popularity became more negative. This might have occurred because students with such goals were concerned with others' evaluations of them, but they tried to escape peer evaluation by way of defensive avoidance (Levy et al., 2004). Regardless of the students' actual academic achievements, the classes with high academic norm salience—relative to those that showed less appreciation of learning—shared a group identity with low tolerance of negative learning attitudes and behaviors. Because avoidance behaviors ran contrary to the classroom norms, they were probably perceived by peers as demonstrating weakness and incompetence, and thus resulted in lower social status.

Complex Effects of Mastery Goals, Gender, and Classroom Academic Norm Salience on Perceived Popularity

Previous studies have confirmed that mastery goals are directly correlated with positive peer relationships (Liem et al., 2008) and friendship quality (Levy-Tossman et al., 2007). However, students with mastery goals do not consider peer interactions from the perspective of increasing their social status (Levy et al.,

2004). Self-affirmation theory suggests that when people feel that their self-value is being threatened in a particular field, they seek self-worth in other areas (Steele, 1988). Considering that students who hold mastery goals are self-focused, they gain high self-worth from learning and have no need to turn to other fields; thus, this study assumed that mastery goals would have no effect on academic achievement. However, the results of the study showed that, despite the insignificant main effect of mastery goals on perceived popularity, there were complex interactions between mastery goals and the impact of gender and classroom academic norm salience on perceived popularity. With low classroom academic norm salience, girls' mastery goals positively predicted perceived popularity, while boys' mastery goals negatively predicted perceived popularity. When academic norm salience was high, the interaction of gender and mastery goals with perceived popularity was no longer significant. This finding shows that, although boys with mastery goals may have suffered social costs, according to the current study, this negative impact weakened in classes with high academic norm salience; and for girls, the positive effect of mastery goals on perceived popularity became moderate as classroom academic norm salience increased. Therefore, high levels of classroom academic norms may play a role in narrowing gender differences in the effect of mastery goals on perceived popularity. In classes that appreciate learning, neither boys nor girls with mastery goals experience additional effects on their perceived popularity. Developing classroom academic norms that appreciate learning may be an effective method of cultivating positive learning motivation and reducing the risk of exclusion or bullying by peers, especially for boys.

In addition, since previous studies have found that high academic norms enhance the correlation of academic achievement with peer acceptance (Chen et al., 2003a; Dijkstra and Gest, 2015) and social dominance (Jonkmann et al., 2009), this study assumed that classroom academic norms would enhance the relationship between academic achievement and perceived popularity. This assumption was not confirmed. The reason for this may be that this study accounted for the effects of academic achievement and achievement goals on perceived popularity and tried to better understand the moderating role of classroom academic norms by comparing the above two effects. Academic achievement is influenced by many factors (e.g., previous academic achievement, individual intelligence) and is not easily changed by students' subjective intentions. In contrast, achievement goals seem to be more controllable. When classroom norms exert significant influence on students, it is much easier for them to adjust their achievement goals than to adjust their academic achievement to conform to classroom norms. Therefore, compared with academic achievement, the relationship between achievement goals and perceived popularity may be more easily moderated by classroom academic norms.

STRENGTHS, LIMITATIONS, AND IMPLICATIONS

The current study tried to shed light on achievement predictors on perceived popularity in early adolescence in the collective cultural context. It also aimed to reveal the significance of academic achievement and performance-approach goals on perceived popularity among Chinese adolescents, as well as the differentiated effects of classroom academic norm salience on the effects of mastery goals and performance-avoidance goals on the perceived popularity of girls and boys, respectively.

The current study has two strengths. First, it examined the relationships between academic motivations and perceived popularity while previous research mainly focused on academic achievement and perceived popularity. Second, the results of this study revealed the unique role of academic-related factors on students' social status in collective cultures.

Several limitations of this study should be noted. First, although this study achieved some findings that contrast with the results of previous Western studies, it did not directly compare Chinese and Western samples. Thus, the findings must be re-examined by a two-sample design for intercultural comparison between China and Western countries. Second, this study only allowed for a limited number of nominations during data collection, and this may have hindered subjects from writing down every person they wanted to nominate due to the large class size (which is typical in China). An unlimited number of nominations might be preferable in future studies of Chinese samples.

The findings of the present study have some implications. They may help us better understand the important roles of two crucial factors—internal individual motivations and external peer groups—in early adolescents' competition for social status. These unique effects of academic achievement, achievement goals, and classroom norms on social status in the collectivist context of China reveal the importance and necessity of multicultural research. Furthermore, the findings suggest it is critical to conduct practical implications for developing the school environment and classroom atmosphere in ways that will be conducive to adolescents' academic development, positive peer status, and harmonious interaction between adolescents' academics as well as their interpersonal relationships.

In conclusion, the present study indicated that girls' academic achievement and performance-approach goals of both genders positively predicted students' perceived popularity. Classroom academic norm salience strengthened the negative role of performance-avoidance goals on perceived popularity and seemed to weaken gender differences of the influence of mastery goals on perceived popularity.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Ethics review form studies at the faculty of psychology, BNU with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. All parents or legal caregivers also provided written informed consents for the present study. The protocol was approved by the Scientific Review Committee, Faculty of Psychology, Beijing Normal University.

AUTHOR CONTRIBUTIONS

FL designed the study, supervised the quality in the process of researching and provided financial support. PR gathered data. YZ analyzed data and wrote the manuscript. XL interpreted data and revised the manuscript. HL analyzed data and revised the manuscript.

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