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Predicting Mathematics Achievement: The Role of Socioeconomic Status, Parental Involvement, and Self-Confidence

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Abstract

This study examines the direct and indirect effects of family socioeconomic status (SES), through parental involvement and self-confidence, on students' mathematics learning. The multilevel analyses are conducted within the context of Trends in International Mathematics and Science Study (TIMSS) 2011 in Turkey. Results indicate that two SES components - home educational resources and school composition - positively predict students' mathematics achievement. Furthermore, results indicate that parental involvement at home, and parental involvement in school activities, both have a mediating role between home educational resources, and school composition and mathematics achievement, respectively. Self-confidence appears as the strongest predictor of mathematics achievement, which also mediates the impact of both home educational resources, and parental involvement at home on achievement. Finally, the findings from this current study highlight the importance of multilevel analyses in examining the role of parental involvement in mediating the relationship between SES and students' mathematics achievement.

Keywords

Parental involvement
Self-confidence
Socioeconomic status
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Introduction

The importance of parent characteristics (e.g. family socioeconomic status, parent involvement) in explaining the individual differences in academic outcomes make them the subject of various studies (e.g. Alves, Gomes, Martins, & Almeida, 2017; Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018; Fleischmann & Haas, 2016; Galindo & Sonnenschein, 2015; Gustafsson, Nilsen, & Hansen, 2018; Jhang & Lee, 2018 ; Long & Pang, 2016; Lv et al., 2018; Park, Stone, & Holloway, 2017). Studies have revealed that parents' socioeconomic status (SES) significantly predict students' motivational beliefs (Filippin & Paccagnella, 2012), and mathematics achievement (Çiftçi & Cin, 2017). In literature, SES is usually conceptualized with indicators such as parental income, education and occupation, home possessions, cultural possessions, and home educational resources (OECD, 2009; Şirin, 2005). In their study, Long and Pang (2016) demonstrate that students with parents who possess a higher degree of education and more educational resources are more likely to have higher problem solving skills. Similarly, Filippin and Paccagnella (2012) indicate that parents' SES is positively related to students' self-confidence.

Although numerous research has reported the influence of SES on achievement, few research has focused on the underlying mechanisms of this association (Gustafsson et al., 2018). Recent studies have indicated that SES is a factor which influences parent involvement (Jafarov, 2015). Moreover,

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parental involvement might be a factor which mediates the impact of SES on achievement (Tazouti & Jarlégan, 2016). In educational sociology, many researchers have examined parental involvement using Coleman's (1988) conceptual framework (e.g. Roth, 2013; Wei, 2012). This framework attributes the concept of social capital to parental involvement. More specifically, social capital in this context refers to the strength of parent-child relationships, parents' high expectations for schooling, and parent-school relationships (Coleman, 1988, 1990). Social capital plays as much of an important role in student education as financial (e.g. family's income) and human (parents' education level) capitals. Thus, parental involvement can be considered to be a suitable measure of social capital (McNeal, 1999). Social capital inheres parents' effort to put in time and resources for their children education (Coleman, 1988); when parents have a close relationship with the school, they know how their children behave in school, and how they perform in academic tasks (Roth, 2013). Additionally, parental involvement in school activities can be thought of as a public resource which may improve school quality, such as creating a better school learning environment. Parental involvement in parent-teacher conferences and school events may also increase the trust between parents and the school staff (Park et al., 2017).

Furthermore, Coleman (1988) states that parents' education can be less effective on the educational development of the child, if there is an absence of supportive parental behavior. Parental involvement may mediate the relationship between parents' human capital, and their children's human capital. That is, parents' income, occupation, or education may influence their involvement and, thus, their children education. For example, low educated parents may be less involved in their children's education due to their own lack of knowledge regarding the school system, thus negatively impacting their children's achievement (Lee & Bowen, 2006). Similarly, Tazouti and Jarlégan (2016) indicate that the mothers' involvement in their children's education mediates the link between SES and children's achievement.

Researchers affirmed that parental involvement is a multidimensional construct which might be operationalized through various parental behaviors, attitudes, aspirations, or active participations at home (e.g., discussing school activities, checking homework) or school (e.g., volunteering) regarding the educational progress of their children (Fan & Chen, 2001). In their meta-analysis, Fan and Chen (2001), and Hill and Tayson (2009) indicate a moderate relationship between parental involvement, and children's academic achievement. Studies have found significant positive associations between parents' educational aspirations, and children's motivational beliefs (e.g., Fan & Williams, 2010); a similar relationship has also been identified between parents' positive attitudes toward child education, and children's cognitive competence (Topor, Keane, Shelton, & Calkins, 2010). Hattie (2009) states that one of the major conclusions from the meta analyses of parental involvement research is that parental expectations, and parent-child discussions about learning were the most effective dimensions on students' achievement. However, the findings of the studies on the relationships between parent involvement and student mathematics achievement are mixed (Fan & Williams, 2010; Hong, Yoo, You, & Woo, 2010; Shute, Hansen, Underwood, & Razzouk, 2011; Sui-Chu & Willms, 1996). For instance, Sui-Chu and Willms (1996) indicate that parent-child discussion of school activities is strongly related to mathematics achievement, but parents' participation at school has a negative effect on mathematics achievement. In a recent study, Park et al. (2017) shows that schools where parents are more involved in school based activities (e.g. volunteering) are more likely to have higher mathematics achievement level.

Concerning the effects of SES and parent involvement on motivational beliefs, in this study, I focus on self-beliefs. In previous research on motivation, a variety of terms such as self-concept, self-esteem, self-efficacy, and self-confidence are used to refer to self-beliefs (Riding, 2001; Valentine, DuBois, & Cooper, 2004). A recent study reports that self- beliefs appear to be the best predictors of mathematics achievement (Stankov & Lee, 2017). Researchers suggest indirect relationships between parental characteristics, and mathematics achievement through students' self-beliefs (e.g. Ahmed, Minnaert, van der Werf, & Kuyper, 2010; Dinkelmann & Buff, 2016; Rodríguez et al., 2017). For instance, Rodríguez et al. (2017) report that parents' expectations are positively related to students' mathematics

achievement, and this relation is mediated through self-efficacy. Similarly, Dinkelmann and Buff (2016) state that the relationship between parents' home based support, and students' mathematics achievement is mediated by children's mathematics competence beliefs. In addition, McConney and Perry (2010) indicate that students' domain specific self-efficacy beliefs may be a factor influencing the relationship between their SES and mathematics achievement.

As discussed above, the relationship among SES, parental involvement, and student academic outcomes are complex. Few studies examine this complexity, addressing the indirect relationships between SES and student academic outcomes (e.g. Kung, 2016; Long & Pang, 2016; Öztürk & Singh, 2006; Tazouti & Jarlégan, 2016). This sort of complex relationship may also differ from one culture to another to make the associations even more multifaceted. Studies regarding the impact of family SES (Bradley & Corwyn, 2002) and parental involvement on student academic outcomes (Alvarez-Valdivia et al., 2012) are examples of such cultural diversities.

To this end, more research on how parent characteristics influence student achievement is required. Therefore, this study intends to extend the previous research on relationships among family SES, parent involvement, self-beliefs, and student mathematics achievement to a level which allows interactions through mediating variables. I investigate these relationships using Turkey's Trends in International Mathematics and Science Study (TIMSS) 2011 eighth-grade data. Due to multilevel structure of TIMSS data, I carry out the analyses with student level as the first level, and school level as the second level. Considering Turkey's relatively lower mathematics achievement in TIMSS 2011, the current study may also provide some insight into this poor performance. As TIMSS selects a nationally representative sample in each country, results of this study is generalizable to the eighth grades' population in Turkey.

In the TIMSS 2011 context, a student's self-belief in their mathematics ability is referred to as student confidence in learning mathematics (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009). Therefore, in this study, I use the term self-confidence to refer to students' self-beliefs. I also combine students' perceptions of their parents' behaviours on checking homework, and discussing school activities in a single variable parental involvement at home. In addition, students' reports of home educational resources, consisting of two dimensions of home possessions and parents' education level, were used as student level SES indicators.

In line with Colemans' social capital framework and prior research findings outlined earlier, for the aim of the study, I posit the following relations for the student level : (a) Home educational resources (SES) will be related to students' self-confidence, and TIMSS mathematics achievement; (b) Parental involvement at home will mediate the relationship between home educational resources (SES), and self-confidence; (c) Self-confidence will be related to students' TIMSS mathematics achievement; and (d) Self-confidence will mediate the relationship between parental involvement at home, and TIMSS mathematics achievement. The hypothesized model is shown in Figure 1. Although not presented in the figure, students' gender is controlled in the analyses as gender may influence students' perception of parent involvement (Jafarov, 2015), self-beliefs (Kvedere, 2014; Pitsia, Biggart, & Karakolidis, 2017), and achievement (Lv et al., 2018). The influence of gender is not presented in Figure 1 for clarity reasons.

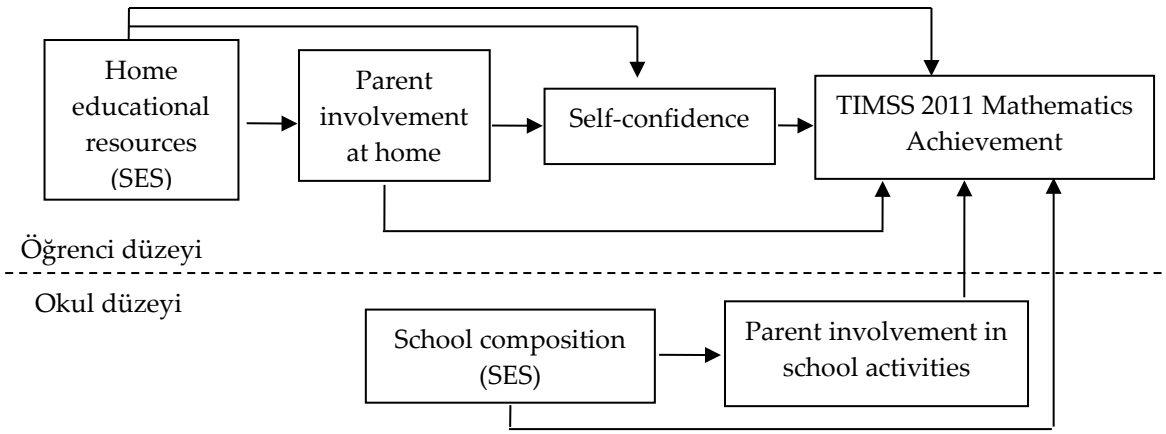

Figure 1. Hypothesized Model. TIMSS=Trends in International Mathematics and Science Study

For the school level of the analyses, school principal reports of school composition (SES), and parent involvement in school activities were the two variables I used. The relationships I posit at the school level are as follows: (a) School composition (SES) and parental involvement in school activities will be related to students' TIMSS mathematics achievement; (b) Parental involvement in school activities will mediate the relationship between school composition (SES), and TIMSS mathematics achievement.

Turkey is amongst the countries with a high level of that between-school achievement differences (Brunner, Keller, Wenger, Fischbach, & Lüdtke, 2017; Yıldırım, Yıldırım, Yetişir, & Ceylan, 2013). Previous research has also reported a strong relationship between schools' SES level, and students' mathematics achievement in Turkey (Akyüz, 2014; Yıldırım, 2012; Yıldırım, Yıldırım, Ceylan, & Yetişir, 2013). Therefore, considering the SES and parental involvement at the school level may provide further insight into the structure of Turkish students' mathematics achievement. In addition, few studies have investigated the effects of school-level parent involvement in student-level academic performance (Park et al., 2017). Therefore, this study would contribute valuable information on this subject which could be used for educational research.

Method

Participants

The TIMSS 2011 assessment is conducted by the International Association for the Evaluation of Educational Achievement (IEA) in 63 countries. The study aims to provide information about the educational context in participating countries, and mathematics and science achievement level of fourth and eighth grade students. The present study employs in Turkey 6928 eighth-grade students' responses to the student questionnaire (49% girls), and 239 school principals' responses to the school questionnaire. The sampling design used in the TIMSS 2011 assessment was two-stage stratified cluster sampling, where schools were the first stage and classrooms were the second stage sampling units. In Turkey, sampling schools at the first stage was followed by randomly selecting one classroom from each sampled school at the second stage (Mullis, Martin, Foy, & Arora, 2012).

Measures

Details on how the variables are derived in TIMSS 2011 are reported in TIMSS 2011 User Guide (Foy, Arora, & Stanco, 2013). The constructs investigated in this study are limited by the available items from the TIMSS 2011 student and school questionnaires.

Student Level Variables

Home educational resources. This scale, as a student level SES indicator, was constructed using students' responses to the following two items: 'Do you have any of these things in your home?' ('own room/ internet connection'), and, 'What is the highest level of education completed by your mother (or stepmother or female guardian) and father (or stepfather or male guardian)?' ('many resources (1), some resources (2), few resources (3)').

Parental involvement at home. A 4-point Likert-type response of 'everyday or almost every day (1)', 'once or twice a week (2)', 'once or twice a month (3)', and 'never or almost never (4)', was given by the participating students to parental involvement items. The parental involvement scale is based on responses to the following four items: 'My parents ask me what I am learning in school', 'My parents check if I do my homework', 'I talk about my schoolwork with my parents', and 'My parents make sure that I set aside time for my homework'. The internal reliability (Cronbach's alpha) of this scale was = .70. In TIMSS database, there is no derived scale for parental involvement at home. Therefore, one factor principal component regression scores for these four items were used in the analyses (DiStefano, Zhu, & Mindrila, 2009).

Self-confidence. A 4-point Likert-type response of 'agree a lot (1)', 'agree a little (2)', 'disagree a little (3)', and 'disagree a lot (4)', was given by the participating students to self-confidence items. The following nine items were employed to construct students' self-confidence scale in learning mathematics: 'I usually do well in mathematics', 'I learn things quickly in mathematics', 'Mathematics is more difficult for me than for many of my classmates', 'Mathematics is not one of my strengths', 'Mathematics makes me confused and nervous', 'I am good at working out difficult mathematics problems', 'My teacher thinks I can do well in mathematics <programs/classes/lessons> with difficult materials', 'My teacher tells me I am good at mathematics', and 'Mathematics is harder for me than any other subject'. The internal reliability (Cronbach's alpha) of self-confidence scale was = .87. In TIMSS database, scale categories were 'confident (1)', 'somewhat confident (2)' and 'not confident (3)'.

TIMSS 2011 mathematics achievement. Eighth grade TIMSS mathematics test consists of four content domains (number, algebra, geometry, and data and chance), and three cognitive domains (knowing, applying, and reasoning). Students answered different test booklets and their mathematics achievement scores were obtained using the Item Response Theory (IRT) scaling approach. There were five achievement scores (5 plausible values) and, for this study, analyses replicated with each of the proficiency scores and obtained estimates were averaged to incorporate the impact of imputation error (Mullis et al., 2012).

School Level Variables

School composition. This scale, as a school level SES indicator, was constructed using school principals' responses to the following question: 'Approximately what percentage of students in your school come from economically disadvantaged homes/ Come from economically advantaged homes?'. Response options were, '0 to 10%'; '11 to 25%'; '26 to 50%'; 'more than 50%'. TIMSS uses these responses to set the schools in one of the following three groups: 'more affluent than disadvantaged students (1)', 'neither more affluent nor more disadvantaged students (2)', 'more disadvantaged than affluent students (3)'.

Parental involvement in school activities. This variable was based on the self-report of school principals about the participation of parents in school activities. Response categories were 'very low (5)', 'low (4)', 'medium (3)', 'high (2)', and 'very high (1)'.

The items measuring positive beliefs for parental involvement at home, parental involvement in school activities, self-confidence, school composition, and home educational resources were inverted before the analyses so that higher scores would indicate higher endorsement rates.

Analyses

The variables I used had missing values in the TIMSS 2011 questionnaire data. Therefore, prior to the regression analyses, I imputed missing values in the data using the expectation-maximization algorithm in SPSS. The IEA's International Data Base Analysis Program (IDB analyzer) (IEA, 2017) was used to compute the descriptive statistics and correlations between the variables.

The TIMSS 2011 data used in the study has a multilevel structure (i.e. students nested within schools). Therefore, sequential multilevel regression analyses were performed to test the mediational hypotheses (Krull & Mackinnon, 2001; Zhang, Zyphur, & Preacher, 2009). In this study, gender, home

educational resources, parental involvement at home, and self-confidence were group-mean centered at student level. Parental involvement in school activities, and school composition were grand-mean centered at school level. In HLM analyses, both the intercept and the slopes were permitted to vary randomly at the school level. In the analyses, total student weight, and school weight were used.

Prior to the analyses, variables were standardized (z-scores), and intra-class correlation coefficients (ICC) of student level dependent variables were estimated via random effect ANOVA (Raudenbush & Bryk, 2002). For student level dependent variables, results indicate that ICC was 6% for math self-confidence, 12% for parental involvement at home, and 31% for TIMSS 2011 mathematics achievement in Turkey. In HLM analyses, R^2 - calculated by the formula suggested by Raudenbush and Bryk (2002) - at a specific level (student or school level) is the variance that can be explained by the independent variables. Zhao, Lynch and Chen (2010) classification was used to test the mediated relations investigated in the study. Also, joint significance test was used to calculate the level of statistical significance of the indirect effects (Leth-Steensen & Gallitto, 2016; Taylor, MacKinnon, & Tein, 2008).

Results

Before testing the hypothesized model, I examined the correlations among variables for preliminary analysis of the data. Means and standard deviations of the variables, and the zero-order correlations among them are presented in Table 1. Table 1 shows that there are significant correlations between TIMSS 2011 mathematics achievement, and all four other variables. The highest correlations are between TIMSS math achievement, students' mathematics self-confidence, and home educational resources (SES).

Table 1. Descriptive Statistics and Zero-Order Correlations Among Variables

	M	**SD**	**1**	**2**	**3**	**4**
Student level						
1. Gender	1.51	.50	-			
2. Home educational resources (SES)	1.50	.58	-.02	-		
3. Parent involvement at home	-.01	1.01	-.05*	.20**	-	
4. Math self-confidence	1.65	.71	.01	.19**	.19**	-
5. TIMSS 2011 Math achievement	452.61	112.98	-.04*	.40**	.13**	.49**
School level						
1. School composition (SES)	1.54	.72	-			
2. Parent involvement in school activities	2.33	.98	.34**			

Note. Gender was coded 1 = girl, 2 = boy; [a] Regression scores obtained using principal component analysis. TIMSS = Trends in International Mathematics and Science study, $^{**}p < .01$; $^{*}p < .05$.

Predicting Parental Involvement

As shown in Table 2, at the student level, only 3% of variance within schools is explained for parental involvement at home. Home educational resources (SES) are a significant positive predictor of parental involvement at home. Similarly, as shown in Table 2, at the school level, school composition (SES) is a strong positive predictor of parental involvement in school activities, and 12% of variance between schools is explained for parent involvement in school activities.

Table 2. Standardized Coefficients, Standard Errors and Explained Variance for Dependent Contextual Variables

Predictors	Dependent contextual variables							
	Parent involvement at home		Parent involvement in school activities[a]		Math self-confidence			
	Model 1		Model 1		Model 1		Model 2	
Student level	***β***	**SE**	***B***	**SE**	***β***	**SE**	***β***	**SE**
Gender	-.06**	.02			.00	.02	.01	.02
Home educational resources (SES)	.16**	.02			.20**	.02	.17**	.02
Parent involvement at home							.18**	.02
School level								
School composition (SES)			.34**	.09				
R^2 student level	.03		-		.03		.07	
R^2 school level	-		.12		-			

Note. Gender was coded 1 = girl 2 = boy; TIMSS = Trends in International Mathematics and Science study. [a]: level-2 variable, regression coefficient obtained using IDB analyzer based on two-step approach, **p < .01; *p < .05.

Predicting Self-Confidence

As seen in table 2, at the student level, with respect to the hypothesized paths, math self-confidence is positively predicted by both home educational resources (SES), and parental involvement at home. In joint significance test, there is mediated effect if each of the paths in the mediation is statistically significant (Taylor et al., 2008). As shown in Figure 2, home educational resources (SES) is a significant predictor of parental involvement, and parental involvement is a significant predictor of self-confidence. Therefore, the results suggest that home educational resources (SES) are significantly and indirectly related to self-confidence, through parental involvement at home. Model explains 7% of the variance in self-confidence.

Predicting Mathematics Achievement

With respect to the hypothesized paths, TIMSS mathematics achievement is predicted by home educational resources, parental involvement at home, and self-confidence. These variables yield 29% of the explained variance in achievement at student level.

Table 3. Standardized Coefficients, Standard Errors and Explained Variance for Timss Math Achievement

Predictors	TIMSS Mathematics Achievement					
	Model 1		Model 2		Model 3	
Student level	***β***	**SE**	***β***	**SE**	***β***	**SE**
Gender	-.05**	.02	-.05**	.02	-.05**	.02
Home educational resources (SES)	.22**	.02	.21**	.02	.14**	.02
Parent involvement at home			.03*	.02	-.05**	.02
Math self-confidence					.42**	.02
School level						
School composition (SES)	.29**	.04	.22**	.05	.20**	.04
Parent involvement in school activities			.19**	.04	.18**	.05
R^2 student level	.07		.08		.29	
R^2 school level	.24		.34		.31	

Note. Gender was coded 1 = girl 2 = boy. TIMSS: TIMSS = Trends in International Mathematics and Science study, **p < .01; *p < .05.

As shown in Figure 2, parental involvement at home is a significant predictor of self-confidence, and self-confidence is a significant predictor of TIMSS mathematics achievement. Therefore, the results support the mediating role of self-confidence between parental involvement at home, and achievement. As seen in table 3, self-confidence is the strongest predictor at student level.

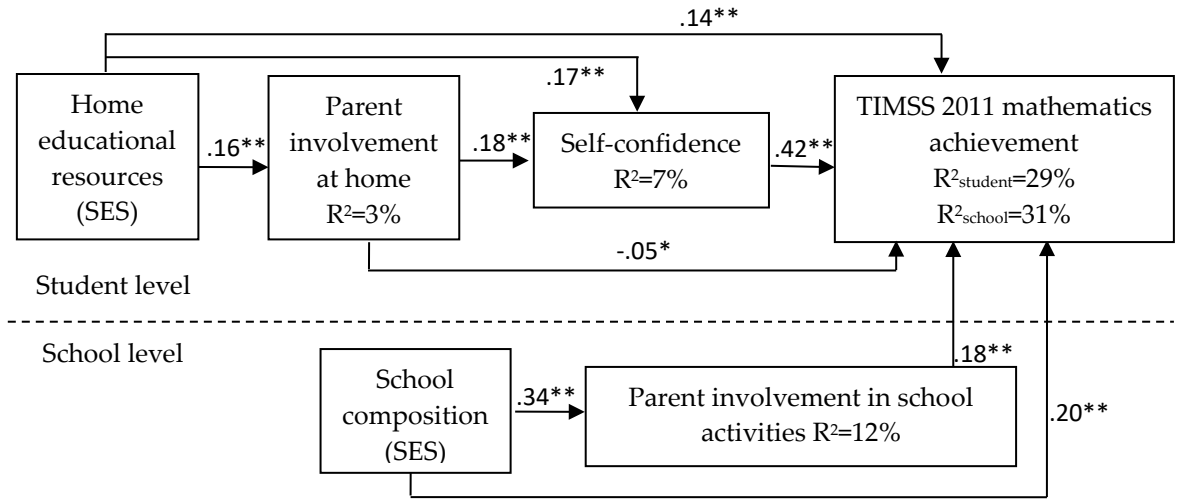

Figure 2. Summary of the full model tested in steps. TIMSS = Trends in International Mathematics and Science study, *p < .05; **p < .01

As seen in Table 3, the effects of home educational resources and parental involvement at home are small, although they are significant. Similarly, as shown in figure 2, home educational resources (SES) are indirectly related to mathematics achievement. In addition, the indirect relationship between home educational resources (SES), and achievement through parental involvement and self-confidence are also significant. At the school level, school composition (SES), and parent involvement in school activities are strongly and positively related to mathematics achievement. Furthermore, the mediating role of parent involvement in school activities between school composition (SES) and mathematics achievement is also significant. Figure 2 presents this indirect effect. At the school level, 31% of variance in TIMSS mathematics achievement is explained.

Discussion

In the present study, I examine the role of students' self-beliefs, SES variables, and parental involvement in predicting mathematics achievement using student and school level TIMSS 2011 data in Turkish education. The overall results are in line with the hypothesized relationships in the study. Consistent with the social capital framework, results reveal that home educational resources (SES) (at student level), and school composition (SES) (at school level) positively affect parental involvement at home, and parental involvement in school activities, respectively; thus, this relationship influences students' mathematics achievement. The results also reveal that home educational resources (SES) have an indirect positive effect on self-confidence, via parental involvement at home. This study also supports the mediational role of self-confidence between parent involvement at home, and mathematics achievement. I discuss these findings in more detail subsequently.

Prediction of Parental Involvement

Concerning the effects of SES on parent involvement, I find the significant effects of parental involvement at home and in school activities as being consistent with previous research (Jafarov, 2015; Kung, 2016). At the school level, I find that school composition has an effect on parental involvement in school activities. In Turkey, it appears that parental involvement in school activities are more likely in schools that have affluent parents. This is consistent with the qualitative work of Bellibaş and Gümüş (2013) indicating that the parents in affluent schools are more sensitive towards schools' needs, have

more connections with teachers, and more readily volunteer to involve themselves in activities in school than low-SES parents in Turkey.

At the student level, the results show that the model predicting parental involvement at home accounts for a significant, albeit small, amount of variance. Despite studies that suggest the importance of parents' SES on parental involvement at home (e.g. Fan & Chen, 2001), in Turkey, home educational resources do not strongly relate to parental involvement at home. Furthermore, Tazouti and Jarlégan (2016) show that, in France, the relationship between SES and parent involvement may be negative. It seems that the effect of SES on parent involvement may be culturally divergent.

Prediction of Self-Confidence

Concerning the effects of home educational resources and parent involvement, I find significant effects on self-confidence at the student level. In line with previous research (Filippin & Paccagnella, 2012), home educational resources do significantly predict the students' self-confidence beliefs. Similarly, with regard to the effect of parental involvement on motivational beliefs at student level, the result of the present study is in line with the work of Fan and Williams (2010). It seems that parental involvement may positively affect students' mathematics self-confidence.

The expectation that the relationship between home educational resources, and mathematics self-confidence is mediated by parental involvement at home seems justified statistically; however, this model explains only a small amount of variance. The reason for the small effect of parental involvement on self-confidence beliefs might also be attributed to the parental involvement items which are not specific to mathematics content. Parents' involvement at home measured specifically for mathematics homework and mathematics discussions might have more influence on students' mathematics self-confidence beliefs.

Prediction of Mathematics Achievement

In terms of the effects of SES on mathematics achievement, I find positive significant effects of home educational resources and school composition. The effect of home educational resources on mathematics achievement is small, compared to the effect of school composition in the study. In Turkey, school composition seems to be more crucial, with respect to students' mathematics achievement.

The results in this study, regarding motivational predictors of mathematics achievement, support the previous research (e.g. Stankov & Lee, 2017) which state that self-related ability beliefs strongly predict mathematics achievement. In this study, students' self-confidence is the strongest positive predictor of TIMSS mathematics achievement in Turkey. The finding regarding the role of students' self confidence in predicting mathematics achievement is consistent with the view that students' self-beliefs may be a factor which influences the relationship between SES and mathematics achievement (McConney & Perry, 2010). It seems that, in Turkey, home educational resources positively affect students' self-confidence, and hence, their mathematics achievement.

In this study, the ordinary correlation between parental involvement at home and mathematics achievement is positive. However, this association turns into negative in the mediation model which regress mathematics achievement on the self-confidence. Therefore, we may suspect that a net suppression effect is present (Tabachnick & Fidell, 2007). However, all cases of net suppression in mediation analysis can be seen as a competitive mediation, according to the work of Zhao et al. (2010). This direct negative effect is consistent with previous research (e.g., Castro et al., 2015; Shute et al., 2011), albeit small, and may be related to the fact that Turkish parents may increase their discussion of school related issue, and are more likely to be involved with homework if their child's achievement is low. This finding, however, is contrary to Chowa, Masa and Tucker (2013), and Fajoju, Aluede and Ojugo (2016) whose research findings indicate that children are more likely to be successful academically if parents are involved at home with their children's work. Although statistically significant, due to the large sample size in the study, this small negative direct effect may also be considered as practically not significant. Therefore, this result suggests that parental involvement at home might not be enough to facilitate students' mathematics achievement directly, and might only have a positive indirect influence

on mathematics achievement via self-confidence beliefs. With regard to the indirect effect of parental involvement at home on mathematics achievement, the result of the present study is in line with the recent work of Dinkelmann and Buff (2016); they indicate that parents' home based support behaviours have an indirect positive effect on mathematics achievement, mediated by child's mathematics related competence beliefs. In this study, the sample was restricted to eighth grade students. It is possible that parental involvement at home may have more influence on lower elementary grade students' achievement (Özcan, 2016; Yıldırım, Yıldırım, & Ceylan, 2017).

Regarding the mediating role of parental involvement at home, the finding is in line with previous research (e.g. Chowa et al., 2013; Dumont et al., 2012; Long & Pang, 2016). Although I identify a significant mediating role between home educational resources and mathematics achievement, this mediation may not be practically significant due to the small relationship between home educational resources and parental involvement at home.

In terms of school level, in line with previous research (Park et al., 2017) the results indicate that, in schools with higher level of parental involvement in school activities, students' TIMSS 2011 mathematics achievement scores are also higher when compared to schools with a lower level of involvement. Parental involvement in school activities may influence students' achievement through its influence on social networks, and relationships in the school. These results also support Coleman's (1988) approach, which identifies the parental involvement as a dimension of social capital. It appears that, in Turkey, a composition of parents' social networks may be highly effective on students' success. A recent research also demonstrates that parents' participation in school activities have a positive effect on students' mathematics achievement in Asian Confucian culture (Jhang & Lee, 2018). Similarly, it appears that Turkey is one of the non-western countries in which there is a positive relation between parental involvement in school activities, and mathematics achievement. As reported in previous research (e.g. Roth, 2013) this finding suggests examining these relationships in future research. In future research, examining the kind of activities parents participate in school, and the nature of parents' social networks related to this participation might provide a better understanding of the relationship between parental involvement, and mathematics achievement in Turkey. Furthermore, it appears that, in Turkey, parental involvement in school activities may be more effective on students' mathematics achievement than parental involvement at home. This finding, however, was contrary to Paredes (2011) and Sui-Chu and Willms (1996) whose research findings suggest that parental involvement at home is more important for mathematics success than parents' participation at school.

As stated by Park et al. (2017), parental involvement in school may foster strong communication and cooperation between school administrators, teachers, and parents. In terms of the school level, the results show that the impact of school composition on mathematics achievement is mediated by parental involvement in school activities. This finding extends prior research (e.g. Park et al., 2017), focusing just on the direct influences of school level parental involvement on students' achievement. This mediational effect may also be regarded as an explanation for why there is a strong relationship between school SES and students' mathematics achievement in Turkey. Therefore, integrating the effect of school level parental characteristics into models of student achievement would be an important issue to consider in future research.

Limitations

Despite the promising findings of the study, there are several limitations that need to be addressed. This study can provide important insights into the underlying mechanism of SES influence on mathematics achievement. However, for the hypothesized model as derived from the existing literature, it is difficult to specify definite causal conclusions. Further research with longitudinal designs is needed to validate the causality of the relationships found in this study. In addition, research using different achievement measures, such as course grades or prior achievement of students, would also contribute to an understanding of the effects of SES on parental involvement, and on learning in academic settings. Another crucial point is that parental involvement is a multidimensional construct. I could not examine the different dimensions of parental involvement due to the limited data available

in the TIMSS 2011 data. Besides, items measuring parental involvement at home are related to general issues in students' education, rather than being specific to the mathematics domain. The limitations outlined above might also provide a partial explanation for the practically insignificant links between parental involvement at home, and mathematics achievement. In sum, the relationships studied in this research need to be detailed further by investigating different dimensions of parental involvement related to the mathematics domain.

Conclusion

In conclusion, the present study demonstrates that, in Turkey, parents' SES affects children's mathematics learning, both directly and indirectly, through parental involvement. The results highlight the need for parental involvement in students' education to enhance their mathematics achievement. Firstly, when students perceive their parents as being involved in their schooling, they might have high self-confidence in mathematics. As a result, fostering parental involvement at home would be useful for academic learning. Secondly, when parents are involved in school activities, they may have better contact with the school staff, which may lead to a better community resource; thereby, improving school quality by fostering school level parental involvement would be useful for the achievement of students. Finally, as parents from high SES are more involved in their child's schooling in Turkey, providing sufficient resources for low SES schools to foster parental involvement may reduce the achievement gap between the students from high, and low SES backgrounds.

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