EKUAD JETPR
Eğitim Kuram ve Uygulama Araştırmaları Dergisi

ISSN 2149-7702
e-ISSN 2587-0718

DOI: 10.38089/ekuad.2021.69

Vol 7 (2021) Issue 2, 264-277

An Investigation of the Reason for Failure of High School Students in Mathematics Course

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Abstract

The general purpose of this study is to examine the reasons for the failure of students studying at the second level of education (high school). The implementation process of the research was carried out with students studying in public high schools in Isparta province in the 2019-2020 academic year. In the study, a cross-sectional survey model was used and accordingly, it was examined whether differ in terms of various variables. The sample of the study consists of a total of 588 students studying at located in the city center of Isparta. In the study, the "Mathematics Course Failure Scale" was used as a data collection tool, which was developed for this purpose and whose reliability and validity studies were conducted. Statistical techniques such as frequency, arithmetic mean, t test, one-way ANOVA were used in the analysis of the data. It has been determined that family, friends, the school environment and physical equipment, teachers' attitudes towards students and teaching methods, classroom environment, the curriculum applied in all high schools, the system being applied, and the personal characteristics of the students play an important role in students' failure in mathematics lessons and some suggestions were made in line with the findings of the study.

Keywords

Mathematic Failure
Reasons for Failure
Failure Scale
Education
High Schools

Article Info

Received: 13.02.2021
Accepted: 05.07.2021
Online Published: 31.08.2021

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Introduction

Although mathematics is one of the basic courses, it is perceived by many students as a difficult course to learn. This situation causes the students to develop negative attitudes towards the mathematics lesson and consequently to decrease their success (Kurbanoğlu and Takunyacı, 2012).

Science and technology, which has been developing rapidly in the last century, has increased the importance of the knowledge learned for societies to adapt to the new world order and compete with developed countries, by affecting individuals and societies and forcing them to change. Therefore, it has become important to grow successful, productive and innovative individuals in their field and to make these individuals gain the skills to reach information, organize information, present evaluation and communicate. One of the fields that has an important place in the development of science and technology is mathematics. Mathematics lesson has a great effect on young people to have a profession. However, when exams such as entrance exams to higher education institutions, entrance exams to high schools are examined, it is seen that students fail more in mathematics lessons. Students' exam failures have also come to the fore in the results of international exams such as TIMMS (Trends in International Mathematics and Science Study) and PISA (Program for International Student Assessment). In the International Mathematics and Science Research (TIMSS) which was done for the third time in 1999, among 38 participant countries, 8th grade students became 31st in Mathematics and 33rd in Science (Bağcı and Kılıç, 2003a-2003b).

Mathematics has an important place in the rapid technological development of societies in recent years. Knowledgeable and qualified individuals are needed to direct technology and science in the future. Mathematics is a tool used in revealing and directing human abilities, and in gaining a systematic and logical habit of thinking (Bulut, 1988). Mathematics is the common thinking tool of people. It constitutes the basis for man to know himself and the universe. Societies that have gained the ability to think numerically have always been successful. Mathematics is a science that gives people the habit of reasoning (Başer, 1996).

In the new education system, it has been stated that affective skills such as students' self-confidence in mathematics, believing that they can learn mathematics, being willing to learn mathematics and enjoying dealing with mathematics should be taken into account (Ministry of National Educatıın – in Turkish Milli Eğitim Bakanlığı, 2018). This is possible by using different teaching methods that focus on students rather than traditional teaching (Beyaztaş & Senemoğlu, 2015). Student-centered approaches such as mathematical modeling, collaborative learning and spatial thinking have a positive effect on students' attitudes towards mathematics (Davdas & Lay, 2018). Teachers have a great role in helping students gain positive attitudes towards mathematics and building self-confidence towards mathematics. The equipment that teachers have and the importance they attach to the cognitive development of students directly affect the quality of mathematics teaching (Beyaztaş & Senemoğlu, 2015; Kunene, 2011; Yenilmez & Duman, 2008).

Mathematics is not a lesson that is full of symbols, complex and difficult to understand, contains abstract concepts and can be learned by memorization. Many students think that they can be successful just by studying for a few hours the day before the exam. However, they realize that this is not the case after they get low marks in the exams. Many students in our country start schools with the prejudice from their environment and their friends that mathematics is a difficult lesson. In primary schools, teachers are inadequate in teaching mathematics or using the right methods and techniques, causing students to worry that they will not be able to achieve mathematics in their future education and develop a negative attitude towards mathematics (Baykul, 2002). The way of teaching in primary and high schools and some ongoing inadequacies have been shown as important factors affecting students' mathematical success (Dursun & Dede, 2004; Kiwanuka, Damme, Noortgate, Anumedem & Namusisi, 2015; Yenilmez & Duman, 2008). Especially in primary education, students who develop negative attitudes towards mathematics believe that they will not be able to succeed in mathematics and continue this in the following school years, preventing them from learning new concepts (Yenilmez & Özbey, 2006). In addition, some factors such as students' socio-economic level, gender, teacher qualifications, teaching techniques and physical facilities of the school have been shown as important factors affecting mathematical success (Dursun & Dede, 2004; Demir & Kılıç, 2010; Savaş,

Taş & Duru, 2010). Therefore, this situation negatively affects the students' perspective on mathematics and learning the mathematics lesson.

In her study, Cumhur (2018) stated that the factors affecting mathematical success as student, family, teacher, curriculum, learning environment, school type, out-of-school auxiliary courses, time allocated to learning, technology which were combined under nine main themes. In addition, teachers made suggestions such as investigating the factors causing failure, establishing a good mathematical foundation, increasing school-student-parent cooperation, revising the curriculum, giving necessary seminars to teachers, improving teachers' self-development, using visual materials and making the learning environment suitable. Imam and Srivastas (2015), in their work expressed that while the gender of the students did not affect their mathematics achievement, the time students spent watching TV negatively affected their mathematics achievement. In the study of Sarıer (2016) the most important factors affecting the academic success of students; socio-economic status, self-efficacy and motivation were found. Önder (2016) in his study declared that the reasons for the failure were determined as the lack of academic support from the families of the students and the lack of a working environment, the low socio-economic level of the families and the lack of sufficient importance to education. Başar and Doğan (2020) identified four factors affecting the fear of mathematics in their study. These factors were determined as fear due to the students' own personal characteristics, fear of the environment and family, fear of the teacher and fear of the structure of mathematics.

A technological breakthrough in education is attempted with the interactive board that has been installed in all schools with the developing technology in recent years. Thus, it is necessary to take advantage of today's possibilities, different methods and techniques, games and activities by moving away from traditional methods (Boyacıoğlu & Köroğlu, 2003).

Unfortunately, the subjects of the mathematics lesson, which is a part of our lives and that we cannot fully model into our daily life, are still a nightmare for many students. Mathematics is one of the lessons that our students have the most difficulties in achieving today. For this purpose, the reasons of mathematics failure of students studying in Isparta state high schools were examined. For this purpose, the following questions were tried to be answered:

1. What are the findings on the demographic characteristics of the students?
2. Do students show a significant difference between the findings of the reasons for their mathematics lesson failures and their gender?
3. Is there a significant difference between the findings of the reasons for students' mathematics course failures and whether they have their own study rooms?
4. Do students' mathematics lesson failures show a significant difference between the findings of the reasons and the situations of their parents?
5. Is there a significant difference between the findings of the reasons for students' mathematics course failures and school types?
6. Do students show a significant difference between the findings of the reasons for their mathematics lesson failures and their classes?
7. Do students show a significant difference between the findings of the reasons for their mathematics course failures and their income levels?

Method

This research is a study aimed at determining the reasons of mathematics course failure of students studying in high schools. It is a study conducted by using survey model and survey models are models that aim to describe a past or present situation (event, person, object) as it exists in its own conditions (Karasar, 2005). It does not attempt to change or influence them in any way (Aksoy, 2003). Survey studies aim to describe the characteristics of communities. The interests, abilities, attitudes, beliefs, etc. characteristics of the communities regarding a subject or event are tried to be determined. Fraenkel and Wallen (2006) defined survey researches as studies in which a large group of people's views or characteristics (belief, attitude, level, anxiety, knowledge, etc.) were selected as the sample

population to describe a subject, and the data of the research were formed by the answers given by the community that constituted the sample.

The study is restricted to high school students studying in Science High School, Science and Social Sciences Anatolian High Schools, Anatolian High Schools and Vocational and Technical Anatolian High Schools in the city center of Isparta. In order to obtain the data in the study, the "Mathematics Course Failure Questionnaire" developed by Yalçınkaya (2016) consisting of 46 items with demographic (gender, classroom, teacher, parents 'education, study room, family's monthly income, parents' status) information have been used.

The universe of this research consists of the students studying in high schools in the center of Isparta in the 2019-2020 academic year. In this direction, the scale prepared by the researcher in line with the permission obtained from the Provincial Directorate of National Education was delivered to 1250 students studying in 8 high schools in the city center of Isparta. The data answered by a total of 588 students, 336 females and 252 males, from 8 high schools were evaluated.

SPSS 23.0 package program was used to analyze the data obtained in the study. In evaluating the responses given to the scales by the study group, the frequency distributions, mean scores, and percentage distributions of the answers were examined and the results obtained were interpreted. Factor analysis was conducted to determine the construct validity of the scale. The Kaiser-Meyer-Olkin (KMO) test was conducted to determine whether the data obtained were suitable for factor analysis and it was found to be 0.908. Diagonal values of Anti-mage Correlation Matrix were calculated in order to determine sampling adequacy. Cronbach Alpha Coefficient was calculated for the reliability of the scale and was determined as 0.918.

Findings

In this section, sub-problems related to the research problem and findings related to these problems are included. Research findings are presented in line with questions about sub-problems.

Findings about Demographic Information of Students

In this part of the study, the findings and comments related to demographic chararcteristics such as gender, class, teacher, parents' education, study room, monthly income of the family, and the condition of the parents of students studying in Science High Schools, Science and Social Sciences Anatolian High Schools, Anatolian High Schools and Vocational and Technical Anatolian High Schools located in the city of Isparta are included. The distribution of demographic characteristics of the students is given in Table.1.

Table1. Findings regarding Demographic Characteristics of Students Studying in High Schools

Variable	Category	F (number)	% (percentage)
Gender	Female	336	57,1
	Male	252	42,9
Class	Grade 9	87	14,8
	Grade 10	146	24,8
	Grade 11	223	37,9
	Grade 12	132	22,4
Gender of the Math Teacher	Mrs	180	30,6
	Mr	408	69,4
Your Mother’s Education	Not able to read or write	0	0
	Primary school	205	34,9
	Middle School	114	19,4
	High school	169	28,7
	University	95	16,2
	Master Degree and Above	5	0,9

Table1. Findings regarding Demographic Characteristics of Students Studying in High Schools (Continues)

Variable	Category	F (number)	% (percentage)
Your Father's Education	Not able to read or write	0	0
	Primary school	120	20,4
	Middle School	101	17,2
	High school	179	30,4
	University	180	30,6
	Master Degree and Above	8	1,4
Do you have a study room?	Yes	477	81,1
	No	111	18,9
Family's Monthly Income	Minimum Wage and Below	59	10,0
	Minimum Wage-3500 TL	241	41,0
	3501 TL-6000 TL	203	34,5
	6001 TL and Above	85	14,5
Mother-Father	Divorced/Separate	44	7,5
	Married/Together	544	92,5
Mother	Alive	584	99,3
	Deceased	4	0,7
Father	Alive	584	99,3
	Deceased	4	0,7

When Table 1 is examined it can be seen that the sample group consists of 588 students, 336 (57.1%) female and 252 (42.9%) male. According to the data, it is seen that female students participating in the study are more than male students. Besides, when students are analyzed according to their classes, it is seen that 87 (14.8%) of them are from the 9th grade, 146 (24.8%) from the 10th grade, 223 (37.9%) from the 11th grade, and 132 (22.4%) from the 12th grade.

According to Table 1, 180 (30.6%) female and 408 (69.4%) male teachers attend the mathematics course of the students participating in the study. In the study, it has been determined that the number of male teachers who attend students' mathematics lessons is approximately twice more than the number of female teachers. According to the education status of the mothers, it is seen that 205 (34.9%) are primary school, 114 (19.4%) secondary school, 169 (28.7%) high school, 95 (16.2%) university and 5 (% 0.9) are master degree and above graduates. Also, when the education status of the fathers is examined, it is seen that 120 (20.4%) are primary school, 101 (17.2%) secondary school, 179 (30.4%) high school, 180 (30.6%) university and 8 (1%), 4) are graduates of a higher education institution. When considered whether the students have their own study rooms at their homes and it is seen that 477 (81.1%) have their own rooms and 111 (18.9%) do not have their own study rooms.

When the monthly incomes of the families are examined, monthly income of 59 families (10.0%) is between minimum wage and below, 241 families' (41.0%) monthly income between minimum wage-3500 TL, 203 families (34.5%) between 3501 TL-6000 TL and 85 families (14.5%) have been identified to have an income of 6001 TL and above. It was found that the parents of 584 students (99.3%) who participated in the study were alive; It was determined that the mother and father of 4 students (0.7%) died. When the conditions of the mothers and fathers were examined, it was seen that 44 (7.5%) of the students were separate and 544 (92.5%) of them were together.

One of the methods used to determine the construct validity is factor analysis. Within the scope of factor analysis, "exploratory factor analysis" technique is used to reveal the factor structure of the scale (Şencan, 2005, Büyüköztürk, 2009). Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett-Sphericity test are used to determine the suitability of the data for factor analysis. While the KMO approaching 1 indicates that it is perfect, falling below 0.50 is unacceptable. KMO values; 0.90 and above are stated as excellent, 0.80-0.90 as very good, 0.60-0.80 as medium and 0.50-0.60 as bad (Tavşancıl, 2006). Factor analysis of Causes of Mathematics Failures scale was examined and KMO test was conducted to determine the adequacy of the data obtained from the sample. KMO value of the

prepared scale was found to be 0.924. Since the KMO value found is above 0.60, it shows that the data are suitable for factor analysis. When the data obtained are examined, it was determined that the general average of the answers given by the students to the items of the scale was close to the level of "I am indecisive" with ($\bar{X}$) = 2,725.

Principal component analysis and varimax rotation technique were used on the data obtained from the scale, and firstly, eigenvalues and percentages were examined to determine the number of factors under which the items included in the factor analysis were collected (Gelbal, 2004). By examining the eigenvalues of the factors, it was decided that the scale was suitable for an 8-factor structure. Considering the content of the items in the scale, the first of the factors obtained in the factor analysis is the "Negative Thinking Dimension", the second is the "Student Dimension", the third is the "Efficient Work Dimension", the fourth is the "Family Dimension", the fifth is the "Teacher Dimension", the six is the "School and Environment Dimension", the seventh is the "Curriculum and Program Dimension" and the eighth is called the "Course Dimension". It was determined that the highest load value in each factor in the scale ranged from 0.741 to 0.355. The names of the factors of the scale and the factor analysis results for these factors are given in Table 2.

Table 2. Factor Analysis Results of Reasons for Math Failure Scale

Factors	Items	$\bar{X}$	Factor Eigenvalues	Disclosed Variance (%)	Cumulative Variance (%)
Negative Thought Dimension	26,30,31,32,33,34, 37,38,41,42,45,46	2,9174	10.359	22.519	22.519
Student Dimension	7,8,9,10,12,18,40	3,1084	3.244	7.053	29.572
Family Dimension	2,3,4,5,6,21,22	2,2072	2.224	4.834	34.405
Efficient Studying Dimension	23,24,25,39	3,4847	1.743	3.790	38.196
Course Dimension	11,17,35,36,43	2,2037	1.637	3.560	41.755
Teacher Dimension	13,16,19,20	2,5451	1.413	3.071	44.826
Curriculum and Program Dimension	14,15,19	2,5612	1.271	2.762	47.589
School and Environment Dimension	1,27,28,44	2,5799	1.195	2.598	50.187

When the data obtained were examined, the reasons for students' math failure in the course of the factors are found to be listed as first the "Lesson Dimension", then the "Family Dimension", then the "Teacher Dimension", "Curriculum and Program Dimension", "School and Environment Dimension", "Negative Thinking Dimension", "Student Dimension" and "Efficient Work Dimension".

The correlation between the findings of the reasons for their mathematics lesson failures and their gender

According to the opinions of students studying in high schools whether there is a significant difference between the reasons for math failure and the gender of the students was examined according to the t-test results and is given in Table.3.

Table 3. T-test results between students' gender and mathematics lesson failure reasons scale

Gender	N	$\bar{X}$	Sd	df	t	*p*
Male	252	2,716	0,6058	586	0,295	0,768
Female	336	2,732	0,6855			

(p<0,005)

When Table 3 was examined, it was seen that there was no significant difference between the gender of the students studying in high schools and the reasons for mathematics course failure. It was

determined that the average causes of math failure in both male and female students were close to each other.

Besides, according to the students' opinions, all the scale items were examined separately according to the t-test results in order to determine whether there was a meaningful difference between the reasons for failure in the mathematics lesson and the gender of the students, and the results are given in Table.4.

Table 4. Results of the t-test between the students' gender and the items of the Mathematics Course Failure Scale

Item	Gender	N	$\bar{X}$	Sd	df	t	*p*
	Male	252	1,9008	1,2345	586	3,408	0,001
I3	Female	336	2,2619	1,2986			
	Male	252	1,8770	1,1761	586	2,863	0,004
I22	Female	336	2,1786	1,3263			

(p<0,005)

In Table 4, it was seen that there was a significant difference between the I3 and I22 items of the students' causes of math lesson scale and their gender. It was determined that this difference is in favor of female students t (586) = 3.408 and t (586) = 2.863 (p <0.005). This result shows that the difference between the mean I3 scores of female and male students in mathematics lesson failure is 0.36 standard deviation and the difference between the mean scores of I22 is as much as 0.30 standard deviation.

The correlation between the findings of the reasons for students' mathematics course failures and their own study rooms

According to the opinions of students studying in high schools, whether there is a meaningful difference between the reasons for mathematics course failure and whether the students have their own study rooms was examined according to the t-test results and is given in Table.4.

Table 5. T-test results between whether students have their own study rooms and the mathematics course failure reasons scale

Do you have a study room?	N	$\bar{X}$	Sd	df	f	*p*
Yes	477	2,718	0,6636	586	0,555	0,579
No	111	2,756	0,6017			

(p<0,005)

When Table 5 is examined, it is seen that there is no significant difference between the students studying in high schools whether they have their own study rooms and the reasons for mathematics course failure. According to the averages, it was determined that the average of the students who have their own study rooms and the students who cannot have their own study rooms are close to each other.

The correlation between the findings of the reasons for their mathematics lesson failures and their parents

According to the opinions of students studying in high schools, whether there is a significant difference between the reasons for math failure and the status of the students' parents was examined according to the t-test results and is given in Table.6.

Table 6. T-test results between the status of the students' parents and the mathematics lesson failure reasons scale

Mother-Father	N	$\bar{X}$	Sd	df	t	*p*
Divorced/Separate	44	2,818	0,5957	586	0,978	0,328
Married/Together	544	2,718	0,6563			

(p<0,005)

According to Table 6, it has been observed that there is no significant difference between the status of the parents of the students studying in high schools and the reasons for mathematics lesson

failure. In addition, according to the opinions of the students, all the scale items were examined separately according to the t-test results in order to determine in which items whether there was a significant difference between the reasons for math failure and the status of the parents of the students, and the results are given in Table.7.

Table 7. T-test results between the status of the students' parents and the reasons for math lesson failure scale items

Item	Mother-Father	N	$\bar{X}$	Sd	df	t	p
I3	Divorced/Separate	44	2,8864	1,4013	586	4,249	0,000
	Married/Together	544	2,0441	1,2533			
I21	Divorced/Separate	44	2,8182	1,5139	586	3,530	0,000
	Married/Together	544	2,0735	1,3180			

(p<0,005)

In Table 7, it was seen that there was a significant difference between the I3 and I21 items of the students' causes of math lesson scale and the status of their parents. It was determined that this difference showed a difference in favor of separation of the parents t (586) = 4.249 and t (586) = 3.530 (p <0.005). This result shows that the difference between the average I3 scores of the students whose parents are separated is up to 0.84 standard deviation and the difference between the average of I 22 scores is as much as 0.74 standard deviation.

The correlation between the findings of the causes of mathematics course failures and school types

Whether there is a significant difference between the students' reasons for mathematics failure and the school types they study at was tested with variance analysis and the results obtained are given in Table 8.

Table 8. ANOVA results between the types of school students attend and the mathematics course failure reasons scale

Variance Source	Sum of Squares	df	Average of Squares	F	*p*
Intergroups	2,739	3	0,913	2,160	0,92
Within Groups	246,818	584	0,423		
Total	249,557	587			

(p<0,005)

According to Table 8, it has been determined that there is no significant difference between the reasons for students' failure in mathematics lesson and the type of school they attend F (3,584) = 2,160 (p> 0,05). This result can be interpreted as that there is no significant difference between the reasons of math failure of students studying at different schools and the types of schools they study. Also, according to the opinions of the students, all the scale items were examined separately according to the ANOVA results in order to determine whether in which items there was a significant difference between the reasons of math failure and the school types they studied, and the results are given in Table 9.

Table 9. ANOVA results between the types of schools students attend and the reasons for math failure in the scale items

Item	Variance Source	Sum of Squares	df	Average of Squares	F	p	Meaningful Difference
I1	Intergroups	40,495	3	13,498	5,566	0,001	A-D
	Within Groups	1416,253	584	2,425			
	Total	1456,748	587				
I2	Intergroups	28,987	3	9,662	4,669	0,003	A-D
	Within Groups	1208,483	584	2,069			
	Total	1237,469	587				
I4	Intergroups	23,330	3	7,777	4,850	0,002	A-D
	Within Groups	936,466	584	1,604			
	Total	959,796	587				
I6	Intergroups	35,520	3	11,840	6,599	0,000	A-B,
	Within Groups	1047,901	584	1,794			A-D
	Total	1083,422	587				
I9	Intergroups	27,361	3	9,120	4,809	0,003	C-D
	Within Groups	1107,556	584	1,896			
	Total	1134,917	587				
I13	Intergroups	51,199	3	17,066	8,712	0,000	B-C,
	Within Groups	1143,964	584	1,959			A-B
	Total	1195,163	587				
I16	Intergroups	32,356	3	10,785	5,427	0,001	A-B
	Within Groups	1160,628	584	1,987			
	Total	1192,985	587				
I19	Intergroups	55,781	3	18,594	9,525	0,000	A-B,
	Within Groups	1139,979	584	1,952			A-D,
	Total	1195,760	587				B-C
I20	Intergroups	73,569	3	24,523	11,896	0,000	A-D,
	Within Groups	1203,852	584	2,061			C-D
	Total	1277,422	587				
I21	Intergroups	31,081	3	10,360	5,745	0,001	A-B
	Within Groups	1053,096	584	1,803			
	Total	1084,177	587				
I22	Intergroups	33,104	3	11,035	7,032	0,000	A-B,
	Within Groups	916,466	584	1,569			B-C
	Total	949,570	587				
I23	Intergroups	39,382	3	13,127	5,723	0,001	A-D
	Within Groups	1339,535	584	2,294			
	Total	1378,917	587				
I31	Intergroups	42,224	3	14,075	7,296	0,000	A-D,
	Within Groups	1126,626	584	1,929			C-D
	Total	1168,850	587				

(p <0.005) (A: Science High School, B: Science and Social Sciences Project Schools, C: Anatolian High Schools, D: Vocational and Technical Anatolian High Schools)

As seen in Table 9, as a result of one-way analysis of variance (ANOVA) between items I1, I2, I4, I6, I9, I13, I16, I19, I20, I21, I22, I23 and I31 of the scale and the types of schools students attend, It shows a significant difference at the 0.05 level. According to the sixth item of the scale, there is a significant difference between the students studying at the Science High School and the students studying at both the Science and Social Sciences Schools and the students studying at Vocational and Technical High Schools.

The correlation between the findings of the reasons for their mathematics course failures and their classes

Whether there is a meaningful difference between the students' causes of math lesson failure and their classes was tested with analysis of variance and the results obtained are given in Table 10.

Table 10. ANOVA results between the students' grades and the mathematics lesson failure reasons scale

Variance Source	Sum of Squares	df	Average of Squares	F	p	Meaningful Difference
Intergroups	7,205	3	2,402	5,788	0,001	10-11,
Within Groups	242,352	584	0,415			11-12
Total	249,557	587				

(p <0.005) (9: 9th grade, 10: 10th grade, 11:11th grade, 12:12th grade)

According to Table 10, it was determined that there is a significant difference between the students' reasons for math lesson failure and their grades F (3,584) = 5,788 (p> 0.05). Post-hoc, Tukey HSD test results were taken into consideration to examine the significance of the difference between groups. Accordingly, it has been observed that there is a meaningful difference of opinion between 10th grade students and 11th grade students, and between11th grade students and 12th grade students. This result can be interpreted as that there is a significant difference between the causes of math failure and their grades of students studying in different grades. Also, according to the opinions of the students, all the scale items were examined separately according to the ANOVA results in order to determine in which items whether there was a significant difference between the causes of math failure and the classes they studied, and the results are given in Table.11.

Table 11. ANOVA results between students' grades and math lesson failure reasons scale items

Item	Variance Source	Sum of Squares	df	Average of Squares	F	*p*	Meaningful Difference
	Intergroups	70,099	3	23,366	9,841	0,000	9-10,
I1	Within Groups	1386,649	584	2,374			10-11,
	Total	1456,748	587				10-12
	Intergroups	60,001	3	20,000	9,920	0,000	10-11
I2	Within Groups	1177,468	584	2,016			
	Total	1237,469	587				
	Intergroups	56,748	3	18,916	8,845	0,000	10-11
I7	Within Groups	1292,857	584	2,214			
	Total	1349,605	587				
	Intergroups	47,223	3	15,741	8,736	0,000	9-12,
I8	Within Groups	1052,246	584	1,802			10-12,
	Total	1099,469	587				11-12
	Intergroups	47,104	3	15,701	7,987	0,000	10-11,
I13	Within Groups	1148,060	584	1,966			10-12
	Total	1195,163	587				
	Intergroups	49,317	3	16,439	8,324	0,000	9-11
I15	Within Groups	1153,350	584	1,975			10-11
	Total	1202,667	587				
	Intergroups	32,356	3	10,785	5,427	0,001	9-11
I20	Within Groups	1160,628	584	1,987			
	Total	1192,985	587				
	Intergroups	33,999	3	11,333	5,323	0,001	10-12,
I33	Within Groups	1243,423	584	2,129			11-12
	Total	1277,422	587				
	Intergroups	38,693	3	12,898	6,284	0,000	11-12
I34	Within Groups	1198,550	584	2,052			
	Total	1237,243	587				
	Intergroups	31,849	3	10,616	5,456	0,001	11-12
I37	Within Groups	1136,430	584	1,946			
	Total	1168,279	587				
	Intergroups	51,993	3	17,331	9,031	0,000	9-11,
I44	Within Groups	1120,679	584	1,919			9-12,
	Total	1172,672	587				10-12

(p <0.005) (9: 9th grade, 10: 10th grade, 11:11 grade, 12:12 grade)

When Table 11 is examined, as a result of the one-way analysis of variance, between the items I1, I2, I7, I8, I13, I15, I20, I33, I34, I37 and I44 of the mathematics failure causes scale and the classes in which students are studying was determined that there was a difference at the 0.05 level. According to the first item of the scale, there is a significant difference between 9th grade students and 10th grade students, and between 10th grade students and both 11th and 12th grade students.

The correlation between the findings of the reasons for their mathematics course failures and their income levels

Whether there is a significant difference between the reasons for students 'mathematics failure and their families' monthly income level was tested with variance analysis and the results obtained are given in Table 12.

Table 12. ANOVA results between the monthly income level of the students' families and the mathematics course failure reasons scale

Variance Source	Sum of Squares	df	Average of Squares	F	*p*	Meaningful Difference
Intergroups	1,590	3	0,530	1,248	0,291	--
Within Groups	247,968	584	0,425			
Total	249,557	587				

(p<0,005)

When Table 12 is examined, it is determined that there is no significant difference between students 'reasons for math lesson failure and their families' monthly income F (3,584) = 1,248 (p> 0.05). Post-hoc, Tukey HSD test results were taken into consideration to examine the significance of the difference between groups. This result can be interpreted as that there is no significant difference between the monthly income levels of the students' families and the reasons for math failure. Also, all the scale items were examined separately according to the ANOVA results in order to determine, the students' views, in which items whether there was a significant difference between the reasons for math class failure and the income levels of their families, and it was determined that there was no significant difference between the scale items and the monthly income level of the families.

Discussion and Conclusion

A total of 588 students from eight schools participated in the study, which was conducted in order to determine which problems are the basis of the failure of the mathematics course with the students studying at high schools in the central district of Isparta. When the answers given by the students to the questionnaire items were examined, it was determined that the number of female students was higher than the number of male students, and that the students studying in the 11th grade participated more. According to the education status of the parents, it was determined that 205 students' mothers and 120 students' fathers were primary school graduates; 114 students' mothers and 101 students' fathers were secondary school graduates; 169 students' mothers and 179 students' fathers were high school graduates; 95 students' mothers and 180 students' fathers were graduates of university; and 5 students' mothers and 8 students' fathers were graduates of master degree and higher education.

When the monthly income of the families are examined; it was determined that the income of 59 families (10.0%) was below the minimum wage. In the study, it was determined that there was no significant difference between the monthly income levels of the students' families and the reasons for math failure.

Although technology makes life easier for people, it can cause negative consequences when not used correctly. The fact that students spend most of their time playing games with technological tools such as phones, tablets and computers negatively affects their success. Since students use technological tools for purposes such as music, games, and social media, the time allocated to the lesson is shortened and their motivation decreases. In their study, Özer and Anıl (2011) stated that while the positive use of computer and educational programs increases mathematical success, in this study, the negative use of technology shortens the time allocated to the mathematics lesson and may affect the success negatively.

The fact that the curriculum is intense and not suitable for the needs of all students is one of the reasons that affect success. Coursebooks should be enriched with new generation questions and examples suitable for mathematical modeling for students. On the other hand, applying the same mathematics program for all high school types negatively affects students especially in vocational high schools. Dursun and Dede (2004) pointed out that the mathematics curriculum should be prepared in a way that allows learning by taking into account the different needs of the students.

Class size, individual differences and other physical facilities affect the mathematical success as they limit the learning environment. Crowded classrooms will reduce students' participation in learning activities and the time given to each student will be reduced. Yenilmez and Duman (2008) stated that the learning environment can affect success in terms of classroom size and physical conditions.

It was observed that there was no significant difference between the parents' status of the students studying in high schools and the reasons for the failure of the mathematics course. In the study of Zhou, Zhou and Traynor (2020); it has been concluded that Chinese children, whose fathers and mothers take care of them at home, are successful in doing their homework related to mathematics. In the study conducted by Metin (2013), the researcher concluded that students whose parents have higher education levels are more successful in SBS (High school Entrance Exam). In the study of Morkoyunlu and Konyalıoğlu (2020), it has been determined that the mathematics achievement of sixth grade students who receive family support increases. In the study of Gask and Jamali (2020), it was concluded that family support was effective in overcoming the fear of mathematics.

Teachers' qualifications are very important in determining the academic success of students (Darling-Hammond, 2000; Kavak, Aydın, Akbaba-Altun, 2007). Teachers can play an important role in increasing their success as a good example to students thanks to their experience, field knowledge, approach to students and idealism. In this respect, it should be ensured that teachers learn new methods and techniques with in-service training from time to time and apply them in the classroom environment. Peker and Mirasyedioğlu (2003) concluded that teachers' applying different teaching models in mathematics lessons and establishing a connection between mathematics lesson and daily life will increase the success in mathematics lesson. The fact that students love their teachers has a positive effect on learning mathematics. Beyaztaş and Senemoğlu (2015) concluded in their study that students who love their teachers are more successful.

We may gather the main reasons of students' math failure under some headings; First of all, problems arising from the system and the curriculum, problems arising from friends and their environment, problems arising from the classroom environment, problems arising from the family, problems arising from the teachers and the methods they apply, problems arising from the school environment and the physical environment, and most importantly, problems arising from the student himself/herself. Students' characteristics such as introversion, emotionality, excessive mobility, health problems and adolescent characteristics such as aimlessness, neglect, frequent unnecessary absenteeism, false friendships, and female-male relationships are some of the characteristics that stem from themselves that cause failure.

Increasing the success in education and training is primarily by fulfilling the duty of everyone who has a role in education. Everyone from the top level officials in the system, school administrators, teachers, parents, students and peer groups should make the necessary effort.

Suggestions

1. Determining and meeting the physical space and needs of schools.

2. Implementation of activities that will enable students willingly come to school by reducing the weekly course load at schools.

3. Arrangement of the number of students in the classroom.

4. Examining and doing the necessary attempts to minimize the absenteeism problems.

5. Increasing the cooperation of parents with the school by raising their awareness.

6. Not putting numerical lessons into the last hours when students are tired and lowly motivated.

7. Ensuring that teachers have information about new methods, techniques and questions.

8. Determining the success of the students studying in private and public schools through a common examination system.

9. Guiding students on efficient study methods.

10. Providing information about the correct use of technological tools (phone, tablet, computer, etc.) and preventing their use during lessons.

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