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The effects of perceived parental math support on middle school students' math engagement: the serial multiple mediation of math self-efficacy and math enjoyment

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Abstract
The present study explored the direct and indirect (serial multiple mediation of math self-efficacy and math enjoyment) effects of perceived parental math support on middle school students' math engagement. A total of 374 middle school students ranging the age of 11 to 15 years completed a set of questionnaires assessing perceived parental math support, math self-efficacy, math enjoyment, and math engagement. In the analysis of structural model, a multiple-step multiple mediation analysis was employed. The findings indicated that perceived parental math support was directly and positively associated with math engagement. Additionally, math self-efficacy and math enjoyment sequentially mediated the relationship between parental math support and math engagement. The limitations and implications of the results are discussed and suggestions for future research are proposed.

Keywords Math engagement · Math enjoyment · Math self-efficacy · Middle school students · Multiple-step multiple mediation model · Perceived parental math support

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Introduction

During the past two decades, there has been a growing interest in understanding the antecedents of math engagement (e.g., Liu et al. 2018; Martin et al. 2015). Particularly, scholars who identify the motivational pathways of math engagement posit that perceived support from social network members (e.g., teachers, parents, and peers) is an important contextual predictor of math-related engagement, motivation, achievement, and career interests (Wang and Degol 2013). Actually, to date, a handful of studies (e.g., Liu et al. 2018; Wang et al. 2017) tested the direct and indirect effects of teacher support on students' math engagement. Empirical findings from these studies confirmed that perceived teacher support is associated with greater math engagement and individual factors like self-efficacy, intrinsic value, boredom, and enjoyment underlie the mechanisms of math engagement. Although the vast majority of researches on the development of students' math engagement mainly focuses on the role of teacher support, there has been respectively less work published investigating the effects of parental math support on school children's math engagement. In addition, it is still obscure through which mediating mechanisms parental math support associates with children's math engagement. To this end, the present study examined the direct and indirect effects of parental math support on students' math engagement. Drawing from control-value theory (Pekrun 2006; Pekrun et al. 2007), the study examined a multiple serial mediator model explaining how math self-efficacy and math enjoyment sequentially mediate the association between parental math support and math engagement.

Math engagement

Math engagement as a multifaceted construct involves four distinct, yet interrelated components, namely, behavioral, emotional, cognitive, and social engagement (Wang et al. 2016). Concentrating on the lesson, doing assignments, and obeying classroom rules are regarded as indicators of behavioral engagement (Fredricks et al. 2004). Being interested and motivated in the lesson, feeling enjoyment while studying, and valuing learning are related to reactions of emotional engagement (Fredricks et al. 2004). Using appropriate learning strategies for the comprehension of complex tasks and concepts, as well as act of participation, involving, being curious on the topic, and enhancing and criticizing ideas, is regarded as cognitive engagement (Helme and Clarke 2001). Finally, social engagement includes the willingness to interact with others and to invest in forming and sustaining peer relationships while learning (Wang et al. 2016). Previous research has shown that math engagement can lead to a series of positive outcomes. For example, students with higher math engagement are more likely to have higher grades and career aspirations in math (Wang 2012; Wang et al. 2016).

Parental math support and math engagement

It is scholarly posited that one of the contextual factors that play an important role in enhancing student engagement is parental support (Wang and Degol 2013). To date, as a contextual factor, parental influences were framed within several theoretical frameworks, including Bronfenbrenner's (1977) ecological systems theory, social-ecological theory (Ungar 2011), self-determination theory (Deci and Ryan 1985), and control-value theory (Pekrun 2006; Pekrun et al. 2007). In general, it is theoretically considered that there is a close link between parental support and student engagement (Bempechat and Shernoff 2012). Researchers (e.g., Choe 2020; Ringeisen and Raufelder 2015; Raufelder et al. 2015) argue that parental support includes both behavioral and emotional components. While parents help their children to prepare for an exam in behavioral dimension, encouraging and praising the efforts and achievements of children indicate the emotional dimension of parental support. In accordance with this conceptualization, parental math support in the current study includes behavioral and emotional support. We operationalize parental math support as parental behaviors helping children in learning and achieving in mathematics as well as providing emotional recognition, praise, trust, and encouragement. Scholars (Wang and Degol 2013) argue that parental behaviors relying on children's math abilities, as well as encouraging and recognizing the efforts children put into learning math, are likely to increase math engagement. Indeed, empirical findings confirm that parenting behaviors significantly link with school children's math engagement (e.g., Sun et al. 2020; Tian and Chen 2020).

In this research, control-value theory was used as the integrative theoretical framework to examine how math engagement is influenced by social-contextual factors, cognitive appraisals, and achievement emotions. Control-value theory (Pekrun 2006; Pekrun et al. 2007) offers an integrative framework for outlining the antecedents and outcomes of achievement emotions in educational contexts. According to control-value theory (Pekrun 2006; Pekrun et al. 2007), environmental factors (e.g., parental math support) are likely to impact student outcomes (e.g., math engagement) through the mechanisms of cognitive appraisals (e.g., math self-efficacy) and achievement emotions (e.g., math enjoyment). That is, when parents behaviorally and emotionally support their children in learning math, this would increase the appraisals of control and value; and when they experience high control and value, then they are likely to experience feelings of enjoyment, and finally higher levels of math engagement. Therefore, based on control-value theory, parental math support may act as an important antecedent of school children's math engagement.

Math self-efficacy as a mediator

While previous research (e.g., Turner et al. 2004) highlights the direct link between parental math support and students' math outcomes, limited attention has been given to the mechanisms underlying this association. It is scholarly (Lent et al. 1994) suggested that supportive contextual factors (such as parental support) may associate with increased academic engagement, performance, and achievement and these associations would be mediated by cognitive appraisals (such as self-efficacy and academic emotions like enjoyment). Based on the control-value theory of achievement emotions, math self-efficacy would be regarded as one of the potential mediating mechanisms between parental math support and students' math engagement. According to the control-value theory (Pekrun 2006), contextual factors like supportive parent-child relationship promote children's control-value appraisal, which in turn is linked with achievement emotions, which then is associated with higher academic engagement and performance. The control-value theory postulates that action-control expectations involving a sense of subjective control over academic activities and outcomes lead individuals to feel self-efficacy (Pekrun 2006). It is suggested that a high sense of self-efficacy helps individuals to initiate and maintain their achievement orientation (Pekrun 2006; Pekrun et al. 2007). According to Bandura (2000, p. 16), self-efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainments." Furthermore, Schunk (1991) defines academic self-efficacy as the individual's judgments of his or her capabilities to successfully perform given academic tasks. Pajares and Miller (1994) argue that academic self-efficacy is a judgment of one's competence to execute specific tasks in academic areas. Based on these perspectives, in the current study, we operationalized math self-efficacy as students' beliefs in capabilities to organize and execute the courses of action to achieve desired outcomes in mathematics. It is scholarly argued that high academic self-efficacy beliefs contribute to working harder, persisting longer, and achieving at a higher level (Bandura 1997; Schunk 1995). Abundant evidence indicates that academic self-efficacy is indeed a robust predictor of positive student outcomes. For example, math self-efficacy has been shown to be related to greater math achievement (Xu and Jang 2017). In addition, previous research has demonstrated that math self-efficacy is positively related to STEM intentions, academic performance (e.g., Lin et al. 2018), emotions of math enjoyment and pride, and negatively related to feelings of math boredom and anxiety (Luo et al. 2016). Recent research (Sun et al. 2020) also supports that math self-efficacy is a significant mediating mechanism between parental influences and students' math engagement.

Math enjoyment as a mediator

Drawing from control-value theory (Pekrun 2006; Pekrun et al. 2007), academic emotions (e.g., enjoyment) would also act as a potential mediating mechanism linking math self-efficacy to math engagement. Achievement emotions refer to "emotions tied directly to achievement activities or achievement outcomes" (Pekrun et al. 2007, p. 15). It is scientifically (Pekrun et al. 2009) highlighted that positive activating emotions like enjoyment importantly contribute to students' learning processes and their academic performance. In the present study, we focused on a central positive academic emotion, namely, enjoyment, and operationalized the construct as activity-related enjoyment arising from learning at math classroom. Extensive research has shown that math enjoyment promotes motivational beliefs like self-competence and subject value (Ahmed et al. 2010). In addition, previous research (Luo et al. 2014) connects math enjoyment with students' incremental beliefs of math ability, classroom attention, and math achievement. Moreover, Liu et al. (2018) report that math enjoyment has a significant impact on increasing students' behavioral, emotional, and cognitive math engagement. As a result, it could be argued that positive feelings such as enjoyment, interest, and pleasure experienced in doing school tasks would provide a base for math engagement.

The present study

While there are a number of studies (e.g., Turner et al. 2004) examining the links between parental support and children's math outcomes, the mechanisms by which parental math support links with students' math engagement remain unclear, particularly in middle school years. Based on control-value theory (Pekrun 2006; Pekrun et al. 2007), the current study addresses this gap by examining math self-efficacy and math enjoyment as potential mediating mechanisms in the link between parental math support and math engagement. As the empirical findings highlight that math engagement declines especially during the middle school years (e.g., Collie et al. 2019; Martin et al. 2015; Wang et al. 2016), we focused on investigating the underlying antecedents and mechanisms of math engagement in middle school students. We formulated two main hypotheses: (1) parental math support directly and positively associates with math engagement in middle school students and (2) math self-efficacy and math enjoyment sequentially mediate the association between parental math support and math engagement. The proposed model was depicted in Fig. 1. To our knowledge, this is the first

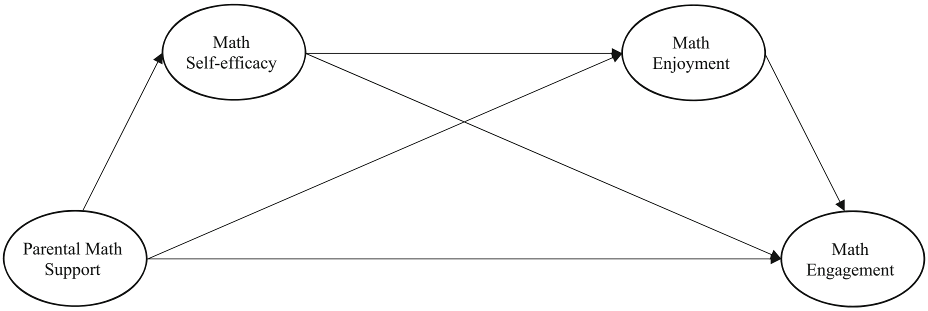

Fig. 1 The proposed multiple-step multiple mediation model

study in which sequential mediator role math self-efficacy and math enjoyment on the link between parental math support and math engagement is explored. It might be argued that understanding predictors and mechanisms of math engagement in middle school students can provide novel information related to prevention and intervention efforts.

Method

Participants

In order to select a representative sample, using cluster sampling, we recruited 374 students from three public middle schools (16 classrooms) located in urban areas of Aydın, Turkey. Located in an urban area at the western city in Turkey, the schools were serving students coming mostly from low and middle socioeconomic families. The mean age of the students was 13.01 (SD_{age} = 0.94, range = 11–15 years). In the research, 52.1% of the participants was females. Of the sample, 28.3% was from sixth grade, 35% was from seventh grade, and 36.6% was from eighth grade. The sample was predominantly from intact families (88.2%). The majority of mothers (81.8%) and fathers (70.3%) had high school and below educational degrees. The mean monthly family income was US $550 and 62.1% of the participants was living below the poverty line (approximately $1139 in a month for households with four people in Turkey). Overall, the sample was representative of the Turkish population in terms of socio-economic characteristics.

Measures

Parental math support Students' perceptions regarding parental math support was assessed with Parent Academic Achievement Support subscale of the Parent Academic Achievement Pressure and Support Scale (Kapıkıran 2016). The scale has been reported to have sufficient validity and reliability in middle and high school populations. In this research, we modified the scale to apply to parental math support. As such, the scale includes 5 items (e.g., "My parents give me all kinds of support to be successful in mathematics.") and they are rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher scores indicate higher levels of perceived parental math support. In the present study, the one-factor structure provided a good fit to the data: χ^2 (4) = 8.908, p > .05, χ^2/df = 2.23, CFI = 0.99, TLI = 0.99, and RMSEA = 0.06 CI [0.00, 0.12]. All the standardized regression weights were significant at 0.001 level and factor loadings ranged from 0.54 to 0.89. Cronbach's alpha coefficient was 0.84.

Math self-efficacy Math self-efficacy was assessed by the Academic Efficacy subscale of the Patterns of Adaptive Learning Scale (Midgley et al. 2000). In this research, we modified the scale to measure students' perceptions related to competence at math. The scale includes 5 items (e.g., "Even if the math is hard, I can learn it."). Students rate items on a five-point Likert scale (1 = not at all true, 5 = very true). Higher scores represent greater levels of math self-efficacy. In the present study, Turkish version of the one-factor scale provided a good fit to the data: χ^2 (4) = 6.908, $p > .05$, $\chi^2/\text{df} = 1.73$, CFI = 1.00, TLI = 0.99, and RMSEA = 0.05 CI [0.00, 0.10]. All the standardized regression weights were significant at 0.001 level and factor loadings ranged from 0.74 to 0.87. Cronbach's alpha coefficient was calculated to be 0.91.

Math enjoyment Math enjoyment was measured by the Enjoyment subscale of the Achievement Emotions Questionnaire class version (Peixoto et al. 2015). The scale has been reported to possess good validity and reliability indices in middle school students. Students rate 4 items (e.g., "I enjoy being in my math class") on a five-point Likert scale (1 = completely disagree, 5 = completely agree), with higher scores indicating higher math enjoyment. In this research, the original one-factor structure of the Enjoyment Scale was confirmed in the sample of the current study: χ^2 (2) = 1.715, $p > .05$, $\chi^2/\text{df} = 0.86$, CFI = 1.00, TLI = 1.00, and RMSEA = 0.00 CI [0.00, 0.10]. All the standardized regression weights were significant at $p < 0.001$ and factor loadings differed from 0.86 to 0.92. Cronbach's alpha for the scale was 0.94.

Math engagement Math engagement was assessed by the Math and Science Engagement Scales (Wang et al. 2016). It consists of 33 items measuring four dimensions of math/science engagement, particularly, cognitive (e.g., "I go through the work for math class and make sure that it's right"), behavioral (e.g., "I put effort into learning math"), emotional (e.g., "I don't want to be in math class [reverse item]"), and social engagement (e.g., "I try to understand other people's ideas in math class"). Items are responded on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher scores from the subscales represent greater levels of cognitive, behavioral, emotional, and social math/science engagement, respectively. In the present study, we selected the most representative four items from each subscale of the original Math Engagement Scale and validated the Turkish short version. The second-order factor structure of the abbreviated Math Engagement Scale provided an adequate fit to the data based on most fit indices: χ^2 (98) = 344.373, $p < 0.001$, $\chi^2/\text{df} = 3.51$, CFI = 0.90, TLI = 0.88, and RMSEA = 0.087 CI [0.08, 0.10]. All the standardized path coefficients were significant at 0.001 level. Factor loadings ranged from 0.58 to 0.71 for cognitive engagement, 0.63 to 0.70 for behavioral engagement, 0.78 to 0.89 for emotional engagement, and 0.42 to 0.61 for social engagement. Cronbach's alpha coefficients for cognitive, behavioral, emotional, and social engagement subscales, and the total scale were 0.72, 0.77, 0.89, 0.62, and 0.91, respectively. In the present research, the subscales were used as observed variables for the latent factor math engagement.

Procedure

The research procedures were approved by the local educational authority of Aydın, Turkey. Study questionnaires were administered by research assistants under the supervision of investigators. The research assistants followed a standardized data collection protocol. Since the surveys include items related to math course, the paper-pencil measures were administered to the students in the classrooms out of math course hours. Prior to survey administration, research assistants read the instructions aloud, explained the voluntary nature of the research, and obtained students' informed consent. Students completed surveys approximately in 20 to 30 minutes. No incentives were offered for participating in the research.

Data analysis

Data were analyzed using SPSS 24.0 and AMOS 24.0 package programs. Researchers ensured the accuracy of data entry, analyzed the missing values, and tested the statistical assumptions. Little's missing completely at random (MCAR) test indicated that missing values were randomly distributed across all cases ($\chi^2 = 194.475$, df = 179, $p = 0.203$), and hence, thirteen cases with missing values were list-wise removed. Univariate outliers (twelve cases) detected by standardized z scores greater than ± 3.29 were dropped from the data set. The squared Mahalanobis distance (D^2) values that stand distinctly apart from all the other D^2 values (fourteen cases) were omitted from subsequent analyses, leaving a total of 335 cases (Byrne 2010). The absolute values of skewness ranged from − 0.31 to − 1.94 and absolute values of kurtosis ranged from − 0.57 to 3.79, indicating that the univariate normality assumption was satisfied (Kline 2011). As multivariate kurtosis critical ratio (CR) was above the threshold of 5.0 (CR = 31.450), the bootstrapping technique which take multivariate non-normality problem into account was performed in the main analysis (Preacher and Hayes 2008). Durbin-Watson value of 1.178 indicated the absence of autocorrelation issue in the estimated model. Tolerance values ranged between 0.52 and 0.66. Variance inflation factor (VIF) values were between 1.51 to 1.93. Condition index was 22.075. Thus, multicollinearity problem was not a concern in the model. After testing statistical assumptions, we calculated descriptive statistics and examined measurement and structural models. In the analysis of structural model, we used a multiple-step multiple mediator model with two mediating mechanisms (e.g., math self-efficacy and math enjoyment) (Hayes et al. 2011). In order to assess specific and total indirect effects simultaneously, we performed AMOS user-defined estimands (Amos Development Corporation 2012). In addition, we used 5000 bootstrapping samples and 95% bias-corrected confidence intervals to test the significance of indirect effects. To evaluate the model fit, the most frequently used three fit indices, namely, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were considered. A CFI and TLI value of 0.90 and above and a RMSEA value of 0.08 and below are indicative of adequate model fit (Byrne 2010).

Results

Descriptive statistics

Means, standard deviations, reliabilities, and bivariate correlations among the research variables are presented in Table 1. As expected, all the variables were significantly and positively related to each other. Parental math support was positively related to math self-efficacy ($r = 0.56$, $p < 0.01$),

Table 1 Descriptive statistics, reliabilities, and bivariate correlations for research variables ($N = 335$)

Variables	Mean	SD	α	1	2	3	4
1. Parental math support	4.47	0.61	0.84	-			
2. Math self-efficacy	4.10	0.81	0.91	0.56^{**}	-		
3. Math enjoyment	3.77	1.23	0.94	0.46^{**}	0.62^{**}	-	
4. Math engagement	3.94	0.70	0.91	0.55^{**}	0.72^{**}	0.68^{**}	-

$^{**}p < 0.01$

math enjoyment ($r = 0.46$, $p < 0.01$), and math engagement ($r = 0.55$, $p < 0.01$). Math self-efficacy was positively related to math enjoyment ($r = 0.62$, $p < 0.01$) and math engagement ($r = 0.72$, $p < 0.01$). Moreover, math enjoyment was positively related to math engagement ($r = 0.68$, $p < 0.01$). Bivariate correlations were moderate to high in magnitude. Furthermore, all measures had high internal consistency reliabilities. Finally, importantly, a 3 (grade level) × 2 (gender) factorial multivariate analysis of variance (MANOVA) results indicated that there were no significant mean differences in terms of grade level and gender interaction for all study variables (Pillai's Trace = 0.012, F (8, 654) = 0.512, $p = 0.848$). Thus, we did not include grade level and gender in the model as covariates.

Measurement model

The measurement model comprised four latent variables (parental math support, math self-efficacy, math enjoyment, and math engagement) and 18 observed variables. Parental math support was represented by 5 items of modified Parent Academic Achievement Support Scale. Math self-efficacy was represented by 5 items of modified Academic Efficacy Scale. Math enjoyment was represented by 4 items of Enjoyment Scale. Math engagement was represented by four subscales (cognitive, behavioral, emotional, and social engagement) of Math Engagement Scale. Confirmatory factor analysis (CFA) was applied to test the measurement model. Based on CFA results, the four-factor first-order measurement model yielded adequate fit indices: χ^2 (129) = 423.527, $p < 0.001$, χ^2/df = 3.28, CFI = 0.94, TLI = 0.92, and RMSEA = 0.08 CI [0.07, 0.09]. All the parameter estimates were significant at $p < 0.001$. Standardized factor loadings ranged from 0.62 to 0.87 for parental math support, 0.77 to 0.85 for math self-efficacy, 0.85 to 0.92 for math enjoyment, and 0.66 to 0.86 for math engagement. Moreover, all the latent variables were significantly and positively related to each other ($p < 0.001$).

Structural model

The structural model comprises parental math support as predictor variable, math self-efficacy and math enjoyment as sequential mediators, and math engagement as outcome variable (see Fig. 2). For the analysis of structural model, we used a multiple-step multiple mediator model which enables assessing specific and total indirect effects simultaneously (Hayes et al. 2011). The results indicated that the hypothesized serially mediated model yielded an adequate model fit: χ^2 (129) = 423.527, $p < 0.001$, χ^2/df = 3.28, CFI = 0.94, TLI = 0.92, and RMSEA = 0.08 CI [0.07, 0.09]. Figure 2 displays the direct effects and Table 2 displays the specific and total indirect effects.

As seen in Fig. 2, parental math support was positively and significantly linked to math self-efficacy ($\beta = 0.52$, $p < 0.001$), but not to math enjoyment ($\beta = 0.09$, $p > 0.05$). Math self-efficacy was positively and significantly linked to math enjoyment ($\beta = 0.64$, $p < 0.001$) and

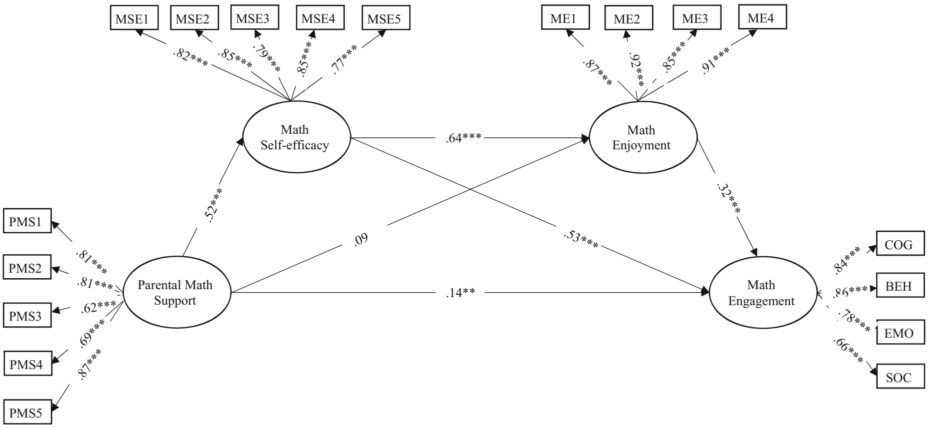

Fig. 2 Serial mediation of math self-efficacy and math enjoyment in the relationship between parental math support and math engagement. Standardized path coefficients are presented. PMS1–PMS5, indicators of parental math support; MSE1–MSE5, indicators of math self-efficacy; ME1–ME4, indicators of math enjoyment; COG, cognitive engagement; BEH, behavioral engagement; EMO, emotional engagement; SOC, social engagement; COG, BEH, EMO, and SOC are indicators of math engagement. $^{**}p < 0.01$, $^{***}p < 0.001$

math engagement ($\beta = 0.53$, $p < 0.001$). Additionally, math enjoyment was positively and significantly linked to math engagement ($\beta = 0.32$, $p < 0.001$). Finally, and as hypothesized, parental math support was directly and positively related to middle school students' math engagement (H1; $\beta = 0.14$, $p < 0.01$). Parental math support, math self-efficacy, and math enjoyment altogether accounted for 75% of the variance in math engagement. By performing Amos user-defined estimates, we calculated specific and total indirect effects in the structural model. To estimate the significance of indirect effects, we used 5000 bootstrap samples and 95% bias-corrected confidence intervals.

As presented in Table 2, the specific indirect effect of parental math support on math engagement via the mediation of math self-efficacy ($\beta = 1.50$, 95% CI [1.05, 2.16]) was significant. In addition, as expected, the specific indirect effect of parental math support on math engagement via the serial mediation of math self-efficacy and math enjoyment (H2: $\beta = 0.57$, 95% CI [0.34, 0.96]) was significant. This finding indicates that there is serial multiple mediation effect of math self-efficacy and math enjoyment in the association between parental math support and math engagement. In other words, parental math support links with math self-efficacy, which in turn associates with math

Table 2 Specific and total indirect effects of parental math support on middle school students' math engagement ($N = 335$)

	Standardized			
	β	SE	95% CI	p
Specific indirect effect 1 (parental math support → math self-efficacy → math engagement)	1.50	0.28	[1.05, 2.16]	0.000
Specific indirect effect 2 (parental math support → math self-efficacy → math enjoyment → math engagement)	0.57	0.15	[0.34, 0.96]	0.000
Total indirect effect	2.22	0.36	[1.66, 3.07]	0.000

enjoyment, which then relates to math engagement. Moreover, after controlling for both mediators, the direct effect of parental math support on math engagement was still significant, indicating partial mediation. Consequently, the present findings support the hypotheses that (a) parental math support directly and positively associates with math engagement among middle school students, and (b) math self-efficacy and math enjoyment sequentially mediate the relationship between parental math support and math engagement.

Discussion

In the present study, we aimed to further understand the antecedents and mechanisms of math engagement. Guided by control-value theory (Pekrun 2006; Pekrun et al. 2007), we put forward a multiple-step multiple mediation model suggesting that parental math support as a contextual variable would indirectly associate with math engagement through individual factors (such as self-efficacy and academic emotions) in a sample of middle school students. Specifically, we hypothesized that (1) parental math support directly and positively associates with math engagement in middle school students and (2) math self-efficacy and math enjoyment sequentially mediate the relationship between parental math support and math engagement. With respect to the proposed hypotheses, we found that parental math support is directly and indirectly (through serial mediation of math self-efficacy and math enjoyment) related to math engagement in middle school students. Present findings further contribute to current knowledge on students' math engagement.

First, our study provides support for the hypothesis that parental math support is directly and positively related to middle school students' math engagement. That is to say, students whose parents provide behavioral and emotional math support are more likely to perform well on math class engagement. As stated earlier, according to control-value theory (Pekrun 2006; Pekrun et al. 2007), environments supporting students' autonomy, cooperation, and self-regulation help children to feel in control of achievement activities and outcomes and value learning processes. Proximal social and learning environments encouraging controllability and academic values increase the odds of self-regulation, academic engagement, performance, and achievement. In line with control-value theory, the present finding suggests that parental behaviors helping children in learning and achieving in mathematics (parental behavioral support) and providing emotional recognition, praise, trust, and encouragement (parental emotional support) significantly link with students' math engagement. It is also scholarly proposed that emotional and behavioral care and support from parents are likely to increase math engagement (Wang and Degol 2013). In addition to theoretical explanations, the present finding is also consistent with previous research (e.g., Rice et al. 2013; Sun et al. 2020; Tian and Chen 2020; Turner et al. 2004; Wang and Eccles 2012). For example, Wang and Eccles (2012), in their longitudinal study, reported that perceived support from parents is an important protector variable in increasing school engagement during the middle school years. Findings from Wang and Eccles's (2012) study suggest that parental support has protective effects throughout adolescence. Turner et al. (2004) have also found that parental support is linked with math self-efficacy, math outcome expectations, and math and science career interest in young adolescents. Rice et al. (2013) reported that perceived social support importantly contributes to positive attitudes towards math and science and leads to a higher sense of self-efficacy in these subjects. Findings from recent studies (e.g., Sun et al. 2020; Tian and Chen 2020) also suggest a significant link between parental behaviors and children's math engagement. As a result, based on the theoretical views and empirical findings reported here, it can be argued that parental math support (including behavioral and emotional support) is an important predictor of math engagement in middle school years.

Secondly, the results of the multiple-step multiple mediation model indicate that the specific indirect effect of parental math support on students' math engagement via both math self-efficacy and math enjoyment was significantly positive. This finding provides support for our hypothesis that parental math support is associated with greater math self-efficacy, which in turn is associated with greater math enjoyment, and then with higher math engagement. In other words, a multiple-step multiple mediating role of math self-efficacy and math enjoyment was confirmed in the link between parental math support and math engagement in middle school students. The control-value theory (Pekrun 2006; Pekrun et al. 2007) explains the interplay between environmental factors, cognitive appraisals, achievement emotions, and engagement, performance, and achievement outcomes. According to this theory, parental behavioral and emotional support, acting as an important contextual factor, laid the foundations for developing control and value appraisals. Based on this theory, control and value appraisals involving a sense of control of achievement activities and outcomes also act as proximal determinants of achievement emotions. For example, students with a high level of math self-efficacy and a tendency to value math class activities are more likely to experience class-related emotions of enjoyment, pride, and hope. It is also theoretically emphasized that enjoyment of achievement activities contributes to students' learning and leads to persistence in the pursuit of challenging goals (Pekrun et al. 2009). Consistent with control-value theory, previous research (e.g., Liu et al. 2018; Wang et al. 2017) has acknowledged that individual factors like self-efficacy, intrinsic value, boredom, and enjoyment act as underlying mechanisms in the link between teacher support and math engagement. A recent research (Sun et al. 2020) also demonstrated that math self-efficacy is one of the mechanisms underlying the association between parental influences and math engagement. However, to our knowledge, the present study provides the first empirical evidence that parental math support is linked with math engagement through serial mediation of math self-efficacy and math enjoyment. Thus, the present findings further enhance the understanding of potential underlying mechanisms in the link between parental math support and math engagement. Parental math support, math self-efficacy, and math enjoyment altogether accounted for a large amount of variance (75%) in math engagement.

However, the present study is not without limitations. First, the research was cross-sectional in nature, and thus, it does not allow us to draw causality conclusions. Future research may longitudinally explore the links between parental math support, math self-efficacy, math enjoyment, and math engagement and may assess the causality of the directions. Secondly, as the sample was recruited from a western city of Turkey, testing hypothesized model with diverse sample groups would improve generalizability of the findings. Furthermore, as the study relied on self-report data collected from students themselves, this may have led to common method variance and social desirability biases. Future research may explore the links between parental math support and math engagement through collecting data from multiple respondents like parents, teachers, and students. Lastly, as the link between parental math support and math engagement was significant even after accounting for mediating mechanisms, the proposed model confirmed a partial mediation effect, and hence, there would be other potential mediating processes underlying the parental math support and math engagement association.

Despite the above limitations, the present study extends current understanding of the positive association between parental math support and students' math engagement. Specifically, the findings from the multiple-step multiple mediation model reveal that math self-efficacy and math enjoyment mediate the link between parental math support and math engagement. The present findings suggest that students who perceive high levels of parental behavioral and emotional math support may develop a greater level of math self-efficacy, which in turn associates with higher math enjoyment, and then links with greater math engagement. As stated earlier, math engagement is a strong predictor of academic performance and STEM career aspirations (Hughes et al. 2008; Wang et al. 2016; Wang and Holcombe 2010). Therefore, from a practical standpoint, it is essential for teachers, counselors, and school administrators to discover what they can do to enhance math engagement in middle school students. The present findings first highlight that intervention programs might aim to increase parents' awareness in providing behavioral and emotional math support to their children. By strengthening parents' behavioral and emotional support to children, practitioners might help school children to increase their engagement in math courses. Wang and Eccles (2012) suggest that the impacts of parental support on children's school engagement continue throughout adolescence. Thus, it would be said that the more parents appreciate, support, encourage, trust, and praise efforts that children make while learning mathematics, the more likely that children engage and perform well in math class and activities. Secondly, the present research demonstrates that practitioners might aim to acquaint parents with the mediating roles of math self-efficacy and math enjoyment in linking parental math support and math engagement. If the parents know the precursors and mechanisms that might be associated with children's math engagement, this awareness might help parents to understand their role and increase their parental confidence on child and school outcomes.

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