

An Examination on the Relation Between Mathematics Anxiety and Achievements of 5th, 6th, 7th and 8th Grade Students

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Abstract

The basic aim of this study is to develop an anxiety scale to determine the anxieties of primary education 5th - 8th graders felt for mathematics course and to examine the relation between the students' anxieties and their achievements in mathematics in terms of various variables. Screening model was used in research. The 5th-8th graders studying in primary education schools in Sındırgı district of Balıkesir province in 2010-2011 education years constitute the population of the study. 244 students studying in a mobile village primary education school in district constitute the sample of the study. An exploratory factor analysis was performed by the researcher to examine the structural validity and factor structure of anxiety scale. The significance of difference between the upper and lower 27% for reliability was examined through Cronbach alpha coefficient. The findings revealed that the scale had a two-factor structure and that Cronbach alpha reliability was 0.89 and that the reliability values of all sub dimensions were higher than 0.70 and that all differences between item averages of upper and lower 27% groups were significant. In addition, according to the obtained results, it was determined that there was no difference in students' anxiety levels according to the classes and that there was a negative relation between mathematics achievement scores and mathematics anxiety.

Keywords: Mathematics Anxiety, Achievement in Mathematics, Mathematics Education

Introduction

The necessity of teaching mathematics in schools of all levels is considered to be as an indisputable judgment. In addition, the judgment that the students' achievement level in mathematics plays a more distinctive role than that of other courses is common for all segments of community. Learning mathematics means helping students discover their own mental freedoms in establishing their own personal thoughts and relations [1].

Learning mathematics is inevitable in order to catch up with the contemporary civilization level. Despite this, mathematics is perceived to be as a difficult, abstract, and distasteful course. The mathematics anxiety may be defined as the feelings and anxieties that are felt while dealing with the numbers in courses and daily life or solving a mathematics problem [2]. Buckley and Ribordy (1992) define the mathematics anxiety as an irrational fear that avoids solving mathematics problems in daily life and academic environments. Moreover in their studies they demonstrated that high level of fear felt for mathematics had a negative impact on their mathematics examination performance. It was found that the individuals with the least interest on mathematics in the past they were inclined to feel high level of anxiety for mathematics [3]. Researches that are performed set forth many reasons for the grounds of anxiety. For example Jackson and Leffingwell (1999) put forth the anxiety reasons for mathematics as teachers' bad behaviors, the difficulty of some mathematical subjects, gender bias, teachers' indifference and expectations, language and communication barriers, quality of education, and teachers' dissatisfaction [4]. Harper and Daane (1998) argue that the mathematics anxiety and its reasons appear during the primary education school years and that generally the anxiety in students is invoked by home teachers [5]. The studies that are done reveal that the mathematics anxiety affects the achievement in mathematics course such that thanks to these studies performed, it was determined that the students, who considered themselves as successful in mathematics course, believed to continue their success with sufficient effort in mathematics all the time [6,7].

It is observed that the mathematics anxiety affecting the students' education seriously and constituting an impediment for them is a source of constant challenge from primary education to higher education and that most of the students have failed in this struggle [8]. It is known that the students acquire the mathematics anxiety through the conditional learning. In this sense, considering that in international comparative studies our country has a low level of achievement in mathematics and a high level of anxiety, it is thought that the mathematics anxiety and its elements must be investigated. For this purpose the aim of the study is to develop an anxiety scale to determine the anxieties of primary education 5th, 6th, 7th, and 8th graders felt for mathematics course and to examine the relation between the students' anxieties and their achievements in mathematics in terms of various variables.

In line with this objective the answers were sought for the following questions:

1. Is there a significant relation between the mathematics anxiety scores of 5th-8th graders in primary education schools according to their grade (class) levels?
2. Is there a significant relation between the educational achievements of 5th-8th graders in mathematics course in primary education schools and the anxiety scores?

Method

Research Model and Study Group

Screening model aiming at revealing the current situation as it is was used in research. The 5th-8th graders studying in primary education schools in Sındırgı district of Balıkesir province in 2010-2011 education years constitute the population of the study. 5th-8th graders studying in a primary education school in Osmanlılar village in Sındırgı constitute the sample of the study. The reason for selecting this primary education school is that it has a mobile vehicle system and provides education for the students of 15 villages in the area. Thus, the sample has a unique diversity and seems to be capable of representing the population consisting of the students in the area. In this primary education school 89 students from each class selected through cluster random sampling method participated in scale development part of the study and 155 students participates in the application after the scale being developed. 30 of 155 students receive education in 5th grade, 33 of them in 6th grade, 54 of them in 7th grade, and 38 of them in 8th grade.

Data Collection Tools

In this study the variable of anxiety for mathematics course, which is considered playing a role in its success, was discussed. Educational achievement scores were obtained by averaging students' scores they received in the first and second term in mathematics course in determining educational achievement of mathematics course. Moreover 5-point Likert type of anxiety scale was developed to determine the students' anxieties felt for mathematics course.

Findings and Interpretations

Validity of Scale

First of all, 30 students are requested to write an essay to express their ideas

and feelings for the mathematics course in order to specify the sentences that will be placed in anxiety scale. The sentences regarding anxiety in the texts obtained were selected and after the literature review was performed, an item pool consisting of 40 items was formed. After the items were submitted to the expert for consideration to ensure their understandability and the linguistic structure control (inspection), they were applied to 89 primary education school students. Data obtained were subjected to factor analysis and so the structure validity was reviewed.

Kaiser-Meyer-Olkin (KMO) test results were examined in order to test the data structure compliance for factor analysis in terms of sample size. Depending upon KMO value obtained as 0.78, it can be said that the value was in compliance with the sample size [9]. According to Barlett test of Sphericity, the chi square value being significant at the level of 0.01 indicates that the data derive (arise) from multivariate normal distribution. These findings show that the data have an appropriate structure for the factor analysis. As a result of factor analysis, it was determined that the scale items were grouped under two factors, whose core values are greater than 1. It was observed that the variance the factors set forth regarding the scale was 68.128% and the common variances of both factors varied between 0.637 and 0.944. As the variance between 40% and 60%, which was put forth in multivariate patterns, was accepted as adequate [10], it is seen that the variance values that are put forth in obtained data are adequate. In Table 1 the factor pattern of the scale obtained after Varimax vertical rotation technique.

Table 1.

Factor Loads Obtained As a Result of Factor Analysis of Anxiety Scale

ITEM NO	FACTOR1 fear	FACTOR2 relevance
item9	.354	.765
item10	.313	.846
item11	.310	.886
item12	.435	.855
item13	.512	.771
item14	.461	.687
item16	.761	.542
item17	.737	.525
item18	.852	.470
item20	.793	.402
item21	.815	.344
item28	.757	.340
item29	.680	.621
item30	.714	.597
item35	.715	.596
item36	.769	.551
item37	.718	.494
item38	.867	.287
item40	.880	.312

Another factor analysis was performed again with the data obtained at the consequence of applying 19-item scale obtained by removing the items that were not grouped under a specific factor to 155 students in study group. Final KMO value of the scale was determined as 0.887. When the data were examined in Table 1, most factors are grouped under factor one and this indicates that the scale is unidimensional and homogenous. It was determined that Cronbach's alpha value was 0.87, which was calculated to examine the internal consistency of the scale, for which structure validity was ensured through factor analysis. The test can be said to be reliable as the reliability coefficient being greater than 0.70, which was calculated for a psychological test was adequate for the reliability of test score [10].

Reliability of Scale

An unrelated t-test analysis was performed for the significance of difference between the average item scores of upper and lower 27% groups, which were constituted according to total scores of the test and the correlation of item-total score, which was performed additionally for the reliability analysis. t-test results are given in Table 2 in relation to the comparison of item-total correlations of mathematical anxiety scale with the item scores of lower 27% and upper 27% groups.

Table 2.

Item analysis results

Item No	Item-Total Correlation	t (Lower 27%-Upper 27%)	Item No	Item-Total Correlation	t(Lower 27%-Upper 27%)
9	.745	-17.359*	19	.778	-16.514*
10	.725	-13.401*	20	.739	-17.780*
11	.747	-15.589*	21	.705	-13.951*
12	.822	-13.560*	28	.714	-14.546*
13	.781	-18.604*	30	.835	-20.557*
14	.725	-14.985*	35	.772	-23.690*
16	.878	-22.253*	36	.819	-15.305*
17	.749	-16.438*	38	.690	-11.381*
18	.869	-22.902*	40	.715	-11.504*

*p< 0.01

According to Table 2, it is seen that for all items in the scale item-total correlations vary between .690 and .878 and that t- values are ($p < 0,01$). Accordingly it can be said that the reliabilities of items in the scale are high and that they are aimed at measuring the same behavior. In respect of the reliability of mathematics anxiety scale, alpha coefficient was found as .807 for factor1, as .815 for factor2 and .860 for total (total anxiety scale score of each student). For the criterion validity of mathematical anxiety scale the correlation calculated between research test scores that are taken as a criterion and the scale is .787 ($p < 0,01$) for factor1 and .615 ($p < 0,01$) for factor2. and .660 ($p < 0,01$) for total. As a result, It was determined that there were positive significant relations between factor scores, factors of mathematical anxiety scale and total anxiety score.

Findings and Interpretations Concerning the First Problem

An answer was sought for the question of “Is there a significant relation between the mathematical anxiety scores of according to grade levels of 5th-8th graders in primary education school?” To this end, one-way analysis of variance was performed. According to results obtained, it was determined that total mathematics anxiety scores did not indicate a significant difference according to grades (classes) [$F=0.487$, $p=.692 > 0.05$].

Findings and Interpretations Concerning the Second Problem

In the research secondly, an answer was sought for the question of “Is there a significant relation between the educational achievements of 5th-8th graders in mathematics course in primary education school and the anxiety scores?” In order to find an answer to the question correlation analysis was conducted. According to the findings obtained, it was determined that achievement in mathematics and anxiety scores together indicated a significantly negative correlation ($r = -0.660$, $p < 0.01$). In addition, when the determination coefficient ($r^2 = 0.43$) is taken into consideration, 43% of total variance in mathematics achievement derives from the anxiety.

Results and Recommendations

The following results were obtained according to obtained findings in research:

- The scale developed to measure the students’ anxiety levels in mathematics may be said to be valid and reliable.
- Since there is no difference according to the grades (classes) between the students’ anxiety levels for mathematics, it can be said that the anxieties felt for mathematics are developed before they start to receive education in these grades and that they are resistant to change.

- There is a negative relation between mathematics achievement scores and the anxiety level for mathematics. This finding that is obtained also harmonize with the results of some studies in literature [11,12,13,14,15,16].

When it is considered that the anxiety is acquired through conditional learning, training teachers is considered to be important to avoid the anxiety developing at early ages. Thus, elements leading to anxiety environment should be eliminated and awareness in teachers must be raised. It must be borne in mind that the teachers, who arrange the teaching and learning environment, may struggle with the anxiety in the best manner. Furthermore the anxiety level in students may be heightened by learning algebra, which is remarkable with its abstract structure as one of the most difficult and basic topics of mathematics, in 5th-8th grades in primary education schools. This situation may affect their achievements in advanced classes. Thus, during this process students must be treated in a way to reduce the anxiety in them and stimulate the achievement. In addition to this, deficiencies in this subject may be removed by conducting qualitative studies regarding the reasons of anxiety.

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