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Research Article

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Investigating the relationship between mathematics motivation and mathematics anxiety in 4th grade primary students with and without a diagnosis of giftedness

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ABSTRACT

The aim of this study is to examine the relationship between mathematics motivation and mathematics anxiety in 4th grade primary school students who are diagnosed as gifted and those who are not, in terms of some variables. A descriptive and relational screening model was used in the study. The sample of the study consisted of 500 students, 250 of whom were diagnosed as gifted (SAC students) and 250 of whom were not diagnosed as gifted, selected from different regions of Turkey. The Mathematics Motivation Scale and the Mathematics Anxiety Scale were used as data collection instruments. As a result of the analyses, a significant negative relationship was found between mathematics anxiety and intrinsic motivation, extrinsic motivation and total motivation, and a significant positive relationship was found between mathematics anxiety and motivation. In the regression analysis it was found that all motivation sub-dimensions predicted mathematics anxiety. There was no significant relationship between mathematics motivation and mathematics anxiety in 4th grade female students with and without giftedness. A significant negative relationship was found between mathematics anxiety and intrinsic motivation, extrinsic motivation and total motivation in 4th grade male students with and without giftedness. A positive significant relationship was found between maths anxiety and motivation. When the results of the regression analysis were analyses, it was found that all motivation sub-dimensions predicted mathematics anxiety. A significant difference was found in the sub-dimensions of intrinsic motivation and extrinsic motivation of the participating students' mathematics motivation, but no significant difference was found in the sub-dimension of motivation. There was a significant difference between the mathematics anxiety levels of 4th grade students diagnosed as gifted and those not diagnosed as gifted.

Introduction

Mathematics motivation and mathematics anxiety are two interrelated constructs that significantly influence students' experiences and performance in mathematics. Mathematics motivation refers to the intrinsic and extrinsic factors that drive students to engage with and persist in mathematical tasks. It encompasses various types of motivation, including intrinsic motivation (the inherent enjoyment of math), identified regulation (recognizing the importance of math for future goals), and extrinsic motivation (performing math for external rewards or to avoid negative outcomes) (Guay et al., 2010). Conversely, mathematics anxiety is characterized by feelings of tension, apprehension, and fear associated with mathematical tasks, which can hinder performance and lead to avoidance behaviors (Zakaria & Nordin, 2008; Ashcraft, 2002; Finlayson, 2014).

Research indicates that these two constructs are not merely oppositional; rather, they interact in complex ways. For instance, high levels of mathematics anxiety can undermine motivation, leading to decreased engagement and poorer performance (Wang et al., 2015; Ashcraft, 2002; Orbach et al., 2019). However, some studies suggest that motivated students may channel their anxiety into increased effort and engagement, demonstrating that anxiety can sometimes coexist with high motivation (Wang et al., 2018; Pollack et al., 2021). This nuanced relationship highlights the importance of understanding both constructs in educational settings, particularly in STEM fields where mathematics plays a critical role (Li, 2023; Milovanović, 2020).

The types of mathematics anxiety can be categorized into several dimensions, including test anxiety, performance anxiety, and general math anxiety. Test anxiety specifically refers to the fear of negative evaluation during assessments, which can exacerbate feelings of inadequacy and lead to avoidance of math-related tasks (Lyons & Beilock, 2012; Ashcraft & Moore, 2009). Performance anxiety, on the other hand, relates to the fear of not meeting personal or societal expectations in mathematical performance, often influenced by stereotypes and societal pressures (Hutter et al., 2018). General math anxiety encompasses a broader range of fears and apprehensions associated with engaging in mathematical tasks, which can manifest from early educational experiences (Lai et al., 2015; Krinzinger et al., 2009).

Moreover, the interplay between mathematics motivation and anxiety can vary across different demographic groups, such as gender. Studies have shown that female students often report higher levels of math anxiety compared to their male counterparts, which can affect their motivation and achievement in mathematics (Milovanović, 2020; Timmerman et al., 2017). Understanding these differences is crucial for developing targeted interventions to enhance motivation and reduce anxiety, ultimately fostering a more positive attitude towards mathematics among all students (Ali & Hassan, 2019; Finlayson, 2014).

Mathematics is a subject that students generally find difficult. However, with proper motivation, students become interested in learning mathematics and are ready to learn the subjects in a short time (Akbaba, 2006). The necessary intrinsic and extrinsic motivation is achieved through the use of materials selected according to the problem in the lesson, the students' sharing with each other and their active participation throughout the process. Since the learning process takes place at different speeds according to the individual capacity of each student, all students feel successful and motivated. Motivated students take a more active role in the lesson. Students who succeed in solving problems increase their motivation because they enjoy what they are doing (Autıo, 2019).

In recent years there have been remarkable changes in mathematics education. Various reforms have been made both in the areas of learning in school mathematics and in the way, mathematics is taught. Mathematics is no longer just a field of calculation, but also a field where problem-solving skills are developed, new ideas are generated, and activities are carried out to develop mathematical thinking. The realization of learning in mathematics rests on two pillars. The first is that students learn mathematics by understanding it. The second is to provide environments where they can realize their learning, express their thoughts freely and use their reasoning skills (NTCM: National Council of Teachers of Mathematics, 2000). In this way, students are expected to be better motivated, and more meaningful learning is to be achieved.

Grade 4 is the last year of primary school. For students, the end of primary school is seen as the transition to secondary school. From 3rd to 4th grade, there is a rapid increase and differentiation in the number of courses. The achievements become more difficult, and this situation is initially met with anxiety and concern by the students. At this point, teachers and parents have great duties. They should adapt students to this new situation and prepare environments to reduce their anxiety (Türk and Bedir, 2021). Recent changes in mathematics education (e.g., curriculum changes, teaching methods, increased use of technology) may help elementary school students adapt to new situations and sometimes increase or decrease their mathematics anxiety.

The expectation of the Ministry of National Education from individuals who graduate from primary school in the objectives of the curricula is that they have the knowledge, aesthetic and social skills to continue their lives in a self-confident manner in accordance with their individuality (MoNE: Ministry of National Education, 2018). It is very important for teachers and parents to help students transition from primary to secondary school. Teachers and parents can develop teaching processes that are appropriate to the principle of student-appropriateness to reduce students' anxiety and increase motivation and can utilize strategies and best practices that are appropriate for the pace and type of learning and temperament model. It can also be effective to use certain approaches such as cooperative learning or communication techniques that reduce anxiety. In order for individuals to have this equipment, primary school education is very important. This period is called primary education. The education that people will receive throughout their lives will be built on this foundation.

In recent years, Turkey has made significant strides in recognizing the existence of gifted students and developing specialized educational programs tailored to their unique needs. This recognition is crucial, as gifted individuals often possess the potential to drive societal advancement when provided with appropriate educational opportunities. Conversely, if neglected or mismanaged, their capabilities can lead to negative outcomes for society (Golle et al., 2022; Kirkiç, 2019). The establishment of Science and Art Centers (BİLSEM) by the Ministry of National Education in Turkey exemplifies this commitment, aiming to nurture the talents of gifted students across various educational stages (Beldağ, 2022). Such initiatives underscore the importance of early identification and specialized education for gifted individuals, aligning with the broader goal of enhancing societal progress through the cultivation of exceptional talents (Beldağ, 2022; Tan, 2021).

Teachers play a pivotal role in the identification and support of gifted students, as they are often the first to recognize these students' unique educational needs (Golle et al., 2022). Research indicates that teachers' perceptions significantly influence the educational experiences of gifted students, highlighting the necessity for targeted professional development in gifted education (Kanli, 2020). Effective teacher training can equip educators with the skills to implement acceleration and enrichment strategies, which are essential for fostering the academic and emotional well-being of gifted learners (Kanli, 2020; Reis et al., 2021). Furthermore, studies

suggest that when gifted students engage in project-based learning and independent studies, they report higher satisfaction and perceived effectiveness of their educational programs, which in turn enhances their competencies.

Despite the advancements in gifted education in Turkey, challenges remain in achieving equity and access to quality programs for all gifted students. While significant progress has been made, there is a clear need for systemic reforms to ensure that gifted education is inclusive and equitable (Tan, 2021; Worrell et al., 2019). This includes addressing demographic disparities in gifted program enrollment and ensuring that all students, regardless of their background, have access to the resources necessary to realize their potential (Worrell et al., 2019). Moreover, the development of specialized curricula that cater to the diverse needs of gifted students is essential for maximizing their educational outcomes (Aksoy, 2023).

The fact that gifted and normal students experience low motivation or anxiety towards mathematics, especially in primary school years, is so important that it affects their entire lives. Therefore, this study aims to contribute to the field by investigating the situation between both groups.

Method

In the research, descriptive and relational survey models were determined among the quantitative research models. The relational screening model is defined as a model that uses analysis methods that address the relationship between variables and examine the level of change in the other variable if there is a change in one variable (Büyüköztürk et al., 2008; Creswell 2021; Karasar, 2018). While the descriptive scanning method was used for the Mathematics Motivation Scale and the Mathematics Anxiety Scale, the relational scanning model was also used between the status of gifted students and normal students according to the scales.

Sample

The population of the study consists of students diagnosed as gifted and not diagnosed as gifted. The sample of the study consists of 500 4th grade primary school students who are diagnosed as gifted and not diagnosed as gifted. The students participating in the study came from different provinces of Turkey (Gaziantep, Istanbul, Erzurum, Kahramanmaraş, Kütahya, Mersin). The students who constitute the sample of the study and who are studying in Science and Art Center (SAC) educational institutions and other students who are not studying in SAC were selected by convenience sampling method. According to Yıldırım and Şimşek (2008), this type of sampling is related to the fact that it is easier to include individuals or groups in the research process or easier to access them. Convenience sampling is a non-random sampling method in which the sample group to be selected from the main mass is determined by the judgement of the researcher. In convenience sampling, data are collected from the main mass in the easiest, fastest and most economical way (Aaker et al., 2007: 394; Malhotra, 2004: 321, Zikmund, 1997: 428).

Table 1 Demographic information of the students participating in the research

Category	Gender	N	Total	%
Diagnosed as Gifted	Female	120	250	50
	Male	130		
Not Diagnosed as Gifted	Female	110	250	50
	Male	140		
Total		500	500	100

Looking at the frequency values of the demographic information of the students who participated in the research, it was found that 50% of the participants were students diagnosed as gifted and 50% were students who were not diagnosed as gifted.

Procedure

In this study, the Mathematics Motivation Scale developed by Balantekin and Oksal (2014) and the Mathematics Anxiety Scale developed by Bindak (2005) were used. Since existing scales were used in the study, permission was first requested from the researchers to use their scales. In line with the permissions received, the necessary permissions were obtained from Kahramanmaraş Sütçü İmam University Social and Human Sciences Department and Kahramanmaraş Provincial National Education Department. Then, while the scales were applied to students in three different provinces (Istanbul, Kahramanmaraş, Mersin) for normal students, the data were obtained by applying them to 4th grade students in Science and Art Centers in six provinces (Gaziantep, Istanbul, Erzurum, Kahramanmaraş, Kütahya, Mersin) in order to reach the target number of gifted students.

Mathematics motivation scale

The first data collection tool of the research is the Mathematics Motivation Scale. Necessary permission was obtained to use the scale developed by Balantekin and Oksal (2014).

Table 2 Mathematics motivation scale for primary school 3rd and 4th grade students

1	It is enough to learn the topics in math class enough to be successful in the class.
2	When math questions are too difficult, I stop doing them.
3	I do my homework to get a high score.
4	I get bored easily in math class.
5	I do my math homework because my teacher wants me to.
6	Getting a high grade in math class is not important, what is important is learning the topics in the class.
7	I study math to pass the class.
8	I am not sure how much benefit I will get from what I learn in math class.
9	Math class does not interest me.
10	I study math only to meet my family's expectations.
11	I do not want to spend time with math.
12	I like to deal with difficult questions in math.
13	Math class interests me.
14	I am happy when I study math.

The 5-point Likert type scale consists of 14 items and three dimensions. The reliability coefficient for the extrinsic motivation sub-dimension is 0.78, for the motivation sub-dimension it is 0.71, for intrinsic motivation it is 0.61, and for the overall scale it is 0.91. In this research, it was calculated as 0.70, 0.74, 0.69 for these dimensions and 0.81 for general, respectively. Since the scale is prepared in a 5-point Likert style, it is scored as Strongly Agree (5), Agree (4), Undecided (3), Disagree (2) and Strongly Disagree (1). There are no negative items in the scale. Accordingly, since the Extrinsic Motivation (5,9,14,17,26) and Motivation (7,11,19,23,27) factors consist of five items, a minimum of 5 and a maximum of 25 points can be obtained from these factors; Since the Intrinsic Motivation (16,28,36,40) factor consists of four items, a minimum of 4 and a maximum of 20 points can be obtained.

Mathematics Anxiety Scale

“Mathematics Anxiety Scale” developed by Bindak (2005) to determine the anxiety level of primary school students was used in the study. Firstly, permission to use the scale was obtained via e-mail. The scale consists of 10 items and one dimension.

Table 3 Mathematics anxiety scale for primary school

1	When I think of math, I think of complicated, incomprehensible things
2	I find it hard to get up to the board in math classes
3	I always worry that I will be asked questions in math classes
4	I understand math now, but I worry that it will get harder
5	I am not afraid of anything else as much as I am afraid of math exams
6	I am afraid that I will not pass my class because of math
7	I feel like I am shrinking with fear when I enter math class
8	I don't know how to study for math exams
9	Math is very fun for me
10	I am afraid of asking questions in math class

There are 9 positive and 1 negative statement in the 5-point Likert type scale. Positive statements are scored as 5-4-3-3-2-1 and negative statements are scored in reverse order. A high average score obtained from the scale indicates a high level of mathematics anxiety. The highest score that can be obtained from the scale is 50 and the lowest score is 10. Cronbach alpha reliability coefficient of the scale is .84. In this study, reliability was calculated at the level of 0.86.

Data analysis

Since descriptive and relational screening models were used among the quantitative research models in the study, different statistics were used for each. Descriptive statistics methods (such as frequency, percentage, average) were used for the Mathematics Motivation Scale and Mathematics Anxiety Scale applied to primary school 4th grade students. Correlation formulas were used for relational screening between gifted students and normal students according to the scales used.

Scale permissions were first obtained for the data planned to be collected within the scope of the research. Then, permissions from the Ministry of National Education and the Ethics Committee and parental permission were obtained in writing, and then the data collection process began. All 500 data collected were entered into the SPSS 25.0 package program and all data were included in the study.

In the initial analysis, the distributions of the variables were tested for normality using skewness and kurtosis (values greater than ±1 and $p > .05$). It was found that the test scores met the criteria for a normal distribution of the variables (Tabachnick et al., 2013). Since it was seen that there were no excessive deviations in the normal distribution curves, it was decided to apply parametric statistical techniques. Subsequently correlation and regression analyses were used to determine the relationship between the scales, and independent sample t-test was applied in two-variable analyses.

Results

As the relationship between mathematics motivation and mathematics anxiety of gifted and non-gifted primary school 4th graders was examined in terms of some variables, the scores from the scales are given respectively.

Table 4 Correlation analysis results between mathematics motivation and mathematics anxiety of 4th grade students with and without giftedness

Variable		1	2	3	4	5
Intrinsic motivation	r	1				
	p					
Lack of motivation	r	0,885**	1			
	p	0,000				
Extrinsic motivation	r	0,894**	0,867**	1		
	p	0,000	0,000			
Total motivation	r	0,912**	0,976**	0,899**	1	
	p	0,000	0,000	0,000		
Maths anxiety Total	r	-0,798**	0,892**	-0,853**	-0,887**	1
	p	0,000	0,000	0,000	0,000	

When analysing Table 2, it was found that there was a significant negative relationship between maths anxiety and intrinsic motivation (r=-0.798 p=0.000), extrinsic motivation (r=-0.853 p=0.000) and total motivation (r=-0.887 p=0.000). It was found that there was a significant positive relationship between maths anxiety and motivation (r=0.892 p=0.000). In order to explain the relationship between mathematics motivation and mathematics anxiety in more detail, the regression results are shown in Table 3 below.

Table 5 Results of regression analyses on the relationship between mathematics motivation and mathematics anxiety in 4th grade students with and without giftedness

Variables		β	t	P	R	R^2	F	p
Math Anxiety Total	Motivation							
	Intrinsic Motivation	0,643	9,65	0,000				
	Lack of motivation	0,523	9,74	0,000	0,883	0,712	211,421	0,000*
	Extrinsic Motivation	0,442	8,87	0,000				
	Motivation Total	0,784	29,44	0,000				

* p< .05

When analysing Table 4, the scores of the mathematics anxiety and mathematics motivation sub-dimensions show a significant relationship (R=0.883, R2=0.712; p<0.000). Analysing the results of the t-test on the significance of the regression coefficient, it was found that 'all the motivation sub-dimensions of intrinsic motivation, motivation, extrinsic motivation and total motivation predicted mathematics anxiety and explained 71% of the total variance.

Table 6 The results of the correlation analysis between the mathematics motivation and mathematics anxiety of 4th grade female students were and not diagnosed as gifted.

Variables		1	2	3	4	5
Intrinsic Motivation	r	1				
	p					
Lack of Motivation	r	0,112	1			
	p	0,021				
Extrinsic Motivation	r	0,089	0,032	1		
	p	0,014	0,026			
Motivation Total	r	0,054	0,043	0,063	1	
	p	0,024	0,018	0,015		
Math Anxiety Total	r	0,152	0,245	0,118	0,137	1
	p	0,071	0,083	0,048	0,062	

When Table 4 is examined, it was determined that there was no significant relationship between the mathematics motivation and mathematics anxiety of 4th grade female students who were

diagnosed as gifted and those who were not. According to this result, regression analysis was not performed because there was no significant relationship.

Table 7 The results of the correlation analysis between the mathematics motivation and mathematics anxiety of 4th grade male students were and not diagnosed as gifted.

Variables		1	2	3	4	5
Intrinsic Motivation	r	1				
	p					
Lack of Motivation	r	0,776**	1			
	p	0,032				
Extrinsic Motivation	r	0,693**	0,702**	1		
	p	0,001	0,001			
Motivation Total	r	0,831**	0,725**	0,642**	1	
	p	0,000	0,015	0,000		
Math Anxiety Total	r	-0,669**	0,836**	-0,793**	-0,598**	1
	p	0,010	0,004	0,025	0,019	

When Table 5 is examined, it is seen that the mathematics anxiety of 4th grade male students diagnosed as gifted and not gifted is related to intrinsic motivation (r=-0.669 p=0.010), extrinsic motivation (r=-0.793 p=0.025), total motivation (r=-0.598 p). It was determined that there was a significant negative relationship between =0.019). It was determined that there was a positive significant relationship between mathematics anxiety and lack of motivation (r = 0.836, p = 0.004). The regression results performed to explain in detail the relationship between mathematics motivation and mathematics anxiety of 4th grade male students diagnosed as gifted and not are shown in Table 6 below.

Table 8 Regression analysis results regarding the relationship between mathematics motivation and mathematics anxiety of 4th grade male students diagnosed as gifted and not.

Variables		β	t	P	R	R^2	F	p
Math Anxiety Total	Motivation							
	Intrinsic Motivation	0,618	6,72	0,001				
	Lack of motivation	0,431	7,53	0,027	0,754	0,701	121,63	0,017
	Extrinsic Motivation	0,384	6,23	0,016				
	Motivation Total	0,571	17,58	0,025				

* p< .05

When Table 6 is examined, the scores of mathematics anxiety and mathematics motivation sub-dimensions show a significant relationship (R = 0.754, R2 = 0.701; p < 0.017). When the t-test results regarding the significance of the regression coefficient were examined, it was determined that all motivation sub-dimensions, namely intrinsic motivation, motivation, extrinsic motivation and motivation total sub-dimensions, predicted mathematics anxiety and explained 70% of the total variance.

Table 9 T-test analysis results between the mathematics motivations of 4th grade students who were diagnosed as gifted and those who were not

	Variables	n	X± Sd	t	p
Intrinsic Motivation	Diagnosed as Gifted	250	18,47±7,63	3,703	0,000*
	Not Diagnosed as Gifted	250	15,78±6,86		
Lack of Motivation	Diagnosed as Gifted	250	12,25±5,72	0,649	0,065
	Not Diagnosed as Gifted	250	13,12±6,11		
Extrinsic Motivation	Diagnosed as Gifted	250	20,29±7,47	2,853	0,007*
	Not Diagnosed as Gifted	250	16,31±6,39		

* p< .05

According to the results of the analysis conducted within the research, it was found that there was a statistically significant difference between the mathematics motivation of 4th grade students who were diagnosed as gifted and those who were not, in the sub-dimensions of intrinsic motivation and extrinsic motivation, and that there was no significant difference in the sub-dimension of motivation. It was observed that the significant difference in the sub-dimensions of intrinsic and extrinsic motivation was due to the fact that the intrinsic motivation scores of 4th grade students diagnosed as gifted were significantly higher than the intrinsic motivation scores of students who were not diagnosed as gifted.

Table 10 T-test analysis results between the mathematics anxiety scores of 4th grade students diagnosed as gifted and those who were not

	Students	n	X± Sd	t	p
Math Anxiety Total	Diagnosed as Gifted	250	32,53±7,78	6,734	0,002*
	Not Diagnosed as Gifted	250	44,35±9,27		

* p< .05

According to the results of the analysis conducted within the research, it was determined that there was a statistically significant difference between the mathematics anxiety levels of 4th grade students who were diagnosed as gifted and those who were not. When the scores were examined, it was determined that the mathematics anxiety scores of the 4th grade primary school students who were not diagnosed as gifted were significantly higher than the mathematics anxiety scores of the 4th grade primary school students who were diagnosed as gifted.

Table 11 T-test analysis results between mathematics motivation levels and gender of 4th grade students diagnosed as gifted

	Gender	n	X± Sd	t	p
Intrinsic Motivation	Male	130	31,69±7,57	0,362	,52
	Female	120	30,72±8,22		
Lack of Motivation	Male	130	22,25±4,53	0,556	,46
	Female	120	21,12±4,12		
Extrinsic Motivation	Male	130	20,29±4,10	0,962	,84
	Female	120	20,31±4,11		

* p< .05

According to the results of the analysis conducted within the research, it was determined that there was no statistically significant difference between the mathematics motivation levels and gender of 4th grade students diagnosed as gifted.

Table 12 T-test analysis results between mathematics motivation levels and gender of 4th grade students who are not diagnosed as gifted

	Gender	n	X± Sd	t	p
Intrinsic Motivation	Male	140	28,54±6,38	0,724	0,21
	Female	110	29,46±6,55		
Lack of Motivation	Male	140	25,28±6,57	0,635	0,27
	Female	110	26,52±6,37		
Extrinsic Motivation	Male	140	27,38±6,74	0,248	0,75
	Female	110	28,57±6,37		

* p< .05

According to the results of the analyses conducted within the research, it was determined that there was no statistically significant difference between the mathematics motivation levels of 4th grade students who were not diagnosed as gifted and their gender.

Table 13 T-test analysis results between the mathematics anxiety levels of 4th grade students diagnosed as gifted and their gender

	Students	n	X± Sd	t	p
Math Anxiety Total	Male	130	35,42±8,53	0,695	0,45
	Female	120	34,22±8,42		

According to the analysis results conducted within the research, it was determined that there was no statistically significant difference between the mathematics anxiety levels and gender of 4th grade students diagnosed as gifted.

Table 14 T-test analysis results between mathematics anxiety levels and gender of 4th grade students who are not diagnosed as gifted

	Students	n	X± Sd	t	p
Math Anxiety Total	Male	140	38,27±8,83	0,385	0,40
	Female	110	37,49±8,23		

According to the results of the analysis conducted within the research, it was determined that there was no statistically significant difference between the mathematics anxiety levels and gender of 4th grade students who were not diagnosed as gifted.

Discussion and conclusion

In this study, it was aimed to examine the relationship between mathematics motivation levels and mathematics anxiety levels of 4th grade primary school students who were diagnosed as gifted and not diagnosed as gifted. In line with this purpose, in this section, the findings obtained for the determined purpose are expressed, discussed and interpreted as a result and suggestions are made.

It was determined that there was a significant negative relationship between mathematics anxiety and intrinsic motivation, extrinsic motivation and total motivation. It was found that there was a significant positive relationship between maths anxiety and motivation. When we look at the regression results to explain the relationship between mathematics motivation and mathematics anxiety in detail, the scores of mathematics anxiety and mathematics motivation sub-dimensions show a significant relationship. When the results regarding the significance of the regression coefficient were analysed, it was found that 'all of the sub-dimensions of motivation, namely intrinsic motivation, motivation, extrinsic motivation and total motivation predicted mathematics anxiety. When these results are examined, it is seen that being motivated reduces anxiety, and it is estimated that anxiety, which can push individuals to failure in daily life, has an effect on mathematics, can reduce mathematics motivation in the process of high mathematics anxiety and cause failure.

The relationship between mathematics motivation and mathematics anxiety among 4th grade primary school students has been a subject of considerable research. Findings consistently indicate a significant negative correlation between these two constructs, suggesting that higher levels of mathematics anxiety are associated with lower levels of motivation to engage with mathematics.

Süren & Kandemir (2020) highlight that mathematics anxiety is a critical predictor of students' mathematics achievement, overshadowing even motivation in its impact. This suggests that when students experience high anxiety, their motivation to engage with mathematics diminishes, which in turn affects their performance. Similarly, James et al. (2013) found a significant negative

relationship between mathematics anxiety and achievement motivation, reinforcing the notion that anxiety can undermine students' motivation and subsequently their academic performance in mathematics.

Moreover, Wang et al. (2015) argue that students who lack motivation may experience heightened anxiety, leading to avoidance behaviors that further decrease their engagement with mathematics. This aligns with findings from (Ulfah et al., 2023), who reported a weak negative correlation between mathematics anxiety and learning motivation, indicating that unpleasant learning experiences can diminish students' desire to learn. The implications of these findings are critical, as they suggest that fostering a positive learning environment may help mitigate anxiety and enhance motivation.

Ramirez et al. (2016) further elaborate on this relationship by demonstrating that students with higher mathematics anxiety tend to employ less effective problem-solving strategies, which can hinder their overall mathematical understanding and motivation. This is echoed by (Tangonan, 2022), who noted that unmotivated students often experience increased anxiety, creating a detrimental cycle that affects their learning outcomes.

The literature also suggests that interventions aimed at reducing mathematics anxiety can enhance motivation. For instance, Azizan et al. (2022) explored classroom strategies that effectively minimized anxiety while boosting students' motivation and achievement in mathematics. This indicates that addressing anxiety not only improves students' emotional well-being but also positively influences their motivation to engage with mathematical tasks.

In summary, a substantial body of evidence supports the assertion that there is a significant negative relationship between mathematics motivation and mathematics anxiety among 4th grade primary school students. High levels of anxiety are linked to decreased motivation, which can adversely affect students' engagement and performance in mathematics. Therefore, addressing mathematics anxiety through targeted interventions may be essential for enhancing students' motivation and overall success in mathematics.

Aydın (2011) reported that there was a negative relationship between mathematics anxiety and mathematics motivation in his study. In addition, Kılıç (2011) reported that as mathematics motivation increased, mathematics anxiety decreased. These results support the results obtained in this study.

In the study, it was determined that there was no significant relationship between the mathematics motivation and mathematics anxiety of 4th grade female students with and without giftedness. According to this result, regression analysis was not performed since there was no significant relationship.

As a result of the analyses conducted between the mathematics motivation of students diagnosed as gifted and their gender variables, it was determined that there was no significant difference. Likewise, as a result of the analyses, it was determined that there was no statistically significant difference between the mathematics anxiety of the students diagnosed as gifted and their gender.

As a result of the analyses conducted between the mathematics motivation of students who were not diagnosed as gifted and their gender variables, it was determined that there was no significant difference. Similarly, as a result of the analyses, it was determined that there was no statistically significant difference between the mathematics anxiety of students who were not diagnosed as gifted and their gender.

In the study, it was determined that there was a significant negative correlation between mathematics anxiety and intrinsic motivation, extrinsic motivation and total motivation of 4th

grade male students who were diagnosed as gifted and not diagnosed as gifted. It was found that there was a significant positive relationship between maths anxiety and motivation. According to the regression results conducted to explain the relationship between mathematics motivation and mathematics anxiety of 4th grade male students with and without giftedness in detail, the scores of mathematics anxiety and mathematics motivation sub-dimensions show a significant relationship. When the results regarding the significance of the regression coefficient were analysed, it was found that 'all of the sub-dimensions of motivation, namely intrinsic motivation, motivation, extrinsic motivation and total motivation predicted mathematics anxiety.

When the literature was examined, the limited number of studies examining the relationship between mathematics motivation and mathematics anxiety states of 4th grade male and female students with and without a diagnosis of giftedness drew attention. In a partially similar study in the literature, Gürel and Yetkin-Özdemir (2019) reported that there was no statistically significant difference between the mathematics anxiety levels of gifted and non-gifted female students. In addition, there are a few other studies in literature with similar results (Aydın & Keskin, 2017; Dursun & Bindak, 2011; Tapia & Marsh, 2004). These results are partially similar to the results obtained from our study. It is very important that there is no study related to this result obtained from our study, the result obtained from the study contributes to the literature and will lead the studies to be carried out in the future.

According to the results of the analyses conducted within the scope of the research, it was determined that there was a statistically significant difference between the mathematics motivation of 4th grade students who were diagnosed as gifted and not diagnosed as gifted in the sub-dimensions of intrinsic motivation and extrinsic motivation, while there was no significant difference in the sub-dimension of motivation. It was observed that the significant difference in intrinsic motivation and extrinsic motivation sub-dimensions was due to the fact that the intrinsic motivation scores of 4th grade students who were diagnosed as gifted were significantly higher than the intrinsic motivation scores of students who were not diagnosed as gifted.

When the literature was examined, it was found that there was no study examining whether there was a statistically significant difference between the mathematics motivation of 4th grade students who were diagnosed as gifted and not diagnosed as gifted. The fact that there is no study related to this result in the literature, that the result obtained from the study contributes to the literature and that it will lead future studies is a very important situation.

According to the results of the analyses conducted in the study, it was determined that there was a statistically significant difference between the mathematics anxiety levels of 4th grade students who were diagnosed as gifted and those who were not diagnosed as gifted. When the scores were examined, it was determined that the mathematics anxiety scores of the 4th grade primary school students who were not diagnosed as gifted were significantly higher than the mathematics anxiety scores of the 4th grade primary school students who were diagnosed as gifted.

When the literature was examined, Gürel and Yetkin-Özdemir (2019) found that there was a statistically significant difference between the mathematics anxiety levels of gifted and non-gifted students. They reported that the significant difference was due to the fact that the mathematics anxiety levels of gifted students were significantly lower than the mathematics anxiety levels of non-gifted students. Most of the studies in the literature report that mathematics anxiety levels of gifted students are significantly lower than mathematics anxiety levels of non-gifted students (Lupkowski & Schumacker, 1991; Pajares & Urdan 1996; Vlahovic-Stetic et al, 1999).

Recommendations

This study suggests that primary school students should be encouraged to love mathematics and be provided with educational environments that are free from situations that will cause anxiety, as many studies have found a significant and positive relationship between mathematics anxiety and motivation.

Activities can be carried out to motivate primary school students intrinsically and materially in order to motivate them for their lack of mathematical motivation.

Gifted students have higher levels of math anxiety and motivation because they see that they can do math and go through a special, different education process. Considering this situation, it would be good for normal students to start with simple subjects so that they can feel a sense of success in math.

Since there is no significant difference in mathematics anxiety and fear according to gender, normal education processes can be continued in primary school by taking this situation into consideration.

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