Cypriot Journal of Educational Sciences

Volume 13, Issue 4, (2018) 537-548

www.cjes.eu

Primary school students' mathematics motivation and anxieties*

Yasemin Deringol*, Department of Elementary Education, Istanbul University-Cerrahpasa, 34098 Istanbul, Turkey

Suggested Citation:
Deringol, Y. (2018). Primary school students' mathematics motivation and anxieties. *Cypriot Journal of Educational Science*. *13*(4), 537–548.

Received from August 9, 2018; revised from October 21, 2018; accepted from November 15, 2018.
Selection and peer review under responsibility of Prof. Dr. Huseyin Uzunboylu, Near East University, Cyprus.

Abstract

Mathematics is necessary to enable children to gain the knowledge and skills required for daily life, it teaches them how to solve a problem, enables them to gain ways of thinking and prepares them for the future. The prejudice developed towards mathematics affects the students' perceptions related to the mentioned course. The students' low motivation and high anxiety concerning mathematics are among the most important problems encountered. This research was conducted with students in the third and fourth grades in primary schools in Istanbul province to examine their mathematics motivation and anxieties. It was concluded that students' mathematics motivation was at a medium level and their mathematics anxieties were very low and there were no differences according to gender. Mathematics motivations among fourth grade students were higher than that of third grade students. It can be recommended that classroom teachers should prepare the environment in which they can introduce the entertaining world of mathematics to students.

Keywords: Primary school student, mathematics, mathematics motivation and mathematics anxiety.

* This research is an extension of the report presented at the First International Congress on Seeking New Perspectives in Education (UEYAK-2018).

* ADDRESS FOR CORRESPONDENCE: **Yasemin Deringol,** Department of Elementary Education, Istanbul University-Cerrahpasa, 34098 Istanbul, Turkey. *E-mail address*: yderingl@gmail.com / Tel.: +90 212 404 03 00

1. Introduction

As a basic branch of science, mathematics is an essential area for scientific studies, technological developments and community life. A mathematics course is one of the tools required for bringing children the knowledge and skills necessary in life, teaching them problem solving, the thinking skills included in a problem-solving approach and preparing them for the future (Yildirim, Tarim & Ilfazoglu, 2006). Learning mathematics is a must because it is a field that develops the behaviours required for solving various problems encountered in our daily lives, such as logical thinking and the ability to communicate, recognising relationships and the ability to make generalisations, generalise the relationships recognition and develop creative thinking, mental independence and the ability to think through problems (Aksu, 1991). While mathematics has such importance in every aspect of life, unfortunately, many people are reluctant when it comes to mathematics, and they talk about how difficult mathematics is as a branch of science (Kanbir, 2009).

In learning, cognitive characteristics are as effective as affective characteristics. One of these affective properties is motivation. While many reasons can be given regarding students' failures in mathematics courses, their achievements in this course are dependent on their willingness to immerse themselves in a mathematics course. This case is associated with students' motivations (Bozkurt & Bircan, 2015). Endler, Rey and Butz (2012) define motivation as 'an intrinsic situation that governs behaviour, prompting an individual by giving energy to him/her towards the objectives and that is a part of the learning process'. Accordingly, motivation is one of the most important components affecting learning. According to the results of studies conducted in the field of motivation, students' beliefs in themselves and extrinsic elements, such as the learning environment and rewards are effective in motivation (Palmer, 2005; Unal & Bursali, 2013).

For this reason, students' motivation is frequently discussed as extrinsic motivation and intrinsic motivation (Afzal, Ali & Khan, 2010). In extrinsic motivation, what prompts an individual is not the learning process itself but reinforcers that are not directly associated with the process. In intrinsic motivation, what prompts an individual includes needs originating from the individual themselves, such as interest and curiosity (Akbaba & Aktas, 2005). Praise of a student by a teacher, due to his/her high marks, can be given as an example of extrinsic motivation. Curiosity, a need for knowledge, a desire for becoming competent and a desire for developments can be given intrinsic motivation (Selcuk, 2000). Control is in the individual's grasp with intrinsic motivation while control is in the environment in extrinsic motivation (Yildiz, 2010). Mathematics motivation, on contrary, is in the students' eagerness to learn and active participation in activities related to mathematics (Ispir, Ay & Saygi, 2011). Teachers should refrain from attitudes and behaviours that may prevent students becoming motivated during the learning process, and they should take steps towards motivating students (Balantekin & Oksal, 2014). For this reason, students who are motivated to learn will actively participate in classes and repeat the information, associate information with previous information and ask questions. A person who is motivated does activities on the subject in his spare time, conducts studies and looks for different ways of learning (Schunk, 2009).

Another affective characteristic is the concept of 'anxiety'. Especially, if there is mathematics involved, it is enough for students just to hear the name of the course to feel anxiety. Studies have revealed that a medium level of anxiety positively affects success in courses; however, excessive levels of anxiety impede learning and students fail. A failed student becomes more anxious and, as he/she gets anxious, he/she fails again. As long as this cycle continues, in the long term, this leads people to avoid mathematics, become distant and it even affects their choice of profession. As can be seen, anxiety is both the reason and the outcome of achievement (Deringol, 2017).

Prejudice developed against mathematics in the community also affects students' perceptions of the course. This is especially true of the anxiety that students feel against mathematics and is among the leading problems in the field of mathematics (Bai, 2011; Cates & Rhymer, 2003; Ozdemir & Gul, 2011; Yenilmez, 2010). It was determined that a student of mathematics anxiety of adverse effects

related to the use of mathematics (D'Ailly & Bergening, 1992; Erktin, Donmez & Ozel, 2006; Scarpello, 2005). Mathematics anxiety in students usually emerges with various negative experiences they have at school (Harper & Daane, 1998; Jackson & Leffingwell, 1999). It can be seen that students' negative experiences in mathematics courses during primary school creates mathematics anxiety, this state of anxiety leads to avoiding mathematics until the secondary school period (Ashcraft, 2002; Royse & Rompf, 1992), at the same time, they also lead to the trend in decreasing confidence in mathematics skills (Bursal & Paznokas, 2006). Insecurity and low motivation also lead to students'avoidance of mathematics and their failures in further educational stages, starting from primary education (Zakaria & Nordin, 2008). As can be seen, mathematics motivation and anxiety are related. In this study conducted on the basis of this idea, the objective is to analyse primary school students' mathematics motivations and anxieties in terms of different variables. Sub-problems determined for this purpose are as follows:

i How are students' mathematics motivation and anxiety levels?
ii Do students' mathematics motivation and anxieties vary according to gender?
iii Do students' mathematics motivations and anxieties vary according to their grade level?
iv Do students'mathematics motivations and anxieties vary according to their state of liking the mathematics course?
v Is there a relationship between students' mathematics motivations, anxieties and their grades?

2. Method

2.1. Research design

This study was designed as a quantitative survey model towards comparing primary school students' motivation and mathematics anxieties. It was decided to carry out the present research, which was intended to examine the current situations of primary school students, in a survey model. As stated by Karasar (2005), the survey model's aim is 'describing a situation existing in the past or recently as it is'.

2.2. Participants

The research sample consists of a total of 202 third and fourth grade students attending primary schools in Istanbul province (Turkey) and selected with a simple random sampling method. As basic operation concepts are intensively given in the first 2 years of primary school, the sample of the research was chosen from the students in the third and fourth grades, the last two grades of primary school. Distribution of students in the study group based on gender and grade levels is presented below.

Table 1. Students' gender and grade levels

Grade level	Female		Male		Total	
	f	%	*f*	%	*f*	%
Third grade	55	53.9	47	46.1	102	50.5
Fourth grade	53	53.0	47	47.0	100	49.5
Total	108	53.5	94	46.5	202	100

The sample consists of a total of 202 primary school students including 108 (53.5%) girls and 94 (46.5%) boys. In all, 102 (50.5%) of the students attend the third grade; 100 (49.5%) of them attend the fourth grade.

2.3. Data collection tools

'Personal Information Form', 'Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students' and 'Mathematics Anxiety Scale for Primary School Students' were used as data collection tools in the research.

Personal Information Form: the first data collection tool is 'Personal Information Form' developed by the researcher. Personal Information Form consists of demographic information about students and their answers to the question of whether they like mathematics or not.

Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students: This scale was developed by Balantekin and Oksal (2014) and consists of 14 items and includes 3 sub-dimensions. These dimensions include 'Extrinsic Motivation', 'Demotivation' and 'Intrinsic Motivation'. As the scale was prepared in five-point Likert type, it is scored in the form of Strongly Agree (five), Agree (four), Neither Disagree nor Agree (three), Disagree (two), Completely Disagree (one). There are no negative items in the scale. Accordingly, as the 'Extrinsic Motivation' and 'Demotivation' factors consist of 5 items, minimum 5 and maximum 25 points can be obtained from these factors. As the 'Intrinsic Motivation' consists of 4 items, minimum 4 and maximum 20 points can be obtained (Balantekin & Oksal, 2014). Internal consistency coefficient of the scale was found as 0.78; also found as 0.76 in this research.

Mathematics Anxiety Scale for Primary School Students: this scale was developed by Bindak (2005) and consists of a total of 10 items. This scale was prepared in five-point Likert type, and these options include 'always, often, sometimes, hardly ever and never'. Positive items for anxiety were scored in the form of 5-4-3-2-1, and negative items for anxiety were scored in the form of 1-2-3-4-5. One of the items included in the scale is negative items for anxiety. Thus, an anxiety score was included in each score. High score showed high level of mathematics anxiety. Internal consistency coefficient of the scale was found as 0.84, also found as 0.87 in this research.

2.4. Data analysis

Data collection tools were applied to primary school students on a mathematics course. Volunteering was taken as a basis for participation in the study. The papers, which had imperfect information, were excluded from the study, the ones who completely filled in the measuring tools were included in the study and their data entries were made. Statistical solutions of measurement tools were conducted using SPSS 16.0. Before starting the analyses, the Kolmogorov–Smirnov test was conducted in normality testing of data distributions and, at the same time, Skewness–Kurtosis values of scores were evaluated. As the significance value was found to be lower than 0.05 according to Kolmogorov–Smirnov test results, and the skewness coefficient was between +2.0 and −2.0 according to George and Mallery (2010), it was observed that data showed normal distribution, and parametric tests were used. Accordingly, in data analysis, independent sample *t* test, one-way analysis of variance and Pearson moment correlation technique were applied and calculated.

3. Findings

Findings obtained, which are related to Third and Fourth grade primary school students' mathematics motivations and mathematics anxieties based on variables, are presented below. Findings belonging to the first problem are presented.

Table 2. Mathematics motivation and anxiety score averages of the sample

Scales	*N*	Mean	SD
Extrinsic motivation	202	2.66	1.16
Demotivation	202	1.84	1.00
Intrinsic motivation	202	4.19	0.88

Mathematics motivation	202	2.80	0.68
Mathematics anxiety	202	1.78	0.83

To determine students' levels as per their scores obtained from the scales, the range width of the scale was calculated by using the 'array width/number of groups to be applied' (4/5 = 0.80) formula (Tekin, 1993). Arithmetic average ranges of the scale were determined as 1.00–1.79 'Very Low', 1.80–2.59 'Low', 2.60–3.39 'Medium' 3.40–4.19 'High' and 4.20–5.00 'Very High'. Accordingly, as can be seen in Table 2, students achieved medium levels of scores from the 'Extrinsic Motivation' dimension, low levels of scores from the 'Demotivation' dimension and high levels of scores from the 'Intrinsic Motivation' dimension. Analysing the scale in general, it can be said that students' mathematics motivations are at a medium level, and their mathematics anxieties are very low.

Findings belonging to the second problem are presented below.

Table 3. Independent sample t test results of mathematics motivation and anxiety scores according to the gender variable of the sample

Scales	Gender	*N*	Mean	SD	*t*	*p*
Extrinsic motivation	Girl	108	13.65	5.77	0.929	0.354
	Boy	94	12.89	5.89		
Demotivation	Girl	108	9.78	5.12	1.754	0.081
	Boy	94	8.55	4.82		
Intrinsic motivation	Girl	108	16.41	3.56	−1.489	0.138
	Boy	94	17.15	3.50		
Mathematics motivation	Girl	108	39.86	9.57	0.932	0.353
	Boy	94	38.60	9.51		
Mathematics anxiety	Girl	108	18.00	7.84	0.245	0.807
	Boy	94	17.71	8.85		

No significant differences were found between genders in the sample and 'Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students' 'Extrinsic Motivation' (t = 0.929; p > 0.05), 'Demotivation' (t = 1.754; p > 0.05), 'Intrinsic Motivation' (t = −1.489; p > 0.05) dimensions and scale total (t =0.932; p > 0.05) scores. Also, there are no significant differences among 'Mathematics Anxiety Scale for Primary School Students' (t = 0.245; p > 0.05) total scores.

The findings of the third, fourth and fifth problems are presented below.

Table 4. Independent sample t test results of mathematics motivation and anxiety scores as per grade level in the sample

Scales	Grade	*N*	Mean	SD	*t*	*p*
Extrinsic motivation	Third	102	14.05	6.39	1.875	0.062
	Fourth	100	12.53	5.10		
Demotivation	Third	102	9.45	4.72	0.681	0.497
	Fourth	100	8.97	5.30		
Intrinsic motivation	Third	102	17.14	3.56	1.562	0.120
	Fourth	100	16.37	3.50		
Mathematics motivation	Third	102	40.65	10.03	2.092	0.038
	Fourth	100	37.87	8.84		
Mathematics anxiety	Third	102	18.12	8.41	0.450	0.653
	Fourth	100	17.60	8.22		

No significant differences were found between grades included in the sample and 'Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students' scale total (t = 2.092; p < 0.05) scores. Accordingly; mathematics motivations of fourth grade students are higher than those of

third grade students. There was no significant difference between the grades of the students in the sample and 'Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students' 'Extrinsic Motivation' (t = 1.875; p > 0.05), 'Demotivation' (t = 0.681; p > 0.05), 'Intrinsic Motivation' (t = 1.562; p > 0.05) dimension scores. Also, there are no significant differences among 'Mathematics Anxiety Scale for Primary School Students' (t = 0.450; p > 0.05) total scores.

Table 5. Independent sample t test results of mathematics motivation and anxiety scores from the answers given to the question 'Do you like mathematics?' in the sample

Scales	Answer	*N*	Mean	SD	*t*	*p*
Extrinsic motivation	Yes	169	13.05	5.97	−1.375	0.171
	No	33	14.57	4.88		
Demotivation	Yes	169	8.59	4.71	−4.100	0.000
	No	33	12.36	5.38		
Intrinsic motivation	Yes	169	17.43	3.11	6.775	0.000
	No	33	13.30	3.63		
Mathematics motivation	Yes	169	39.08	9.38	−0.634	0.527
	No	33	40.24	10.40		
Mathematics anxiety	Yes	169	16.50	7.44	−5.644	0.000
	No	33	24.81	9.09		

No significant differences were found between 'Mathematics Course Motivation Scale for Third and Fourth Grade Primary School Students' 'Demotivation' (t = −4.100; p < 0.01) and 'Intrinsic Motivation' (t = 6.775; p < 0.01) dimension scores and answers given to the question 'Do you like mathematics?'. Accordingly, in the 'Demotivation' dimension, scores among students who did not like mathematics were higher than those of students who liked mathematics; in Intrinsic Motivation' dimension, scores among students who liked mathematics were higher than those of students who did not like mathematics. No significant differences were found between 'Mathematics Course Motivation Scale for Third and Fourth Grade Primary School Students' 'Extrinsic Motivation' (t = −1.375; p > 0.05) dimension, scale total (t = −0.634; p > 0.05) scores and answers given to the question 'Do you like mathematics?'. There was significance between 'Mathematics Anxiety Scale for Primary School Students' (t = −5.644; p < .01) total scores and answers to question 'Do you like mathematics?'. Anxieties among students who answered 'I like mathematics' were relatively lower (Table 5).

Table 6. Pearson product moment correlation analysis results for mathematics motivation and anxiety scores with mathematics grades

Scales	*N*	*r*	*p*
Mathematics grades	202	−0.158	0.025
Extrinsic motivations			
Mathematics grades	202	−0.130	0.065
Demotivation			
Mathematics grades	202	0.155	0.028
Intrinsic motivation			
Mathematics grades	202	−0.107	0.129
Mathematics motivation scale			
Mathematics grades	202	−0.289	0.000
Mathematics anxiety scale			

As can be seen from Table 6, a negatively oriented significant relationship was determined between primary school students' mathematics grades and 'Extrinsic Motivation' (r = −0.158; p < 0.05), 'Mathematics Anxiety Scale for Primary School Students' (r = −.289; p<.01) total scores; and a positively oriented significant relationship was found between students' grades and 'Intrinsic Motivation' (r = 0.155; p < 0.05). There are no significant relationships between mathematics grades

and the 'Demotivation' (r = −0.130; p > 0.05) dimension and 'Mathematics Course Motivation Scale for Primary School Third and Fourth Grade Students' (r = −0.107; p > 0.05) total scores.

4. Conclusion and discussion

Students' academic achievements are affected by cognitive input behaviours and affective characteristics (Ilhan & Sunkur, 2012). It is known that cognitive input behaviours are open to change (Senemoglu, 2005), it is hard to notice affective characteristics and, unfortunately, it takes time to change these characteristics (Erden & Akman, 2011). Therefore, it is important to recognise students' affective properties related to the learning–teaching process and related to the course at an early stage. Thus, if students' affective features, which adversely affect their achievement, are detected at an early stage, it can be easier to take measures and even eliminate the problems (Ilhan & Sunkur, 2012). Therefore, similarity the result of this research, in which primary school students' mathematics motivation and anxieties were determined, it can be seen that students achieved a medium of score from 'Extrinsic Motivation' and a low score from 'Demotivation', a high score from 'Intrinsic Motivation' and, considering the scale in general, it can be said that students have a medium level of mathematics motivation.

Students' low scores in the demotivation dimension and their high score in the intrinsic motivation dimension can be explained as the fact that students' motivation towards mathematics may be positive. In a study conducted by Dede and Argun (2004), similarly, it was concluded that students' intrinsic motivations towards mathematics were relatively higher compared to their extrinsic motivations. Aktan (2012) also concluded that, while fifth grade primary school students' mathematics motivations were over the medium level, their motivations were not very high. At the same time, it can be said that mathematics anxieties in the sample were very low.

In the research, primary school students' mathematics motivations and anxieties did not create a difference based on their grade levels. Similarly, in the study conducted by Bozkurt and Bircan (2015), 'Analysis of the Relationship between Primary Fifth Grade Students' Math Motivation with Academic Achievement of Maths', a difference was not found between students' gender and their mathematics motivations. It was concluded that, in the many of the studies conducted, gender was not affective in mathematics motivation (Ayan, 2014; Budak, 2016). According to the results of many studies, no differences were found between anxiety and gender as is the case in this study (Cooper & Robinson, 1991; Dede & Dursun, 2008; Sakal, 2015; Sapma, 2013; Tasdemir, 2015; Tobias, 1991; Yetkin, 2017).

Mathematics motivations of fourth grade students were higher than those of third grade students in the research sample. In a study conducted by Alucdibi and Ekici (2012), it was concluded that students' levels of motivation increased as the level of grade increased. Skinner and Belmont (1993) indicated that levels of motivation decreased passing from primary school to higher education, and students moved away from the learning process in time. In the sample, students' mathematics anxieties did not vary according to the grade level variable. Results of some studies also show similarities with this finding (Aydogdu, 2017; Evren, 2010; Yenilmez & Ozbey, 2006).

Students were asked 'Do you like the mathematics course?' and, based on the answers given by the students, it was found that scores obtained from students who did not like mathematics were relatively higher in the 'Demotivation' dimension, and scores obtained by students who liked mathematics were relatively higher in the 'Intrinsic Motivation' dimension. As can be seen, whether they like mathematics also affects students' motivation towards the course. In a study conducted by Tasdemir (2015), it was concluded that mathematics anxiety levels among students who liked mathematics were significantly lower compared to those of students who did not like mathematics. Similarly, results of many studies conducted with primary school students are in parallel with the results of this study (Baban, 2018; Peker & Senturk, 2012; Sakal, 2015; Sahin, 2008). Also, mathematics anxieties are lower among students who report that they like mathematics. Consequently, liking the mathematics course affects both motivation and anxieties. At this point, teachers have a great responsibility in ensuring that students like the

mathematics course. Classroom teachers should be able to arrange and apply activities that will make students like the mathematics course; they should care about personal differences; they should be able to show fun aspects of mathematics to students and apply various educational techniques to ensure that their students succeed.

The last result of the research is a determination of a negatively oriented relationship between primary school students' mathematics grades and their extrinsic motivation, mathematics anxieties, and a positively oriented relationship between their grades and intrinsic motivation. There are no significant relationships between mathematics grades and scores from demotivation and total motivation. In extrinsic motivation, behaviour may end as soon as reinforcement ends. Individuals with intrinsic motivation are fully focused. Therefore, it can be said that intrinsic motivation is more effective in reaching and maintaining achievement (Gazioglu, 2013). Students with intrinsic objectives tend to have increased levels of intrinsic motivation when they face subjects in which they are interested, enjoy and subjects that will challenge them (Zimmerman, 2002). In many studies (Demir & Budak, 2016; Harackiewicz, Elliot, Carter, Lehto & Barron, 1997; Rawsthome & Elliot, 1999), intrinsic motivation was emphasised to increase achievement. Significant relationships were found between the students' mathematics scores and their motivations and anxiety. There are many studies that have concluded that achievement is associated with both mathematics anxiety and motivation (Aktan, 2012; Shores & Shannon, 2007; Stevens, Olivarez Jr., Lan & Tallent-Runnels, 2004; Yildirım, 2011).

Motivation is a variable closely associated with academic achievement (Awan, Noureen & Naz, 2011; Bobis, Anderson, Martin & Way, 2011; Budak, 2016; Jackson, 2002; Ma & Kishor, 1997; Middleton & Spanias, 1999; Shores & Shannon, 2007; Singh, Granville & Dika, 2002). At the same time, it can be said that mathematics anxiety is an important variable explaining students' achievements in mathematics (Ramirez, Gunderson, Levine & Beilock, 2013; Suinn & Edwards, 1982). Students with a high level of mathematics anxiety will reach a lower level of mathematics achievement compared to students who have a low level of mathematics anxiety (Gazioglu, 2013). According to many studies, there is a negatively oriented relationship between students' achievements in mathematics and their mathematics anxieties. In other words, many studies supported the finding that students with high levels of mathematics achievement have lower levels of mathematics anxiety or there is a negatively oriented significant relationship (Durmaz, 2012; Dursun & Bindak, 2011; Ilhan & Sunkur, 2012; Karimi & Venkatesan, 2009; Kutluca, Alpay & Kutluca, 2015; Lee & Stankov, 2013; Ma, 1999; Sherman & Wither, 2003; Tooke & Leonard, 1998; Wadlington & Wadlington, 2008; Wahid, Yusof & Razak, 2014).

Consequently, knowing students' motivations towards mathematics in general and knowing students' intrinsic and extrinsic motivations towards mathematics specifically will offer a good idea to teachers about how they can apply teaching (Dede & Argun, 2004). Students' lack of belief in becoming successful lies at the base of their anxieties towards a mathematics course. On this subject, teachers have a responsibility to encourage students and make students believe in their success. To achieve this, teachers should determine the objectives of a subject explicitly, use various materials to make courses fun and keep students' motivation high (Yenilmez & Ozbey, 2006).

The following recommendations can be made in line with the results of the study:

Classroom teachers should develop and apply effective activities in order to ensure that their students' mathematics motivations are high and their anxieties are low. Also, teachers should prepare the environments in which they introduce the entertaining world of mathematics to the students. In line with the findings obtained in the study, the present study can be structured quantitatively or qualitatively, with different samples, by taking different variables into account. There were no differences by gender in the study. Accordingly, primary school students' mathematics motivations and anxieties can be examined thoroughly by dealing with them in terms of gender. Longitudinal studies may be conducted to examine the effects of affective factors and observations by primary school students.

References

Afzal, H., Ali, I. & Khan, M. A. (2010). A study of university students' motivation and its relationship with their academic performance. *International Journal of Business and Management*, *5*(4), 80–88. doi: 10.5539/ijbm.v5n4p80

Akbaba, S. & Aktas, A. (2005). Searching internal motivation according to some variables. *M.U. Ataturk Education Faculty Journal of Educational Sciences*, *21*, 19–42.

Aksu, M. (1991). The aims and principles of mathematics teaching. In B. Ozer (Ed.), *Teaching mathematics* (pp. 2–15). Eskisehir, Turkey: Anadolu University Open Education Faculty.

Aktan, S. (2012). *Relationship between the academic success, self-regulating learning skills, and motivations of 5th grade students and teaching styles of teachers* (Master thesis). University of Balikesir, Turkey.

Alucdibi, F. & Ekici, G. (2012). The analysis of biology course motivation levels of secondary education students in terms of different variables. *Journal of Abant Izzet Baysal Education*, *12*(1), 197–227.

Ashcraft, M. H. (2002). Math anxiety: personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, *11*(5), 181–185. doi: 10.1111/1467-8721.00196

Awan, R., Noureen, G. & Naz, A. (2011). A study of relationship between achievement motivation, self-concept and achievement in English and mathematics at secondary level. *International Education Studies*, *4*(3), 72–79. doi: 10.5539/ies.v4n3p72

Ayan, A. (2014). *The relationship between mathematics self-efficacy, motivations, anxieties and the attitudes for secondary school students* (Master thesis). University of Balikesir, Turkey.

Aydogdu, A. (2017). *Analysis of sport success perception and math anxiety according to some variables in primary school students* (Master thesis). University of Nisantasi, Istanbul, Turkey.

Baban, A. (2018). *Mathematical concern and perceived teacher attitude in middle school students* (Master thesis). University of Nisantasi, Istanbul, Turkey.

Bai, H. (2011). Cross-validating a bidimensional mathematics anxiety scale. *Assessment*, *1*, 178–182. doi: 10.1177/1073191110364312

Balantekin, Y. & Oksal, A. (2014). Mathematics lesson motivation scale for primary school 3th and 4th grade students. *Cumhuriyet International Journal of Education*, *3*(2), 102–113.

Bindak, R. (2005). Math anxiety scale for elementary school students. *Journal of Science and Engineering Sciences, 17*(2), 442–448.

Bobis, J., Anderson, J., Martin, A. & Way, J. (2011). *A model for mathematics instruction to enhance student motivation and engagement*. In D. J. Brahier & W. R. Speer (Eds.), *Motivation and disposition: pathways to learning mathematics* (pp. 31–42). Reston, VA: National Council of Teachers of Mathematics.

Bozkurt, E. & Bircan, M. A. (2015). Analysis of relationship between primary fifth grade students' math motivation with academic achievement of math. *International Journal of Turkish Education Sciences*, 201–220.

Budak, H. (2016). *The determination of self-regulating, motivation, metacognitive skills and mathematics success of 4th grade students* (Master thesis). Canakkale Onsekiz Mart University, Canakkale, Turkey.

Bursal, M. & Paznokas, L. (2006). Mathematics anxiety and pre-service elementary teachers' confidence to teach mathematics and science. *School Science and Mathematics*, *106*(4), 173–179. doi: 10.1111/j.1949-8594.2006.tb18073.x

Cates, G. L. & Rhymer, K. N. (2003). Examining the relationship between mathematics anxiety and mathematics performance: an instructional hierarchy perspective. *Journal of Behavioral Education*, *12*(1), 23–34.

Cooper, S. & Robinson, D. (1991). The relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. *Measurement and Evaluation in Counseling*, *24*, 4–11.

D'Ailly, H. & Bergening, A. J. (1992). Mathematics anxiety and mathematics avoidance behavior: a validation study of two MARS factor-derived scales. *Educational and Psychological Measurement*, *52*, 369–377. doi: 10.1177/0013164492052002012

Dede, Y. & Argun, Z. (2004). Identification of students' intrinsic and extrinsic motivation towards mathematics. *Education and Science*, *29*(134), 49–54. doi: 10.1016/j.lindif.2005.06.004

Dede, Y. & Dursun, S. (2008). An investigation of primary school students' mathematics anxiety levels. *Journal of Uludag Education Faculty*, *21*(2), 295–312. doi: 10.16949/turkbilmat.277870

Demir, M. K. & Budak, H. (2016). The relationship between self-regulating, motivation and metacognitive skills and mathematics success of 4th grade students. *Journal of Buca Education Faculty*, *41*, 30–41.

Deringol, Y. (2017). Mathematics worries me! In M. L. Z Tascılar (Ed.), Psychology of special talented children theoretically. Istanbul, Turkey: Nobel, 155–186.

Durmaz, M. (2012). *Identifying the relationships among the degrees of basic psychological needs satisfaction, motivation and mathematics anxiety of high school students (10th grade)* (Master thesis). University of Abant Izzet Baysal, Bolu, Turkey.

Dursun,S. & Bindak, R. (2011). The investigation of elementary school students' mathematics anxiety. *Journal of Social Sciences Cumhuriyet University*, *35*(1), 18–21.

Endler, A., Rey, G. D. & Butz, M. V. (2012). Towards motivation-based adaptation of difficulty in e-learning programs. *Australasian Journal of Educational Technology*, *28*(7), 1119–1135.

Erden, M. & Akman, Y. (2011). *Development and learning.* Ankara, Turkey: Arkadas.

Erktin, E., Donmez, G. & Ozel, S. (2006). Psychometric characteristics of the math anxiety scale. *Education and Science*, *140*(31), 26–33.

Evren, K. (2010). *A study into association between elementary school students, self-esteem in 6th, 7th, 8th grades and their mathematics anxiety* (Master thesis). University of Selcuk, Konya, Turkey.

Gazioglu, G. (2013). Motivation. In M. Baloglu (Ed.), *Learning psychology*. Ankara, Turkey: Nobel.

George, D. & Mallery, M. (2010). *SPSS for windows step by step: a simple guide and reference.* 17.0 update. Boston, MA: Pearson.

Harackiewicz, J. M., Elliot, A. J., Carter, S. M., Lehto, A. T. & Barron, K. E. (1997). Predictors and consequences of achievement goals in the college classroom: maintaining interest and making the grade. *Journal of Personality and Social Psychology*, *73*(6), 1284–1295. doi: 10.1037/0022-3514.73.6.1284

Harper, N. W. & Daane, C. J. (1998). Causes and reduction of math anxiety in preservice elementary teachers. *Action in Teacher Education*, *19*(4), 29–38. doi: 10.1080/01626620.1998.10462889

Ilhan, M. & Sunkur, M. O. (2012). Math anxiety is the power to predict mathematical success of positive and negative perfectionism. *Journal of Mersin University Faculty*, *8*(1), 178–188.

Ispir, O. A., Ay, Z. S. & Saygi, E. (2011). High achiever students' self-regulated learning strategies, motivation towards mathematics, and their thinking styles. *Education and Science*, *36*(162), 235–246.

Jackson, C. D. & Leffingwell, R. J. (1999). The role of instructors in creating math anxiety in students from kindergarten through College. *The Mathematics Teacher*, *92*(7), 583–586.

Jackson, J. W. (2002). Enhancing self-efficacy and learning performance. *The Journal of Experimental Education*, *70*(3), 243–255.

Kanbir, S. (2009). *The investigation of mathematics anxiety based on the problem of language and culture* (Master thesis). University of Marmara, Istanbul, Turkey.

Karasar, N. (2005). *Scientific research methodology* (13th ed.). Ankara, Turkey: Nobel.

Karimi, A. & Venkatesan, S. (2009). Cognitive behavior group therapy in mathematics anxiety. *Journal of the Indian Academy of Applied Psychology*, *35*(2), 299–303.

Kutluca, T., Alpay, F. N. & Kutluca, S. (2015). An investigation of factors affecting 8th grade math students' anxiety levels. *Journal of Dicle University Ziya Gokalp Education Faculty*, *25*, 202–214. doi: 10.14582/ DUZGEF.634

Lee, J. & Stankov, L. (2013). Higher-order structure of noncognitive constructs and prediction of pisa 2003 mathematics achievement. *Learning and Individual Differences*, *26*, 119–130. doi: 10.1016/ j.lindif.2013.05.004

Ma, X. (1999). A meta-analysis of the relationship between anxiety and toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education*, *5*(30), 520–540. doi: 10.2307/749772

Ma, X. & Kishor, N. (1997). Assessing the relationship between attitude towards mathematics and achievement in mathematics: a meta-analysis. *Journal for Research in Mathematics Education*, *28*, 26–47. doi: 10.2307/749662

Middleton, J. A. & Spanias, P. A. (1999). Motivation for achievement in mathematics: findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education*, *30*(1), 65–88. doi: 10.2307/749630

Ozdemir, E. & Gul, H. (2011). Validity and reliability study of mathematics anxiety apprehension survey (MASS). *Education and Science, 36*(161), 39–50.

Palmer, D. (2005). A motivational view of constructivist informed teaching. *International Journal of Science Education*, *27*(15), 1853–1881. doi: 10.1080/09500690500339654

Peker, M. & Senturk, B. (2012). An investigation of 5th grade students' math anxiety in terms of some variables. *Journal of Dumlupınar University of Social Sciences*, *34*, 21–32.

Ramirez, G., Gunderson, E. A., Levine, S. C. & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development*, *14*(2), 187–202. doi: 10.1080/15248372.2012.664593

Rawsthome, L. J. & Elliot, A. J. (1999). Achievement goals and intrinsic motivation: a meta-analytic review. *Personality and Social Psychology Review*, *3*(4), 326–344. doi: 10.1207/s15327957pspr0304_3

Royse, D. & Rompf, E. L. (1992). Math anxiety: a comparison of social work and non-social work students. *Journal of Social Work Education*, *28*(3), 270–277.

Sahin, F. Y. (2008). Mathematics anxiety among 4th and 5th grade Turkish elementary school students. *International Electronic Journal of Mathematics Education*, *3*(3), 179–192.

Sakal, M. (2015). *Examining* 4th *grade students' mathematics anxiety according to some psycho-social variables* (Master thesis). University of Dokuz Eylul, Izmir, Turkey.

Sapma, G. (2013). *The statistical methods analysis of the relationship between the success of the mathematics and the anxiety of the mathematics* (Master thesis). University of Marmara, Istanbul, Turkey.

Scarpello, G. V. (2005). *The effect of mathematics anxiety the course and career choice of high school vocational-technical education students.* (Unpublished PhD thesis). Drexel University, Philadelphia.

Schunk, D. H. (2009).XXXX. In M. Sahin (Ed.), *Learning theories: an educational view*. Ankara, Turkey: Nobel.

Senemoglu, N. (2005). *Development, learning and teaching.* Ankara, Turkey: Gazi.

Sherman, B. F. & Wither, D. P. (2003). Mathematics anxiety and mathematics achievement. *Mathematics Education Research Journal,* 15(2), 138–150.

Shores, M. L. & Shannon, D. M. (2007). The effects of self-regulation, motivation, anxiety, and attributions on mathematics achievement for fifth and sixth grade students. *School Science and Mathematics*, *107*(6), 225. doi: 10.1111/j.1949-8594.2007.tb18284.x

Selcuk, Z. (2000). *Development and learning*. Ankara, Turkey: Nobel.

Singh, K., Granville, M. & Dika, S. (2002). Mathematics and science achievement: effects of motivation, interest, and academic engagement. *The Journal of Educational Research*, *95*(6), 323–332.

Skinner, E. A. & Belmont, M. J. (1993). Motivation in the classroom: reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, *85*(4), 571–581. doi: 10.1037/0022-0663.85.4.571

Stevens, T., Olivarez, A., Jr., Lan, W. Y. & Tallent-Runnels, M. K. (2004). Role of mathematics self-efficacy and motivation in mathematics performance across ethnicity. *Journal of Educational Research*, *97*, 208–221. doi: 10.3200/JOER.97.4.208-222

Suinn, R. M. & Edwards, R. (1982). The measurement of mathematics anxiety: the mathematics anxiety rating scale for adolescents Mars-A. *Journal of Clinical Psychology*, *38*, 576–577. doi: 10.1002/1097-4679

Tasdemir, C. (2015). To investigate the mathematic anxiety levels of secondary students. *Journal of Life Sciences*, *5*(1), 1–12.

Tekin, H. (1993). *Measurement and evaluation in education*. Ankara, Turkey: Yargı.

Tobias, S. (1991). Math mental health: going beyond math anxiety. *College Teaching*, *39*(3), 91–93.

Tooke, D. J. L. & Leonard, C. (1998). Effectiveness of a mathematics methods course in reducing mathematics anxiety of preservice elementary teachers. *School Science and Mathematics*, *98*(3), 136–142. doi: 10.1111/j.1949-8594.1998.tb17406.x

Unal, F. T. & Bursali, H. (2013). Turkish teachers' views about motivation factors. *Middle Eastern & African Journal of Educational Research*, *5*, 7–22.

Wadlington, E. & Wadlington, P. L. (2008). Helping students with mathematical disabilities to succeed. *Preventing School Failure*, *53*(1), 2–7. doi: 10.3200/PSFL.53.1.2-7

Wahid, S. N. S. & Yusof, Y. & Razak, M. R. (2014). Math anxiety among students in higher education level. *Procedia Social and Behavioral Sciences*, *123*, 232–237. doi: 10.1016/j.sbspro.2014.01.1419

Yenilmez, K. (2010). High school students' hopelessness levels towards mathematics. *Hacettepe University Journal of Education*, *38*, 307–317.

Yenilmez, K. & Ozbey, N. (2006). A Research on mathematics anxiety levels of the students of private school and the other schools. *Journal of Uludağ University Education Faculty, 19*(2), 431–448.

Yetkin, O. (2017). *To examine secondary school students'attitudes towards mathematics anxiety and learning* (Master thesis). University of Dokuz Eylul, Izmir, Turkey.

Yildirim, S. (2011). Self-efficacy, intrinsic motivation, anxiety and mathematics achievement: Findings from Turkey, Japan and Finland. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, *5*(1), 277–291.

Yildirim, K., Tarim K. & Ilfazoglu, A. (2006). The effects of cooperative learning within A multiple intelligence framework on academic achievement and retention in maths. *Journal of Theory and Practice in Education*, *2*(2), 81–96.

Yildiz, B. (2010). *An evaluation of the motivation levels of primary school teachers in Terms Herzberg's Two-Factor Theory* (Master thesis). University of Beykent, Istanbul, Turkey.

Zakaria, E. & Nordin, N. M. (2008). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, *4*(1), 27–30. doi: 10.12973/ejmste/75303

Zimmerman, B. J. (2002). Becoming a self-regulated learner: an overview. *Theory into Practice*, *41*, 64–70.