THE EFFECTS OF PARENTS' SOCIO ECONOMIC STATUS ON MATHEMATICS ANXIETY AMONG SOCIAL SCIENCES STUDENTS IN TURKEY

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Abstract

The aim of this study is to determine the relationship between mathematics anxiety and parents' socio-economic status. In accordance with this purpose, Exploratory Factor Analysis was applied on 25 item sMARS developed by Alexander & Martray (1989) and its reliability and validity was tested with Confirmatory Factor Analysis process. As a results of the analysis, a modified scale with 3 factors (*Test Anxiety, Numerical Anxiety, Course Anxiety*) and 11 variables was developed and 12 hypotheses were tested to determine the relationship between parents' socio-economic status variables. For these tests, a non-parametric method, Kruskal-Wallis *H* test and Dunn's post-hoc test were used. The sample for this study includes 325 undergraduate students of Istanbul University, Turkey. As a result of the study, it is concluded that Total Anxiety, Numerical Anxiety and Course Anxiety variables are affected from family income and parents' education level while Test Anxiety are not affected from these variables. It is also concluded that, parents' age variable has no significant relationship with any of the subscales of mathematics anxiety.

Keywords: Math Anxiety, Confirmatory Factor Analysis, Kruskal-Wallis H Test, Parents' Socio Economic Status

1.Introduction

Dreger & Aiken (1957) defines mathematical anxiety as emotional response syndrome against mathematics and arithmetic. The most common explanation of mathematics anxiety is defined as "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations." (Richardson & Suinn,1972:551). Rachman (1998) defines this anxiety as expectation of an unknown fear, similarly Barlow states that this anxiety should be examined together with the element of fear (Williams, 2010:2). Trembley (2000) shows that mathematics anxiety is affected from the variables such as interest and attitude. The low interest and the negative attitudes towards the course lead to anxiety and consecutively to low performance (Aksu, 2002:23)

The phenomenon of mathematics anxiety has been under examination for decades. However, there are difficulties regarding the understanding of the phenomenon due to the lack of agreed on definition of mathematics anxiety. This lack of agreement on the definition leads to formation of various methods to measure mathematics anxiety (Kazelskis, 1998:623). The first scale to measure mathematics anxiety named Numerical Anxiety Scale was introduced by Dreger & Aiken (1957). Richardson & Suinn introduced a 98-item Mathematics Anxiety Rating Scale (MARS) in 1972 and this scale has become the most commonly accepted and used instrument in the literature. Test-retest reliability and internal consistency reliability of the scale are reported as 0.85 and 0.97 respectively. Results of the studies in the following years supported reliability scores are reported by Richardson & Suin's original study (Alexander & Cobb, 1989; Dew & Galassi, 1984; Plake & Parker, 1982; Capraro & Henson, 2001). Due to the psychometric properties of the MARS, this scale has been translated and adopted into many languages and has become the most common scale for mathematics anxiety.

A variety of abbreviated instruments subsequently have been developed that include the 12-item Fennema-Sherman (1976) Mathematics Anxiety Scale (MAS), the 6-item Sandman (1979) Anxiety Toward Mathematics Scale (ATMS), the 24-item Mathematics Anxiety Rating Scale- Revised (MARS-R) (Plake & Parker, 1982), the 25-item abbreviated Math Anxiety Rating Scale (sMARS) (Alexander & Martray, 1989), the 30-item Mathematics Anxiety Rating Scale – Short Version (MARS-SV) (Suinn & Winston, 2003).

Dreger & Aiken (1957) and Richardson & Suinn (1972) define mathematics anxiety as a unidimensional structure. There are several researchers who explain mathematics anxiety with two (Alexander & Cobb, 1984; Brush, 1981; Plake & Parker, 1982; Rounds & Hendel, 1980), three (Alexander & Martray, 1989; Ferguson, 1986; Resnick, Viehe & Segal, 1982) or more than three dimensional structures (Baloğlu, 2004). Alexander & Martray's (1989) commonly used three dimensional sMARS was used in this study. The sMARS correlated 0.93 with the MARS and had a two-week test-retest reliability of 0.86. After performing factor analysis, it is revealed that three underlying factors in the sMARS: Math Test Anxiety (15-items), Numerical Anxiety (5-items), Math Course Anxiety (5-items). Coefficent Cronbach's α was 0.96 for Factor I (Test Anxiety), 0.86 for Factor II (Numerical Anxiety) and 0.84 for Factor III (Course Anxiety) (Pena & et al., 2013).

There are two purposes of this research. First of these purposes is to examine factor structure of the social sciences students in Turkey and to statistically confirm sMARS via examining its reliability and validity with Confirmatory Factor Analysis approach. The second and main purpose of the study is to examine the subscales of the sMARS for the variables that affect mathematics anxiety.

Age, gender, teacher's attitude, parents' attitude, socio-economic status of the parents (age, education and income level) are commonly used variables in the literature that are believed to have an effect on mathematics anxiety. Studies in this field usually aim to prove the effects of the variables on mathematics anxiety. In this study, unlike the prior studies in this field, it is aimed to show how socio-economic status of the parents affects mathematics anxiety's subscales and their extensions.

2. Mathematical Anxiety and Parents' Socio Economic Status

The term of socioeconomic status is used by sociologists to denote an individual or family's overall rank in social and economic hierarchy (Mayer & Jencks, 1989). In most research socioeconomic status has been measured as a combination of parents' education, parents' age and family income. Campbell (1992) underlines that the parents have a key role in the attitudes of their children towards the mathematics course. Mathematics anxiety might also be interpreted as a development of a negative attitude towards the mathematics course, hence variables related with parents affects this anxiety. Gümüş (1997) reported that the anxiety level of the children decreases with the increase in parents' parents' education background. On the other hand, Varol (1990) states that the education background of the parents has no effect on the mathematics anxiety. However, the relationship between these variables has been shown by various researches Yenilmez & Özbey (2006), Konca (2008), Arı et al. (2010) and Mahigir et al. (2012). This outcome can be explained with the intellectual level of the parents and the assistance provided to children by their parents. The parents with high educational level are also educated about developing positive emotions and attitudes towards mathematics. From the economic point of view, it is found that the children coming from low income level families have high level of mathematics anxiety. Girgin,1990; Mahigir et al., 2012 have also studied on the relationship between the income levels of families and the mathematics anxiety levels, however they did not identify the income level as an anxiety affecting variable. In the respective study, the age of the parents has also examined as an anxiety affecting variable however no relationship has been found between those variable.

Due to the lack of consensus and the contradictory results of the empirical studies, it is aimed to examine the subscales of mathematics anxiety instead of the total mathematics anxiety. Since, the previous study about relationship between parents' socio economic status and mathematics anxiety was applied on secondary and high school students, we focus on the same relationship of variables which are sampled from a population of college students.

3. Methodology

3.1 Sample and Data

The sample of the present study consists of 325 undergraduate students who took the mathematics courses in 2013-2014 semesters at Istanbul University Faculty of Economics. Of these students, 169 (%52) were female and 156 (%48) were male. All participants were first and second year students majoring in departments of Faculty of Economics. The participants were selected by using random sampling method (total number of students in different departments was taken into consideration). Seven different departments were represented in the study : 54 (%17) subjects were from Economics, 62 (%19) from Business Administration Department, 50 (%15) from Econometrics Department, 39 (%12) from Labour Economics And Industrial Relations Department, 46 (%14) from International Relations and Political Science Department, 39 (%12) from Tourism Management Department and 35 (%11) from Public Finance Department.

3.2 Instruments

Mathematics anxiety was measured by using 25-item version of the Mathematics Anxiety Rating Scale (MARS, Richardson & Suinn, 1972) called sMARS which was developed by Alexander & Martray (1989). This scale measures the mathematics anxiety with three subscales; test anxiety, numerical anxiety and course anxiety. All of the factors in the scale were measured with 5-step likert type and the participants were asked to choose between 1 "no anxiety" and 5 "high anxiety". The translation of the questions was conducted by two philologists with back-translation methodology. Special care was taken to use direct and simple language for the written questions. The questionnaire was prepared as a two-page document which includes 4 questions to understand demographics and 25 questions to measure the mathematics anxiety. 25 minutes was given to participants to complete the questionnaire.

3.3 Data Analysis

3.3.1 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was used as a primary tool to evaluate the study results. A test was needed to check correlation matrix to understand whether it is a unit matrix or not and to test the independency of variables; Barlett's Test of Sphericity was suggested for this matter. Several researchers have also suggested Kaiser's Measure of Sampling Adequacy (MSA) for the successful application of the factor analysis model (Rencher, 1995:483). Based on the analyses results, Kaiser MSA index is 0.94 and p-value of the Barlett's test is 0.00; these results demonstrate that the data is statistically sufficient to apply factor analysis. Then, the Varimax rotation method was applied on the first result held with Principle Component Analysis. The criteria used to identify optimum factor numbers are: (a) factors with eigenvalues higher than 1, (b) Cattel's Scree test results, (c) interpretation of the factors. Factor loadings which have an absolute value of more than 0.50 are accepted as sufficient to prove that there is a correlation between factors and variables. Based on the analysis results, 3 factors with absolute values higher than 1 have been identified %68 of total variance is explained. The examination of factor structure shows that sMARS fits with the factor structure. Nunnally (1978) argues that the Cronbach's α value must be higher than 0.70 for each of subscale of the scale in social sciences. The Cronbach's α value for the total scale is 0.95. Cronbach's α value for the first factor (Test Anxiety subscale) is 0.95, for the second factor (Numerical Anxiety) is 0.96 and for the third factor (Course Anxiety) is 0.87. These results demonstrate that the total scale and the subscales reliability are high. SPSS 20.0 software was used for exploratory factor analysis.

3.3.2 Confirmatory Factor Analysis

Confirmatory Factor Analysis was used for scale validity confirmation. To choose estimation method for the Confirmatory Factor Analysis, the distribution of the data should be known. For this reason, to test multivariate normality of the variables, normality test with Mardia's (1970) skewness and kurtosis coefficients was applied. Multivariate skewness and kurtosis coefficients were calculated as 124.064 and 821.169 respectively. p-values for the both coefficients are lower than 0.05. χ^2 value related with the test of skewness and kurtosis coefficients in together is 1660.032 and p-value is 0.00. In this situation, since the multivariate normality has not been provided, Robust Maximum Likelihood Estimation (Robust MLE) approach which provides trusted estimations independent from the multivariate normality assumption has been used. Robust MLE approach suggests usage of asymptotic covariance matrix in fit function of MLE and usage of Satorra-Bentler's scaled χ^2 value in the evaluation of general fit of the model (Finney & DiStefano, 2006:289). LISREL 8.80 software was used for CFA.

CFA model has 3 latent and 25 indicator variables. For Factor 1, latent variable of Test Anxiety is coded as TA and its indicator variables are coded from TA1 to TA15. Similarly, for Factor 2, latent variable of Numerical Anxiety is coded as NA and its indicator variables are coded from NA1 to NA5 and for Factor 3, latent variable of Course Anxiety is coded as CA and its indicator variables are coded from CA1 to CA5.

The model was developed hierarchically with fit and modification indexes starting from the original model with 3 latent and 25 indicator variables. In the modelling process; variables with relevantly low indicator variable path coefficients, *t* values, determination coefficients (R^2) or the variables listed in Lisrel 8.80 software's modification indexes with correlated errors which may cause a significant decrease in χ^2 value that demonstrates the model's general fit statistics are eliminated.

This hierarchical process is repeated until an acceptable difference has been achieved in the fit index of the model. There are many fit indexes stated in the literature. Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Residual (RMR), Standardized Root Mean Square Residual (SRMR), Hoelter's Critical N (CN), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Bollen's Incremental Fit Index (IFI), Relative Fit Index (RFI), Root Mean Square Error of Approximation (RMSEA), ComparativeFit Index (CFI). Fit indexes and threshold values used in this study are as follows: RMSEA value of 0.10 or lower has been suggested as indicating a good fit (Brown & Cuddeck, 1992), whereas CFI and GFI of 0.90 (AGFI of 0.80) were generally considered acceptable (Bentler & Bonett, 1980; Fabrigar et al., 1999; Novy et al., 1994). More contemporary criteria recently have been adopted whereby an RMSEA of 0.60 and CFI and GFI value of 0.95 are required before conclusions can be drawn that there is a good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). SRMR value equal to zero represents the best fit while values lower than 0.05 represent a good fit (Schermelleh-Engel et al., 2003: 42-43). Bentler and Bonnet's fit index (1980) NFI's higher values represent good fit; values higher than 0.95 represent a good fit while 0.90 is the threshold value for an acceptable fit (Bentler and Bonett, 1980). For the NNFI suggested by Tucker and Lewis (1973), 0.97 and 0.95 are the threshold values respectively for the good fit and acceptable fit (Schermelleh-Engel et al., 2003: 41). In the IFI, improved version of NFI with using degree of freedom, values higher than 0.90 represent acceptable with and values closer to 1 represent good fit (Bollen, 1990:256). Another index proposed by Bollen (1986) is RFI which is suggested as an alternative to NFI. RFI values higher than 0.90 are indicators of an acceptable fit and values closer to 1 show good fit (Bollen, 1986: 375). CN is developed by Hoelter (1993) used to determine the sample size needed for an acceptable model and values more than 200 can be taken as good fit values (Bollen & Liang, 1988: 492).

Table 1. Fit Indexes for Measurement Models

FIT INDEX	***Reference Values***	***Measurement Model 1***	***Measurement Model 2***	***Measurement Model 3***	***Measurement Model 4***
RMSEA	< 0.06	0.12	0.085	0.071	0.036
RMR	Minimum	0.093	0.066	0.061	0.037
SRMR	< 0.05	0.071	0.055	0.051	0.034
GFI	> 0.90	0.73	0.85	0.91	0.97
AGFI	> 0.80	0.68	0.82	0.87	0.95
NFI	> 0.90	0.94	0.97	0.97	0.99
NNFI	> 0.95	0.95	0.97	0.98	0.99
CFI	> 0.90	0.96	0.98	0.98	1
IFI	> 0.90	0.96	0.98	0.98	1
RFI	> 0.90	0.94	0.96	0.96	0.98
CN	> 200	83.60	140.32	173.72	311.70

To identify the best measurement model to measure mathematics anxiety, a step-by-step CFA process has been applied to the scale and four different models were examined. Fit indexes and reference values for all measurement models are given in the Table 1.Measurement Model 1 (the original sMARS model) has been estimated with 3 latent variables called TA, NA, CA and 25 indicator variables into the model. Although some of the indexes show acceptable or good fit values, most of the indexes show that Measurement Model 1 is inadequate to provide good fit with the data. For this reason, via considering fit indexes and modification indexes, TA4, TA5, TA13, TA14 and CA4 variable are eliminated from the model to estimate Measurement Model 2. Based on fit indexes a better model, Measurement Model 2 with 3 latent and 20 indicator variables has been developed. Nonetheless, the model was rejected for GFI, SRMR and RMSEA and via considering fit indexes and modification indexes, TA2, TA3, TA15 and NA5 are eliminated from the model to estimate Measurement Model 3. Although the values of Measurement Model 3 are better than Measurement Model 2, the model was still rejected for SRMR and RMSEA. Since the success of the measurement model will directly affect the success of the later analyses, another modification has been applied to the model to select the most appropriate model for the data and TA6, TA7, TA11, NA4, CA1 variables were eliminated and the Measurement Model 4 with 3 latent and 11 indicator variables has been estimated. In the Table 1, all of the fit indexes clearly indicate good fit for the Measurement Model 4. Hence, the Measurement Model 4 is taken as the final measurement tool named Revised sMARS.

Table 2. Path Coefficients, Cronbach's α, AVE Scores of the Revised sMARS

Indicator Variables	***Path Coefficients***	***Cronbach's α***	***AVE***
Test Anxiety (TA)			
(TA1) Thinking about an upcoming math test 1 day before	0.83		
(TA8)Picking up a math textbook to begin a difficult reading assignment	0.81		
(TA9) Studying for a math test	0.74	0.90	0.65
(TA10)Receiving your final math grade in the mail	0.78		
(TA12) Being given homework assignments with many difficult problems	0.86		
Numerical Anxiety (NA			
(NA1)Being given a set of subtraction problems to solve	0.88		
(NA2)Being given a set of multiplication problems to solve	0.86	0.91	0.78
(NA3)Being given a set of numerical problems involving addition to solve on paper	0.91		
Course Anxiety (CA)			
(CA2)Walking into a math class	0.74		
(CA3)Signing up for a math course	0.74	0.77	0.53
(CA5) Watching a teacher work an algebraic equation on the blackboard	0.70		

3.3.3 Reliability and Validity

The reliability and validity of the conclusive measurement model held with CFA was needed to test. Convergent validity (the degree of association between measures of a construct) was assessed by reviewing *t*-statistics are statistically significant at the 0.05 level showed that all indicator variables provide good measures to their respective construct, offering supportive evidence to convergent validity (Hoyle & Panter, 1995). Moreover Hair et al. (1998) posits that the average variances extracted (AVE) values exceeding 0.50 offer supportive evidence for convergent validity. Nunnally (1978) argues that the Cronbach's α value must be higher than 0.70 for each of subscale of the scale in social sciences. Table 2 shows that Cronbach's α value is higher than 0.70 for each of the three subscales and AVE values are higher than 0.50. In summary these results gave support to the reliability and validity of the studied subscales in the scale.

3.4. Hypotheses

This study was aimed to test the hypotheses given below to examine relationships between the three subscales of mathematics anxiety and the family income level, the education background of parents and the age of parents.

H_{01} : There is no difference between the means of the Test Anxiety levels from the point of family income.

H_{02} : There is no difference between the means of the Numerical Anxiety levels from the point of family income.

H_{03} : There is no difference between the means of the Course Anxiety levels from the point of family income.

H_{04} : There is no difference between the means of the Total Mathematics Anxiety levels from the point of family income.

H_{05} : There is no difference between the means of the Test Anxiety levels from the point of parents' education background.

H_{06} : There is no difference between the means of the Numerical Anxiety levels from the point of parents' education background.

H_{07} : There is no difference between the means of the Course Anxiety levels from the point of parents' education background.

H_{08} : There is no difference between the means of the Total Mathematics Anxiety levels from the point of parents' education background.

H_{09} : There is no difference between the means of the Test Anxiety levels from the point of parents' age.

H_{010} : There is no difference between the means of the Numerical Anxiety levels from the point of parents' age.

H_{011} : There is no difference between the means of the Course Anxiety levels from the point of parents' age.

H_{012} : There is no difference between the means of the Total Mathematics Anxiety levels from the point of parents' age.

As mentioned before, data measured by ordinal scale cannot provide assumption of multivariate normality. For this reason, Kruskal-Wallis H test that does not require distribution assumption was used. Kruskal-Wallis H test is a non-parametric method which the null hypothesis claims that k number of samples come from identical and continuous populations (Freund, 2002:556). Kruskal-Wallis H test can be used as an alternative to analysis of variance (ANOVA) for data measured by ordinal scale.

4. Findings and Results

Comparisons in the analysis were conducted based on parents' education background, family income and parents' age. The percentage of college level education for either father or mother of the participants was 21.5% (N=70) while 78.5% (N=255) of them had no college level education. Analysis of 325 participants' family income levels showed that 52% (N=169) of them had low income, 36.9% (N=120) of them had mid income and 11.1% (N=36) of them had high income levels. Income level variable was asked as an open-ended question and the answers were categorized as monthly income of TRY 5.000 and below was low, between TRY 5.000 and 10.000 was mid and more than TRY 10.000 was high level of income. Age variable for the parents of the participants was found as %10.5 (N=34) who were 40 years old or below, %73.2 (N=238) who were between 40 and 65 years old and %16.3 (N=53) who were more than 65 years old. The hypotheses were given in the chapter 3.4 were tested for these variables based on the analysis of the scores of total mathematics anxiety and its subscales.

Primarily, descriptive statistics of the subscales of sMARS have been given in the Table 3.

Table 3. Descriptive Statistics of the Revised sMARS factor structure

Subscales	*N*	*Mean*	*SD*
Test Anxiety	325	15.1108	5.31711
Numerical Anxiety	325	3.8338	2.13367
Course Anxiety	325	5.0000	2.49196
Total Math Anxiety	325	23.9446	8.11929

The results of the Kruskal-Wallis H test for the hypotheses H_{01} , H_{02}, H_{03} and H_{04} which were formed to test differences between mathematics anxiety levels from the point of family income level are given in Table 4.

Table 4. Kruskal-Wallis H Test results for the family income variable

Hypotesis	Subscales	*df*	*Kruskal-Wallis* χ^2	*p-value*
H_{01}	Test Anxiety	1	0.356	0.356
H_{02}	Numerical Anxiety	1	49.225	0.000**
H_{03}	Course Anxiety	1	50.216	0.000**
H_{04}	Total Math. Anxiety	1	10.347	0.001**

*****p< 0,05, n= 325, ******p< 0,01, n = 325

Table 4 shows that the p-values of Total Mathematics Anxiety and its subscales; Numerical Anxiety and Course Anxiety are less than 0.05. Hypotheses H_{02}, H_{03} and H_{04} which claims that the group means would be the same for this variables were rejected with 0.05 significance level. The hypothesis of H_{01} could not be rejected since the p-value of the Test Anxiety is more than 0.05. In conclusion, a statistically significant difference was identified between the means of Numerical Anxiety, Course Anxiety, Total Mathematics Anxiety levels from the point of family income. However, there is no difference between the means of the Test Anxiety levels from the point of family income. Dunn's non-parametric post-hoc test (Dunn, 1964) has been used to identify the group which is the source of the mentioned difference. The Dunn's post hoc test showed that significant differences were found among the groups 1-2 (low-mid family income)($Dunn's\ Z_{stat}$ = 2.68, $p - value$ =

0.0036),1-3 (low- high family income) ($Dunn's\ Z_{stat}$ = −7.97, $p - value$ = 0.00), 2-3 (mid-high family income) ($Dunn's\ Z_{stat}$ = −9.38 , $p - value$ = 0.00) for the variable of the NA. For the CA; the only significant differences were between groups 1-3 (low and high family income) ($Dunn's\ Z_{stat}$ = 1.779, $p - value$ = 0.0376) and 2-3 (mid and high family income) ($Dunn's\ Z_{stat}$ = −2.504, $p - value$ = 0.0061). Similarly for Total Mathematics Anxiety, the only significant differences were between groups 1-3 (low and high family income) ($Dunn's\ Z_{stat}$ = 2.315, $p - value$ = 0.0103) and 2-3 (mid and high family income) ($Dunn's\ Z_{stat}$ = −2.937, $p - value$ = 0.0017). Dunn's post hoc test was not used for the variable of TA because of no significant difference between the means of the numerical anxiety levels from the point of family income. "dunn.test" package (Dinno, 2014) of R 3.2.1 software was used for Dunn Test process.

The results of the Kruskal-Wallis H test for the hypotheses H_{05} , H_{06}, H_{07} , H_{08} which were formed to test differences between mathematics anxiety levels from the point of parents' education background have given in Table 5.

Table 5. Kruskal-Wallis H Test results for the parents' education background variable

Hypotesis	**Subscales**	***df***	***Kruskal-Wallis*** χ^2	***p-value***
H_{05}	Test Anxiety	2	4.87	0.087
H_{06}	Numerical Anxiety	2	88.74	0.000**
H_{07}	Course Anxiety	2	7.13	0.028*
H_{08}	Total Math. Anxiety	2	10.40	0.006**

***p**< 0,05, n= 325, ****p**< 0,01, n = 325

Table 5 shows that the p-values of Total Mathematics Anxiety and its subscales; Numerical Anxiety and Course Anxiety are less than 0.05. Hypotheses H_{06},H_{07} and H_{08} which claims that the group means would be the same for this variables were rejected with 0.05 significance level. The hypothesis of H_{05} could not be rejected since the p-value of the Test Anxiety is more than 0.05. In conclusion, a statistically significant difference was identified between the means of Numerical Anxiety, Course Anxiety, Total Mathematics Anxiety levels from the point of the education backgrounds of parents. However, there is no difference between the means of test anxiety levels from the point of education background of parents.

The results of the Kruskal-Wallis H test for the hypotheses H_{09} , H_{10}, H_{11} , H_{12} which were formed to test differences between mathematics anxiety levels based on parents' age have given in Table 6.

Table 6. Kruskal-Wallis H Test results for the parents' age variable

Hypotesis	**Subscales**	***df***	***Kruskal-Wallis*** χ^2	***p-value***
H_{05}	Test Anxiety	2	3.11	0.211
H_{06}	Numerical Anxiety	2	1.737	0.420
H_{07}	Course Anxiety	2	1.011	0.603
H_{08}	Total Math. Anxiety	2	2.116	0.347

***p**< 0,05, n= 325, ****p**< 0,01, n = 325

Table 6 shows that the p-values of Total Mathematics Anxiety and all of the subscales; Test Anxiety, Numerical Anxiety and Course Anxiety are higher than 0.05. Hypotheses H_{09}, H_{10} , H_{11} and H_{12} which claims that the group means would be the same for this variables could not be rejected with 0.05 significance level. In conclusion, there is no statistically significant difference between the means of any subscales or total mathematics anxiety levels from the point of parents' age.

5. Conclusion

The aim of this study was to determine the relationship between mathematics anxiety and parents' socio-economic status among social sciences undergraduate students in Turkey. Unlike the previous studies, the aim in this study is to perform analyses on both mathematics anxiety and its subscales. To fulfil this aim, Alexander & Martray's (1989) sMARS was used. EFA was used to examine the structure of sMARS and a modified model with 3 subscale and 25 variables was handled. This revised model was further narrowed down to 3 subscales and 11 variables with applying DFA. As a result; the scale, with high reliability and validity (see Table 2), given in Table 2 was chosen for this study. This scale also demonstrates a great fit in terms of fit indexes (RMSEA= 0.036, SRMR=0.037, GFI=0.97, CFI=1, NFI=0.99). After the scale development stage, relationship between parents' socio-economic status variables and each of the subscales of sMARS was examined. 12 hypotheses were formed to examine the mathematics anxiety levels from the point of family income, education level and parents' age, and these hypotheses were tested with Kruskal-Wallis H test. Except the H_{01}, H_{05}, H_{09}, H_{10} , H_{11} and H_{12} hypotheses, all of the H_0 hypotheses were rejected with 0.05 significance level (p-value$<$0.05). As a result, all of the subscales of the mathematics anxiety except the test anxiety have shown statistically significant differences from the point of family income and parents' education background variables. On the other hand, any of the subscales of the mathematics anxiety has not shown a statistically significant difference from the points of parents' age variable (p-value$>$0.05). Similarly, the total mathematics anxiety has an interaction with family income and parents' education background variables and no interaction with parents' age variable. These results are in line with the previous studies mentioned in chapter 2. However, there are contradictions between the results of total mathematics anxiety and its subscales. This situation suggests that it is better to examine the mathematics anxiety with its subscales instead of only one factor. Also, this result shows that test anxiety levels of the students are not affected by parents' socio-economic status. Since the test anxiety is related to the individuals' psychological status and the general structure of the education systems, the results can be treated as consistent results. Hence, another important subtraction is that, test anxiety factor should be examined separately when examining mathematics anxiety of the students from countries with test focused education systems such as Turkey.

In the literature, there is a general consensus that mathematics anxiety levels should be lower for students with high family income levels. With the rejection of H_{02}, H_{03}, H_{04} hypotheses, this assumption was approved in this study as well. To identify the source of the discrepancy among the different income level groups, Dunn's post-hoc test was applied. As a result of this test, differences between low – mid income levels and low – high income levels has been identified for Course and Test Anxiety levels. For Numerical Anxiety, a significant difference was identified between all of the income levels. In conclusion, family income levels have an effect on students' mathematics anxiety levels.

The main limitation of the study is that the obtained results can be generalized only to social science students. The obtained results can inspire and guide new studies that focus on the relationship between mathematics anxiety and parents' socio-economic status. In further studies, other factors affecting the mathematics anxiety may also be examined from the point of subscales of the mathematics anxiety. In addition, the sampling might be widen to generalize university students from other disciplines. Furthermore, the modified measurement model in this study can be used in different studies to examine relationships between respective variables.

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