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A Structural Equation Model Explaining 8th Grade Students' Mathematics Achievements*

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Abstract

The purpose of this study is to investigate, via a model, the explanatory and predictive relationships among the following variables: Mathematical Problem Solving and Reasoning Skills, Sources of Mathematics Self-Efficacy, Spatial Ability, and Mathematics Achievements of Secondary School 8th Grade Students. The sample group of the study, itself conducted using a survey model, consisted of 470 8th grade students aging between 14 and 15 years old attending different secondary schools in the city of Konya, Turkey and its surrounding area. Of the total students, 238 were female (50.6%) and 232 were male (49.4%). In the study, the Scale of Sources of Mathematics Self-Efficacy was used to determine students' levels of self-efficacy; the Problem Solving Test was used to measure their problem solving skills; the Reasoning Test was used to measure their reasoning skills; both the Mental Rotation and the Paper Folding Tests were used to measure their spatial skills; and the Mathematics Achievement Test was used to measure their level of mathematics achievement. The data collected in the study were analyzed using one of the Structural Equation Models, that being the Structural Regression Model. According to the results obtained, the variables Sources of Mathematics Self-Efficacy, Spatial Ability, and Problem Solving and Reasoning Skills were witnessed to account for 75% of the variation in mathematics achievement. These variables have a considerable effect on mathematics achievement. Knowing this, it is recommended that, in order increase mathematics achievement, a mathematics teaching model in which these interrelated variables coexist be developed and then implemented in activities supporting self-efficacy.

Keywords

Mathematics Achievement, Problem Solving Skill, Reasoning Skill, Sources of Self-Efficacy, Spatial Ability, Structural Equation Modeling.

Today, in a time when extraordinary and rapid developments occur daily and because foundations of daily life are increasingly becoming mathematical, knowing and understanding mathematics have gained considerable importance. In such a changing world, individuals able to understand and use mathematics will have more say in enhancing opportunities and occasions that may shape their future (NCTM, 2000). In this context, understanding and being successful in mathematics have gained further importance.

Individual factors are highly important in mathematics achievement and success (Akyüz, 2014; Özgüven, 2005; Peker, 2005; Usher, 2009). However,

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not all students are able to exhibit the same level of achievement due to individual factors (NCTM, 2000). Accordingly, it is quite important to ascertain whether students achieve in accordance with their skills or not, to investigate the factors affecting achievement, and to make practical suggestions to teachers and students. When the studies conducted in the relevant literature are examined, many factors are observed to affect mathematics and mathematics achievement. The major factors affecting mathematics and mathematics achievement may be listed as follows: (Üredi & Üredi, 2005), spatial ability (Battista, 1990; Casey, Pezaris, & Nuttall, 1992; Mohler, 2001), problem solving skills (Alcı, Erden, & Baykal, 2010; Arsal, 2009; Günhan & Başer, 2008; Özsoy, 2005), reasoning skills (Ball & Bass, 2003; Brodie, Coetzee, & Lauf, 2010; Kilpatrick, Swafford, & Findell, 2011; Yıldırım, 2011), school type (Dursun & Dede, 2004; Savaş, Taş, & Duru, 2010; Umay, 2003; Weissglass, 2002), learning style (Peker, 2005; Şentürk & İkikardeş, 2011), motivation (Fadlelmula, 2011; Üredi & Üredi, 2005; Yıldırım, 2011), self-efficacy (Alcı et al., 2010), family income level (Savaş et al., 2010), duration of study (Savaş et al., 2010), attitude and interest (Demir & Kılıç, 2010; Peker & Mirasyedioğlu, 2003; Savaş et al., 2010), anxiety (Dursun & Bindak, 2011), and the duration one has attended a university preparation course (Savaş et al., 2010). When the factors affecting mathematics achievement are grouped together and then investigated, it is seen that they form a part of the cognitive, motivational, familial, and socio-economic source. It can be said that cognitive and motivational factors, by virtue of their very nature, are not only more flexible in general, but are also more mendable through education than are familial and socio-economic factors. Accordingly, various studies have been conducted in order to ascertain how to increase students' cognitive skills and motivational levels in mathematics (Arsal, 2009; Koç & Bulut, 2002; Küpçü, 2012; Mevarech & Kramarski, 1997; Özsoy, 2007; Sulak, 2005).

Some mathematical factors can also be seen as mathematical skills. It may be necessary to investigate what skills are defined as mathematical skills by various important institutions (Milli Eğitim Bakanlığı [MEB], 2009; NAEP, 2002; NCTM, 2000; TIMSS (Mullis, Martin, Ruddock, O'Sullivan & Preuschoff, 2012) in order to determine which mathematical skills defined in the relevant literature are of greater importance

When the mathematical skills defined in NCTM (2000), NAEP (2002), TIMSS (Mullis et al., 2012), and MEB's (2009) mathematical teaching programs are examined, it is seen that problem solving and reasoning skills are prominent. Other mathematical skills that have been defined and explained serve as tools in the accurate and effective use of problem solving and reasoning skills. When the studies conducted in the relevant literature on problem solving and reasoning skills are examined, it is understood that there are positive relationships among these skills (Barbey & Barsalou, 2009; Çelik & Özdemir, 2001; Çetin & Ertekin, 2011; Umay, 2003)

Another variable linked to problem solving and reasoning skills which has significant effects on mathematics achievement is spatial thinking ability. Although spatial ability has been defined differently by different researchers (Linn & Petersen, 1985; McGee, 1979; Tartre, 1990; Thompson, 1987), a common point shared among its various definitions is that spatial ability is an ability that requires one to manipulate visual forms on two and three dimensional space within his or her mind. While studies conducted in this regard have indicated that spatial ability is connected with students' mathematics achievement, reasoning, problem solving, and scientific thinking (Arcavi, 2003; Battista, 1990; Booth & Thomas, 1999; Delialioğlu & Aşkar, 1999; Fennema & Sherman, 1997; Fennema & Tartre, 1985; Guay & McDaniel, 1977; Hegarty & Kozhevnikov, 1999; Kayhan, 2005; Markey, 2009; McGee, 1979; Smith, 1964; Tartre, 1990; Van Garderen & Montague, 2003; Wheatley, 1998; Wheatley & Wheatley, 1979), it was also emphasized in these studies that spatial ability is a fundamental skill in the teaching of mathematics.

When the motivational factors in the relevant literature affecting students' academic activities and learning are examined, it can be said that the belief in self-efficacy appears in the forefront (Bandura, 1997; Chen, 2003; Fadlelmula, 2011; Haşlaman & Aşkar, 2007; Pajares 1997; Pajares & Kranzler, 1995; Phan, 2012; Schommer-Aikins, Duell, & Hutter, 2005; Schunk, 2011; Zimmerman, Bandura & Martinez-Pons, 1992). One of the most important reasons for this is that compared with other motivational concepts linked to learning, the belief in self-efficacy is a better predictor of learners' performance (Bong & Clark, 1999; Bong & Skaalvik, 2003; Ferla, Valcke, & Cai, 2009). In its simplest sense, self-efficacy can be defined as an individual's belief that s/he has the capacity to raise his or her learning levels and behaviors to the desired level (Bandura, 1997). The belief in self-efficacy provides significant clues as to an individual's choices of activity, effort & perseverance, patience & determination, and learning & achievement (Bandura, 1997; Schunk & Pajares, 2009; Senemoğlu, 2007; Usher, 2009). Self-efficacy is based on a number of basic sources, including Mastery Experiences, Vicarious Experiences, Social Persuasions, and Psychological States (Bandura, 1997).

In light of the relevant conceptual bases and research, it can be said that the belief in self-efficacy plays a significant role in the effective use of the aforementioned interrelated skills of spatial thinking, problem solving, and reasoning in mathematics.

Purpose of the Study

The results of the TIMMS exam, in which 8th graders in Turkey participated, indicated that mathematics achievement of students of Turkey is below the international average (Mullis, Martin, Robitaille, & Foy, 2009; Mullis et al., 2012). This reality provoked the cognitive and motivational variables affecting mathematics achievement to become a central point for researchers in Turkey (Akyüz, 2014; Bilican, Demirtasli, & Kilmen, 2011; Uzun, Bütüner, & Yiğit, 2010; Yıldırım & Yıldırım 2009; Yıldırım, Çıkrıkçı, & Akbaş, 2012). On the other hand, when the studies conducted in this regard are examined, it is understood that cognitive and motivational variables affecting mathematics achievement have not only been investigated separately, but also while taking into account various mutual relationships (Arslan, 2012, 2013; Booth & Thomas, 1999; Çetin & Ertekin, 2011; Delialioğlu & Aşkar, 1999; Kayhan, 2005; Markey, 2009; Montague, 2003; Tartre, 1990; Üredi & Üredi, 2005). Since the number of studies in which cognitive and motivational variables affecting mathematics achievement were investigated is limited (Alcı et al., 2010; Başaran, 2011; Fadlelmula, 2011; Kalender, 2010), the purpose of the current study is to investigate mathematical skills affecting mathematics achievement and sources of mathematics self-efficacy via a model. In accordance with this purpose, a number of cognitive skills related to mathematics classes and motivational concepts were brought together and a structural equation model explaining the direct and indirect relationships between these concepts was formed. In this way, both direct and indirect relationships between students' problem solving skills, spatial ability, and mathematics self-efficacy beliefs and their mathematics achievements were able to be investigated.

In recent years, the concept of self-efficacy has been more frequently included in learning and motivation theories rather than the terms "self" and "self-esteem" (Şahin, 2013). One of the most important reasons for this is that the self-efficacy belief better predicts students' performance compared with the other concepts related to learning (Bong & Clark, 1999; Bong & Skaalvik, 2003; Ferla et al., 2009). It is pointed out that the studies in the relevant literature on self-efficacy belief usually concentrate on high school and university students (Usher, 2009). Arslan (2012), on the other hand, states that while a large majority of the studies conducted in Turkey on self-efficacy have been implemented on teachers and student teachers, the number of studies conducted in Turkey with secondary school students is quite limited (Arslan, 2012, 2013; Çetin, 2009; Özyürek, 2005). In these studies, secondary school students' self-efficacy beliefs were investigated in relation to their demographics (Arslan, 2013; Çetin, 2009), their self-efficacy beliefs about learning and performance (Arslan, 2012), and their mathematics self-efficacy beliefs (Özyürek, 2005). In the current study however, the relationship of self-efficacy belief with mathematical problem solving and reasoning skills, spatial ability, and mathematics achievement will be investigated via a model. In this way, the effects of self-efficacy belief on mathematics performance and on a variety of different mathematical skills will be seen together.

Moreover, it is known that secondary school years constitute a critical period in regard to students' mathematics and science achievements (Reynolds, 1991). As such, the findings of this study will help teachers and researchers in understanding cognitive and motivational variables affecting mathematics achievement as a whole. In addition, the results of this study will shed light on future studies whose goals will be to ascertain ways to increase students' mathematics achievement. In particular, the findings obtained will provide both theoretical and practical information in increasing students' mathematics self-efficacies and in improving their mathematical skills.

Method

Research Design

This is a descriptive study conducted using the relational survey model. Relational Survey models are models that aim to measure the presence and degree of variation between two or more variables (Karasar, 2008, p. 81).

Universe and Sampling

The population of the study is comprised of 8th grade students attending secondary schools in Greater Konya, Turkey. The sample group of the study however, was selected using the stratified sampling method in which 470 8th grade students aged between 14 and 15 were included. Of the total, 238 were female (50.6%) and 232 were male (49.4%).

Data Collection Tools

Mathematics Achievement Test: The Mathematics Achievement Test, developed by the researcher, was used to measure students' mathematics achievement in the study. The Mathematics Achievement Test contains 16 questions covering the learning fields of numbers, probability and statistics, geometry, and algebra. The discrimination coefficient of the Mathematics Achievement Test was calculated to be 0.36, its difficulty coefficient was calculated to be 0.46, and its KR-20 reliability coefficient was found to be 0.89 (n=145).

Problem Solving Test: The Problem Solving Test was composed of 14 open-ended questions covering the learning fields of numbers, measurement, geometry, pattern, algebra, statistics, and probability. Taking into account the problem solving stages stated by Polya (1957), students were asked via instructions, for each question included in the test, to express the problem in their own words, to make a plan to solve the problem, to implement the plan they made, and to check their result. The responses given to the questions in the test were scored in values varying between 0 and 4 using a rubric. The Cronbach Alpha Reliability Coefficient of the test was calculated to be 0.75 (n=240).

Reasoning Test: In order to measure the mathematical reasoning skill, the Mathematical Reasoning sub-test of the Mathematics Strength Scale developed by Yeşildere (2006) was used. The test included 10 open-ended questions. The responses given to the open-ended questions were scored in values varying between 0 and 4 using a rubric. The Cronbach Alpha Reliability Coefficient of the test was calculated to be 0.76 (n=240).

Sources of Self-Efficacy in Mathematics: In order to determine the sources of self-efficacy of participating students, the Scale of Sources of Self-Efficacy in Mathematics, developed by Usher and Pajares (2009) and adapted into Turkish by Yurt and Sünbül (2013), was used. There are four dimensions in the scale, itself composed of 24 items, namely: Mastery Experience (6 items), Vicarious Experience (6 items), Social Persuasions (6 items), and Psychological States (6 Items). Each item on the scale was scored with values varying between 1 and 100. The Cronbach Alpha Reliability Coefficients calculated for both the whole of the scale and for its dimensions took on values varying between 0.80 and 0.94.

Spatial Ability Tests: In this study, the definition of the spatial ability components made by Olkun (2003) was taken as a basis. Olkun stated that spatial relationships and spatial visualization skills are two fundamental components. While the paper folding test can be used in measuring one's spatial visualization skill (Ekstrom, French, Harman, Dermen, 1976), the mental rotation test can be used in measuring one's spatial relationships skill (Vanderberg & Kuse, 1978) (Olkun, 2003). In this study, the Cronbach Alpha Reliability Coefficient was calculated to be 0.75 (n=70) for the Paper Folding Testand 0.72 (n=70) for the Mental Rotation Test.

Data Analysis

The data obtained were analyzed using the Structural Regression Model, which is one of the structural equation models. This model is a synthesis of the Confirmatory Factor Analysis and the Path Analysis Models (Kline, 2011, p. 218). In this study, the Structural Regression Model was used not only to investigate the relationships between the Sources of Mathematics Self-Efficacy, Mathematical Problem Solving and Reasoning Skills, Mental Rotation and Spatial Visualization skills, and Mathematics Achievement, but also to determine their indirect effects.

Furthermore, the effect size was also calculated in this study. The method proposed by Cohen (1988), in which he proposed that the standardized effect size (f^2) value be used in the calculation of effect size for regression analyses and for linear models, was used in calculating effect size. According to Cohen's classification (1988), the value of $0.02 \leq f^2 < 0{,}15$ indicates a small effect, $0.15 \leq f^2 < 0.35$ an intermediate effect, and $0.35 \leq f^2$ a large effect.

Findings

The adaptive values for the tested model were found to be $\chi 2 = 720{,}34$; $p < 0.001$; $\chi 2/sd = 1{,}736$; RMSEA=0,04; SRMR=0,04; CFI=95; IFI=0,95;

GFI=0,91; AGFI=0,89; and NFI=0,90. It can be said that these values are near perfect adaptive values (Bollen, 1990; Browne & Cudeck, 1993; Byrne, 2006; Hu & Bentler, 1999; Kline, 2011; Steiger, 2007; Tanaka & Huba, 1985). All the paths shown on the model are significant ($p < 0{,}001$).

According to the results of the structural regression analysis model, mathematics self-efficacy sources have a direct and positive effect on spatial ability (β=0,202, $p < 0.01$), mathematics achievement (β=0.280, $p < 0.001$), mathematical problem solving (β=0.205, $p < 0.001$), and reasoning skills (β=0.632, $p < 0.001$). When the indirect effects of the Mathematics Self-Efficacy Sources are examined in the model, it is understood that Mathematics Self-Efficacy Sources have an indirect and positive effect on Mathematical Problem Solving Skill (β=0.533), Spatial Ability (β=0.306), and Mathematics Achievement (β=0.457).

It is also seen in the model that the variable Mathematical Reasoning Skill has a direct and positive effect on Problem Solving Skill (β=0.621, $p < 0.001$) and on Spatial Ability (β=0.484, $p < 0.001$). Moreover, the Mathematical Reasoning Skill variable has an indirect and positive effect on Problem Solving Skill (β=0.126, $p < 0.001$) and Mathematics Achievement (β=0.446, $p < 0.001$). It is understood that the Mathematics Self-Efficacy Sources affecting Mathematical Reasoning Skill accounted for about 40 % of the variation in Reasoning Skill.

Another important variable included in the model is Spatial Ability. In the model, Spatial Ability has a direct and positive effect on Problem Solving Skill (β=0.260, $p < 0.001$) and on Mathematics Achievement (β=0.358, $p < 0.001$). However, it is also understood that Spatial Ability has an indirect and positive effect on Mathematics Achievement (β=0.114) via the Problem Solving Skill. It is seen in the model that Mathematics Self-Efficacy Sources and Mathematical Reasoning Skills affecting Spatial Ability account for approximately 44% of the variation in Spatial Ability.

The only variable included in the model which affects only Mathematics Achievement is Problem Solving Skill. The Problem Solving Skill variable has a direct and positive effect on Mathematics Achievement (β=0.439, $p < 0.001$). It is understood that in the model, the variables Mathematics Self-Efficacy Sources, Mathematical Reasoning Skill, and Spatial Ability account for about 92% of the variation in Problem Solving Skill.

The last variable in the model is Mathematics Achievement. It is understood that the variables Mathematics Self-Efficacy Sources, Spatial Ability, Mathematical Reasoning and Problem Solving Skills, which have either direct or indirect effects on Mathematics Achievement, account for about 75% of the variation in Mathematics Achievement.

Finally, values of effect size were calculated for each structural equation in the model. According to the results obtained, the effect size values calculated for the variables Mathematical Problem Solving and Mathematics Achievement indicate a large effect whereas the effect size values calculated for the variables Mathematical Reasoning and Spatial Ability indicate an intermediate level effect.

Discussion and Suggestions

In this study, the relationships among the variables of mathematics self-efficacy sources, mathematical reasoning and problem solving skills, and spatial ability as well as the effect of these variables on mathematics achievement were investigated using the structural equation modeling. To this end, a structural regression model was formed in light of the relevant theoretical basis and research and was then tested. According to the results obtained, in the tested model, mathematics self-efficacy sources positively and significantly affected reasoning and problem solving skills, spatial ability, and mathematics achievement. This finding is in support of the theoretical explanations and studies conducted in the relevant field on self-efficacy. In his study, Bandura (1997) argued that self-efficacy belief is an important predictor of one's performance results in different academic tasks. It was observed, thanks to the studies conducted on this issue, that self-efficacy belief is effective at all levels of academic life and has therefore been emphasized that self-efficacy belief is a significant component of all kinds of successful behaviors (Chen, 2003; Chen & Zimmerman, 2007; Fadlelmula, 2011; Multon, Brown, & Lent, 1991; Pajares & Kranzler, 1995; Pajares & Miller, 1994; Pietsch, Walker, & Chapman, 2003; Renga & Dalla, 1993; Shunk, 2011; Zimmerman et al., 1992). Shunk (2011) even stated that behind each successful behavior lies one's belief [of self-efficacy] that s/he would be able to perform that specific behavior successfully.

Studies conducted in the relevant field have indicated that self-efficacy belief has positive and significant relationships with spatial ability (Kinsey, Towle, O'Brien, & Bauer, 2008; Towle et al., 2005), reasoning skills (Lawson, Banks, & Logvin, 2007), problem solving skills (Güven & Cabakcor, 2012; Pajares, 1996;

Pajares & Kranzler, 1995; Pajares & Miller, 1994), and mathematics achievement (Alcı et al., 2010; Chen, 2003; Chen & Zimmerman, 2007; Lent, Lopez, & Bieschke, 1991; Lopez, Lent, Brown, & Gore, 1997; Pietsch et al., 2003; Usher, 2009; Üredi & Üredi, 2005; Williams & Williams, 2010). For example, in a study conducted by Towle et al. (2005), the researchers found a positive and significant correlation between one's self-efficacy belief and spatial ability. Pajares and Kranzler (1995), via the path analysis model that they developed, revealed that self-efficacy has a significant effect on mathematical problem solving skills. Üredi and Üredi (2005) furthermore stated that self-efficacy is a significant and positive predictor of mathematics achievement. Both studies present in the literature and the results of the current study support Bandura's (1997) hypothesis that one's self-efficacy belief is an important predictor of his or her success in different academic tasks and of his or her level of performance.

Although the reasoning skill included in the model has a direct effect on spatial ability, it also both directly and indirectly affects problem solving skills in a positive way. It is possible to find studies in the relevant literature supporting these findings (Ball & Bass, 2003; Barbey & Barsalou, 2009; Battista, 1990; Brodie et al., 2010; Çelik & Özdemir, 2011; Çetin & Ertekin, 2011; Kilpatrick, et al., 2001; Wheatley & Wheatley, 1979). Specifically, while Barbey and Barsalou (2009) stated that the inductive reasoning approach may be used as a tool in the problem solving process, Çelik and Özdemir (2011) found a significant correlation between proportional reasoning skills and problem posing skills. Likewise, Çetin and Ertekin (2011) discovered both a high level and positive correlation between proportional reasoning skills and equation solving achievement. Markey (2009) also pointed out that there is a both positive and significant correlation between visual-spatial reasoning skills and success in solving mathematics and geometry problems. Furthermore, Battista (1990) found a significant relationship between logical reasoning and geometrical problem solving performance and spatial visualization skills. Both relevant studies and the results of the current study indicate that reasoning skills significantly contribute to one's ability to effectively use spatial skills and to one's skills in solving mathematics problems.

One of the most striking findings of this study is that the reasoning skill within the model has no direct effect on mathematics achievement. In the model, the reasoning skill has an indirect effect on mathematics achievement via spatial ability and problem solving skills. In other words, reasoning skills have an indirect and positive effect on mathematics achievement by cooperating with and by supporting spatial ability and problem solving skills. Studies explaining the function of reasoning skills in the problem solving process support this finding. English (2004) stated that reasoning by analogy contributes to one's ability to solve problems by aiding him or her to perceive the similarity between the relational structures of a problem previously solved and those of a newly encountered problem. In a similar vein, Leighton and Sternberg (2004) have indicated that reasoning plays an intermediary role in the problem solving process and coordinates ideas and premises by operating behind the scenes.

The spatial ability in the model affects mathematics achievement both directly and indirectly via problem solving skills. There are many studies within the relevant literature indicating that one's spatial ability is correlated with mathematics achievement (Delialioğlu & Aşkar, 1999; Fennema & Tartre, 1985; Guay & McDaniel, 1977; Kayhan, 2005) and problem solving skill (Booth & Thomas, 1999; Hodgson, 1996; Markey, 2009; Smith, 1964). A common point of those studies investigating the relationship between spatial ability and problem solving skills is that those students with effective problem solving skills effectively use the visualization and depiction method. This situation contributes positively to students' problem solving performances and mathematics achievement. Moreover, NCTM (2000) stated that spatial ability is an ability necessary for students to make visualizations, think in a three-dimensional way, reason, and solve problems by using geometrical models.

Finally, the problem solving skill in the model has a direct, positive, and significant effect on mathematics achievement. Various studies in the relevant literature support this result (Güven & Cabakcor, 2012; Özsoy, 2005; Pape & Wang, 2003; Saygı, 1990). For example, Pape and Wang, (2003) found a high correlation between problem solving and mathematics achievement. Likewise, while Güven and Cabakcor (2012) stated that there exists a high level of correlation between self-efficacy and academic achievement, Özsoy (2005) found a high level of correlation between the mathematics achievement of primary education 5th graders and their problem solving skills. Indeed, problem solving skills are quite important for mathematics achievement (NCTM, 2000), and these skills are among the fundamental mathematics skills defined by different institutions (NAEP, 2002; NCTM, 2000; MEB, 2009). In the same vein, studies conducted in the relevant literature and the result of the current study support the idea that problem solving skills are both important and fundamental skills for mathematics achievement.

Another of the most striking findings of these study is that Mathematics Self-Efficacy Sources, Spatial Ability, Problem Solving and Reasoning Skills, which either directly or indirectly affect mathematics achievement, account for approximately 75% of the variation in mathematics achievement. Unlike the studies in the relevant literature, the result of the current study indicate that spatial ability, problem solving, and reasoning skills together with one's self-efficacy belief have a significant effect on mathematics achievement. Developing a mathematics teaching program including these interrelated variables together and using it in activities that support self-efficacy may significantly increase mathematics achievement.

When the existing primary education mathematics teaching curriculum of Turkey is examined, it is seen that although the a large portion of the current study's variables are present in the curriculum, both students' exams and research conducted indicate that students' levels of mathematics achievement is not at the desired level (Mullis et al., 2009; Mullis et al., 2012; Turğut, 2007). As such, various other factors, including student acquisition, activities, teaching methods and techniques, teacher, and school need to be considered critically, leading to the need for both qualitative and quantitative studies to be conducted to this end.

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