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A study on the elementary school students' mathematics self concept

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Abstract

Mathematics self-concept, which can be defined as student ratings of their skills, ability, enjoyment and interest in mathematics, is seen as an important factor in mathematics education. In this context, the purpose of this study was to investigate the elementary school students' mathematics self-concept levels regarding their grade level and gender. Relational survey method was used in this study. The research sample were composed of 281 students, determined by randomly from in a primary and a secondary school in Istanbul in the spring term of 2013-2014 academic year. Data were collected using the "Self-Description Questionnaire-I" developed by Marsh (1992) and adapted into Turkish by Yıldız and Fer (2008). Analysis of variance (One-way ANOVA) and independent sample t-test were employed to analyze data. The results of the analyses indicate that there is a statistically significant difference between elementary school students' mathematics self-concept levels based on their grade levels. Furthermore, there was a significant difference in elementary school students' mathematics self-concept levels points of view gender. In the light of the findings of this study, the researchers have developed suggestions.

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Keywords: mathematics; mathematics self-concept; mathematics education; elementary.

1. Introduction

Professional organizations of mathematics education have attached great importance to affective factors (National Council of Teachers of Mathematics, 2000). According to Bloom (1995), one of the most important and stable

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indicators of affective student attributes is self-concept; it affects many critical behaviors of the students such as effort to learn, determination when confronted by a problem and participation in the lectures.

The term self is generally used in reference to the conscious reflection of one's own being or identity, as an object separate from other or from the environment. There are a variety of ways to think about the self with self-concept. Self-concept is often considered as the cognitive or thinking aspect of self (related to one's self-image) (Huitt, 2011). Intriguingly, there seems to be diverse opinions on the definition of self-concept.

According to Rogers (1959), who is one of the researches on self-concept, self-concept is a combination of organized and at the same time consistent perceptions and beliefs about self. On the other hand, Rosenberg (1989) defines self-concept as a collection of thoughts and ideas about self. Shavelson, Hubner and Stanton (1976) provides another point of view by taking common points of self-concept definitions into account, and they define self-concept as self-perception, created with the effects of past experiences and social environment. Franken (1994) states the importance of one's self-concept that there is a great deal of research which shows that the self-concept is, perhaps, the basis for all motivated behavior. It is the self-concept that gives rise to possible selves, and it is possible selves that create the motivation for behavior (Franken, 1994).

There are different views on characteristics of self-concept, as there are differences in the definition of it. To facilitate research in education, Shavelson, Hubner, and Stanton (1976) proposed a hierarchical model that posited a general self-concept at the apex of the hierarchy beneath which were academic and nonacademic self-concepts, and each was further divided into self-concepts in various dimensions. Academic self-concept refers to a person's "perception of self with respect to achievement in school" (Reyes, 1984). However, there has been several researches and discussions on the validity of this model (Marsh, 1987). One of these researches was conducted by Marsh and Shavelson (1985), and they classified academic self-concept in two dimensions as mathematics self-concept and verbal self-concept; their approach is different compared to Shavelson (1976) model (Marsh, 2005).

In particular, a person's mathematics self-concept refers to the perception or belief in his or her ability to do well in mathematics or confidence in learning mathematics (Reyes, 1984; Shavelson, Hubner, & Stanton, 1976). At the same time, mathematics self-concept is defined as learning mathematics concepts, learning the topics easily, being successful, liking the lectures or not, self evaluation of students in terms of their interest and skills at lectures, and their perceptions about these skills (Marsh, 1992; Reyes, 1984). In the context of this study, self-concept is defined as the way an individual thinks, feels, acts, values and evaluates himself or herself in relation to performance in mathematics.

Self-concept is an important construct in education because of its linkage to academic achievement (Ayodele, 2011; Byrne, 1984; Wang, 2007). Several studies have examined the relationship between self-concept and academic achievement or performance in mathematics. Most of these studies support the belief that self-concept is a strong facilitator of academic achievement in mathematics and that a positive or negative change in self-concept tends to produce a commensurate change in academic achievement or performance (Ayodele, 2011; Marsh & Hau 2004; Wang, 2007; Wilkins, 2004; Yıldız & Fer, 2013).

When we look at the international researches, it can be seen that there are many studies on the mathematics self-concept levels of students (Ahmed, Minnaert, & Kuyper, 2012; Marsh, Kong, & Hau, 2000). Moreover, there are several researches on the relationship between mathematics self-concept and gender (Ayodele, 2011; Fisher, 2008; Manger & Eikeland, 1998; Skaalvik & Ramkin, 1994).

When we consider the researches in Turkey, there are a few studies on the mathematics self-concept levels of the fifth grade students (Arabacı, 2006), seventh grade students (Yıldız & Fer, 2013) and prospective teachers (Isıksal, 2010). Compared to the high number of international studies on the self-concept, which is seen as an important factor in mathematics education, the number of studies on the topic in Turkey is very limited. This fact shows the need to conduct new researches to evaluate self-concept levels of elementary school students. In this context, the purpose of this study is to investigate the elementary school students' mathematics self-concept levels regarding their grade level and gender. In parallel with this purpose, the problem statement of this research is "Do mathematics self-concept levels of elementary school fourth, fifth and sixth grade students change based on grade level and gender variables?".

2. Method

2.1. Research design

The study was a relational survey design in order to describe the degree of relationship between students' mathematics self-concept and their grade level in Mathematics as well as the influence of gender on mathematics self-concept.

2.2. Participants

The participants consisted of total of 281 fourth, fifth and sixth grade students 152 (%) female and 129 (%) male studying in a primary and a secondary school located on the European side of the Istanbul province, in the spring term of 2013-2014 academic year. Descriptive statistics of participants in terms of their grade level and gender have been presented in Table 1.

Table 1. Descriptive statistics of participants in terms of their grade level and gender.

	Female		Male		
Grade	f	%	f	%	Total
4	46	52.9	41	47.1	87
5	52	54.7	43	45.3	95
6	54	54.5	45	45.5	99
Total	152	54.1	129	45.9	281

2.3. Data gathering instrument

The "Self-Description Questionnaire-I" developed by Marsh (1992) and adapted into Turkish by Yıldız and Fer (2008) was used for measuring the mathematics self-concept of students in collection of the quantitative data for the study. The Likert-type scale contains total of 8 items. It is designed as a 5-point likert scale with response categories of: Never (1), Rarely (2), Sometimes (3), Usually (4), Always (5). The researcher calculated the Cronbach's alpha reliability coefficient of the scale as 0.94. The Cronbach alpha coefficient of the scale for this study was 0.84.

2.4. Data analysis

The findings were analyzed by the techniques of descriptive statistics and parametric statistics. Frequency tables and analysis of variance (One-way ANOVA) were employed to analyze data. Furthermore, an independent sample T-test was applied to determine the variation in students' mathematics self-concept by gender.

3. Results

This section provides the findings obtained from the mathematics self-concept sub-scale administered to fourth, fifth and sixth grade students. However, Kolmogorov-Smirnov tests were conducted to establish whether the results had normal distribution prior to analysis of the tests. According to this test, if the $p > .05$, then the data has normal distribution and they can be analyzed with the parametric tests. Accordingly, the results of the Kolmogorov-Smimov test conducted on the results of the mathematics self-concept sub-scale administered to the forth, fifth and sixth grades are as follows, respectively: ($KSZ=.84$, $p=.19>.05$), ($KSZ=.87$, $p=.74>.05$) and ($KSZ=.84$, $p=.85>.05$). Because it was seen that the tests displayed normal distribution on the basis of these results, it was decided to use the Anova and t-test in other analyses. After, descriptive statistics of the scores, related to the mathematics self-concept sub-scale are presented in Table 2.

Table 2. Descriptive statistics of the mathematics self-concept sub-scale.

Grade	N	Min	Max	Mean	sd
4	87	18	38	27.51	4.66
5	95	15	36	24.66	4.86
6	99	12	39	24.45	6.41
Total	281	12	39	25.47	5.56

The table shows that the average score for the mathematics self-concept sub-scale is 25.47. It was seen that the standard deviation is low compared to the average scores. Hence, it can be said that scores of students have a homogeneous distribution. When the table is examined, it can be seen that the scores that have the highest value is 27.51 and the lowest value is 24.45. It can be further said based on these findings that students have average level in the mathematics self-concept.

Afterwards, One-way ANOVA has been conducted in order to find whether there is a considerable difference between the groups in terms of the mathematics self-concept sub-scale results. The results of this study have been presented in Table 3.

Table 3. ANOVA results for the mathematics self-concept sub-scale.

Sources of variance	Sum of squares	Degree of freedom	Mean square	F	p
Between Groups	524.48	2	262.24	8.97	<0.001
Within Groups	8129.51	278	29.24		
Total	8653.99	280			

According to the Table 3, results of the ANOVA conducted on the mathematics self-concept sub-scale of grades showed a significant difference at a statistical level of significance of 0.05 in terms of the mathematics self-concept between the three groups ($F=8.97$, $p<.05$).

Furthermore, the result of the Levene's Test applied to the mathematics self-concept sub-scale data of the grades was ($F=6.14$ $p<.05$), and therefore it can be said that the group variances weren't homogeneous at the $p<.05$ significance level, i.e. groups didn't have equal variances. To identify significantly which specific groups differed, Tamhane's T2 test has been conducted. The results of this study have been presented in Table 4.

Table 4.Tamhane's T2 test results for the mathematics self-concept sub-scale.

Grup(I)	Grup(J)	Mean difference (I-J)	p
Grade 4	Grade 5	2.84	<0.001
	Grade 6	3.05	<0.001
Grade 5	Grade 4	-2.84	<0.001
	Grade 6	0.21	0.99
Grade 6	Grade 4	-3.05	<0.001
	Grade 5	-0.21	0.99

The Tamhane's T2 test comparison results showed that the students in fourth grade significantly ($p<.05$) outperformed the students in groups fifth grade and sixth grade in mathematics self-concept. The results also showed no significant difference at a statistical level of significance of 0.05 in terms of mathematics self-concept between fifth grade and sixth grade ($p=.99>.05$). Differences among students' mathematics self-concept levels points of view gender were analyzed by independent samples t-test. The results of this study have been presented in Table 5.

Table 5. T-test results according to gender for the mathematics self-concept sub-scale.

Gender	N	Mean	sd	df	t	p
Female	152	22.80	4.97	279	10.21	<0.001
Male	129	28.61	4.47			

Results of the independent sample t-test conducted on the mathematics self-concept sub-scale scores of male and female students showed a significant difference at a statistical level of significance of 0.05 in terms of the mathematics self-concept between the two groups ($t=10.21$, $p<.05$). This difference is in favour of the male students.

4. Conclusion, discussion and implications

The results of the analyses indicate that there is a statistically significant difference between elementary school students' mathematics self-concept levels based on their grade levels. The expectation at the study was to see that as students' grade levels increase, their mathematics self-concept increase as well. However, the students with the highest level of mathematics self-concept are the ones at the fourth grade level. The study resulted in the conclusion that as students' grade levels increase, their mathematics self-concept levels decrease. At the same time, the studies of Wilkins (2004) also confirms this result; stating that there is a decline in mathematics self-concept levels of the students as the grade level increases.

According to the results of the study, there was a significant difference in elementary school students' mathematics self-concept levels points of view gender. This difference is in favour of the male students. This result is in line with the previous findings (Fennema & Sherman, 1978; Funk & Bachman, 1996; Manger & Eikeland, 1998; Reyes, 1984). Indeed, Funk and Bachman (1996) reported that boys seem to have a more positive self-concept in a number of dimensions such as mathematics and general self-esteem than do girls. Fennema and Sherman (1978) and Reyes (1984) found that boys showed significantly higher mathematics self-concept than girls. Relatedly, Johnsson-Smaragdi and Johnsson (1995) reported differences in the strength of relationship between self-concept and achievement which seems to be stronger for boys. Further, in a study to find the effect of mathematics self-concept on mathematics achievement among Norwegian elementary school students, Manger and Eikeland (1998) found that boys showed significantly higher mathematics self-concept than girls. However, this result contradicts with the outcomes of Hacıomeroglu and Bilgen's (2013) researches. Hacıomeroglu and Bilgen (2013) states that gender does not significantly affect the mathematics self-concept levels of fourth grade students.

Self-concept is not an innate feature, it is shaped with the social and physical environment in time. School environment, social groups, and parents contribute a lot to the development of self-concept and self-esteem of the children during their primary and secondary schools (Frisby & Tucker, 1993). Past experiences, being active in social groups and feeling valuable positively support the self-concept development (Shunk, 2009). In this context, it is suggested to benefit from cooperative learning groups in mathematics education to contribute to the development of elementary school students' mathematics self-concept.

There are several factors affecting self-concept development in a positive or negative way starting from childhood. Determining these factors and eliminating the ones with negative effects would support positive self-concept development (Ocakcı & Kurtuncu, 2004).

It is considered that, there are also many different factors affecting mathematics self-concept of students (such as mathematics achievement, mathematics attitude, motivation, education level of the parents, socio-economic level of the family, quantity and quality of instruction, classroom environment). As a matter of fact, some more recent studies in this area also support the existence of relationship between mathematics self-concept and mathematics academic achievement (Guay, Marsh, & Boivin, 2003; Marsh & Hau 2004). In this sense, it would be useful to repeat the study to understand the effects of other factors.

It is also considered that, using qualitative data like observation and interviews together with quantitave data would provide multi-dimensional point of view to determine which features of the students affect mathematics self-concept. For this reason, putting emphasis on the studies using qualitative data would be beneficial. Moreover, the studies should be repeated with a more exhaustive sampling.

References

Ahmed, W., Minnaert, A., & Kuyper, H. (2012). Reciprocal relationships between math self-concept and math anxiety. *Learning and individual differences, 22 (3),* 385-389.

Arabacı, G. (2006). *The relationship between the fifth graders' self-concept related to the mathematics course and their achievement in mathematics.* Unpublished master's thesis. Izmir: Dokuz Eylul University.

Ayodele, O.J. (2011). Self-concept and Performance of Secondary School Students in Mathematics. *Journal of Educational and Developmental Psychology, 1(1),* 176-183.

Bloom, B. S. (1995). *Human characteristics and school learning* (Durmuş Ali Özçelik, Trans.). Istanbul: Ministry of Education.

Byrne, B. (1984). The general/academic self-concept nomological network: A review of construct validation research. *Review of Educational Research, 54(3),* 427-456.

Fennema, E., & Sherman, J. (1978). Sex-related differences in mathematics achievement and related factors: A further study. *Journal for Research in Mathematics Education, 9,* 189-203.

Fisher, M. (2008). No gender difference in mathematics performance. July Issue of Science. The University of Wisconsin-Madison. Retrieved May 10, 2012, from http//www.wisc/edu.

Franken, R. (1994). *Human motivation* (3rd ed.). Pacific Grove, CA: Brooks/Cole Publishing Co.

Frisby, C.L., & Tucker, C.M. (1993) Black children's perceptions of self: Implications for educators. *The Educational Form, 57,* 146-156.

Funk, J. B., & Bachman, D. D. (1996). Playing violent video and computer games and adolescent self-concept. *Journal of Communication, 46,* 19-31.

Guay, F., Marsh, H. W., & Boivin, M. (2003). Akademic self-concept and academic achievement: Developmental perspectives on their causal ordering. *Journal of Educational Psychology, 95 (1),* 124-136.

Hacıomeroglu, G., & Bilgen, S. (2013). Examining mathematical self concept of the fourth grade students, 5th International Congress of Educational Research. Canakkale, Turkey.

Huitt, W. (2011). *Self and self-views. Educational psychology interactive.* Valdosta, GA: Valdosta State University.

Isıksal, M. (2010). The relationship among mathematics teaching efficacy, math anxiety and mathematical self-concept: The case of Turkish pre-service elementary teachers. *The Asia-Pacific Education Researcher, 19(3),* 501-514.

Johnsson-Smaragdi, U., & Jonsson, A. (1995). Self-evaluation in an ecological perspective: Neighbourhood, family and peers, schooling and media use. in K. E. Rosengren (Eds.), *Media effects and beyond* (pp. 150-182). London: Routledge.

Manger, T., & Eikeland, O. (1998). The effect of mathematics self-concept on girls' and boys' mathematical achievement. *School Psychology Internationa, 19(1),* 5-18.

Marsh, H.W. (1987). The hierarchical structur of self-concept and the application of hierarchical confirmatory factor analysis. *Journal of Educational Measurement, 24,* 17-39.

Marsh, H.W. (1992). *Self description qustionnaire (SDQ-I): A theoretical and empirical basis for the measurement of multiple dimensions of preadolescent self-concept. An interim test manual and research monograph.* Macarthur, New South Wales, Australia: University of Western Sydney, Faculty of Education.

Marsh, H.W. (2005). *Self-concept theory, measurement and research into practice, the role of self-concept in educational psychology*. British Psychology Society.

Marsh, H. W., & Hau, K. T. (2004). Explaining paradoxical relations between academic self-concepts and achievements: Cross-cultural generalizability of the internal/external frame of reference predictions across 26 countries. *Journal of Educational Psychology, 96,* 56-67.

Marsh, H. W., Kong, C. K., & Hau, K. (2000). Longitudinal multilevel models of the Big- Fish-Little-Pond Effect on academic self-concept: Counterbalancing contrast and reflected glory effects in Hong Kong schools. *Journal of Personality and Social Psychology, 78,* 337-349.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Nation Council of Teachers of Mathematics.

Ocakcı, A., & Kurtuncu, M. (2004). Determination in the levels of depression and self-concept in 9-13 years old age group children living in orphane. *Educational Science and Practice, 3 (5),* 75-86.

Reyes, L. H. (1984). Affective variables and mathematics education. *Elementary School Journal, 84(5),* 558-581.

Rogers, C. (1959). A theory of therapy, personality and interpersonal relationships as developed in the client-centered framework. *Psychology: A Study of a Sciene,* 3, 184-256.

Rosenberg, M. (1989). Self concept research: A historical overview. Social Forces, *68(1),* 34-44.

Shavelson, R.J., Hubner, J.J., & Stanton, G.C. (1976). Self concept: Validation of construct interpratations. *Review of Educational Research. 46(3),* 407-441.

Schunk, D. H. (2009). Learning Theories: An Educational Perspective (5th ed.) (M. Sahin, Trans.). Ankara: Nobel.

Skaalvik, E. M., & Rankin, R. J. (1994). Gender differences in mathematics and verbal achievement, self-perceptions and motivation. *British Journal of Educational Psychology, 64(3),* 419-428.

Wang, J. (2007). A trend study of self-concept and mathematics achievement in a cross-cultural context. *Mathematics Education Research Journal, 19 (3),* 33-47.

Wilkins, J. L. M. (2004). Mathematics and science self-concept: An international investigation. *The Journal of Experimental Education, 72(4),* 331-346.

Yıldız G., & Fer S. (2008). Validity and reliability of the self-description questionnaire-I. *YYU Journal of Education Faculty, , 5(2),* 209-232.

Yıldız, G., & Fer, S. (2013). Do thinking styles and mathematics self concept differentiate with respect to mathematics achievement? [in Turkish]. *Hacettepe University Journal of Education, 28(3),* 440-453.