

Examination of secondary school students' perceptions of mathematics course self-efficiency in Azerbaijan and Türkiye

Hayriye Ciritci¹, Ministry of Education, Kızılay, Devlet, Atatürk Blv No:98, 06420 Çankaya/Ankara, Turkey

Mustafa Cem Babadogan, Ankara University, Faculty of Educational Sciences, Department of Curriculum and Instruction, akülteler, Erdem Cd. No:5, 06590 Çankaya/Ankara, Turkey

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Abstract

The purpose of this research is to analyze the mathematics course self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye in terms of various variables. The study groups of the research consisted of secondary school students aged 10-14. In the study, the Self-Efficacy Perception Scale Against Mathematics prepared by Umay was used. The results show, mathematics self-efficacy perceptions of secondary school students working in both countries in the research unit are close to each other and at a moderate level. While the self-efficacy perceptions of secondary school students in Azerbaijan do not differ according to the variables of gender, mother's employment status, father's employment status, mother's education level, father's education level, and socio-economic status, they differ in terms of contribution according to the age variable.

Keywords: Mathematics; perception; self-efficacy.

* ADDRESS FOR CORRESPONDENCE: Hayriye Ciritci, Ministry of Education, Kızılay, Devlet, Atatürk Blv No:98, 06420 Çankaya/Ankara, Türkiye.
E-mail address: hayriyeciritci@gmail.com / Tel.: +90 5060227884

1. Introduction

Today, mathematics education aims to raise individuals who do research, question, communicate effectively, and use mathematical thinking styles effectively both in daily life and in professional life. Mathematical thinking is the effective use of rules and processes to reach a specific result in a mathematical situation (Yeşildere, 2006; Cleary, Slempe & Pawlo, 2021). Mathematics is generally perceived as a lesson in which students are afraid of making mistakes, cannot ask permission to speak, and therefore fail (Altun, 2010). For this reason, students develop negative attitudes toward mathematics and this situation causes the student to get into a vicious circle between failure and attitude.

Self-efficacy, which expresses an individual's judgment about being able to perform a certain activity (Bandura, 1997; Jalala, Latifoğlu & Uzunboylu, 2020; Evans et al., 2021; Li et al., 2021), is one of the affective constructs that have a strong relationship with student achievement and learning in mathematics (Pantziara, 2016; Hodis & Hodis, 2020). It is thought that individuals with high self-efficacy perception will perform any action with intrinsic motivation without the need for extrinsic motivation (Tan, Lyu & Peng, 2020; Cui, Zhang & Leung, 2021). Self-efficacy in mathematics is the self-assessment of whether one has the necessary knowledge and skills to successfully perform a particular mathematical task or problem (Deringöl, 2020). In this respect, it is one of the affective structures that have a strong relationship with student achievement and learning in the field of mathematics.

Azerbaijan and Türkiye, which are important stakeholders of the Turkish world, share a strong historical, cultural, and linguistic bond. The relations between Azerbaijan and Türkiye are generally defined as "one nation, two states" (Erarslan & Özdemir, 2021). Türkiye is one of the first countries to recognize the independence of Azerbaijan. Since then, Azerbaijan and Türkiye have developed very close ties in the political, economic, and military fields, including education (Zeynalova, 2022). Both in Azerbaijan and Türkiye, mathematics education is accepted as a very important component of the education system and studies are carried out to continuously improve the quality of mathematics education in schools. Although there are comparative studies on the curricula or textbooks of different courses in different levels of the education systems of Türkiye and Azerbaijan in the literature (Yılmaz, 1996; Peker, 1999; Aladdinov, 2006; Çaykesen, 2018; Oran, 2018; Farzaliyeva, 2019; Niyazli, 2019), it has been observed that there are not enough studies on the mathematics course applied in both countries.

1.1. Purpose of study

This study aims to examine the self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye in terms of various variables. For these, general-purpose answers were sought to the following questions;

1. What is the level of mathematics self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye?
2. What is the level of mathematics self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye according to the sub-dimensions of the scale?
3. Do the mathematics self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye vary significantly according to gender, mother's employment status, father's employment status, age, mother's education level, father's education level, and socio-economic status?

2. Materials and Method

2.1. Model of the Research

In this study, whose purpose is to examine the mathematics course self-efficacy perceptions of secondary school students studying in Azerbaijan and Türkiye in terms of various variables, a descriptive

survey, one of the quantitative research methods, was used. A descriptive survey model is a research approach that aims to describe a past or present situation as it is. The event, individual, or object that is the subject of the research is defined as it is in its conditions and no attempt is made to change it (Karasar, 2020).

2.2. Participants

The study group of the research consists of secondary school students aged 10-14 who continue formal education in public schools in Ankara and Antalya provinces in Türkiye and Baku in Azerbaijan in the 2021-2022 academic year. Since the compulsory education period is different in Azerbaijan and Türkiye, instead of the grade level, the age group was preferred in determining the study group to be able to work with the students who correspond to the same education period. An appropriate sampling method was used in the selection of the study group. Appropriate sampling is the selection of the sample from accessible and applicable units due to the limitations in terms of time, money, and labor (Büyükoztürk et al., 2016). The study was carried out on a completely voluntary basis with 80 students from Azerbaijan and 182 students from Türkiye. The demographic characteristics of the study group are summarized in Table 1:

Table 1
Demographic Characteristics of the Study Group

Variable	Group	Turkey		Azerbaijan	
		<i>f</i>	%	<i>f</i>	%
Gender	Male	88	48,4	38	47,5
	Female	94	51,6	42	52,5
Age	10,0	6	3,3		
	11,0	38	20,9	10	12,5
	12,0	69	37,9	21	26,3
	13,0	54	29,7	30	37,5
	14,0	15	8,2	19	23,8
Mother's Education Level	Illiterate	5	2,7	1	1,3
	Literate	11	6,0	11	13,8
	Primary school	24	13,2	4	5,0
	Secondary school	28	15,4	40	50,0
	High school	57	31,3	5	6,3
	Associate degree (2-year university)	14	7,7	4	5,0
	Undergraduate (4-year University)	25	13,7	6	7,5
	Postgraduate	13	7,1	3	3,8
	Doctorate	5	2,7	2	2,5
Other			4	5,0	

Father's Education Level	Illiterate	2	1,1	1	1,3
	Literate	11	6,0	19	23,8
	Primary school	17	9,3	2	2,5
	Secondary school	27	14,8	34	42,5
	High school	67	36,8	4	5,0
	Associate degree (2-year university)	15	8,2	1	1,3
	Undergraduate (4-year University)	24	13,2	10	12,5
	Postgraduate	15	8,2	2	2,5
	Doctorate	3	1,6	4	5,0
	Other	1	,5	3	3,8
Mother's Employment Status	Working	71	39,0	42	52,5
	Not working	111	61,0	38	47,5
Father's Employment Status	Working	162	89,0	73	91,3
	Not working	20	11,0	7	8,8
Socio-Economic Status	Low	12	6,6	3	3,8
	Medium	157	86,3	57	71,3
	High	13	7,1	20	25,0

When the table is examined; 51.6% of the participants from Türkiye and 52.5% of the participants from Azerbaijan are female students; 48.4% of the participants from Türkiye and 47.5% of the participants from Azerbaijan are male students; 37.9% of the participants from Türkiye are 12 years old and 37.5% of the participants in Azerbaijan are 13 years old; 31.3% of mothers from Türkiye are high school graduates and 50.0% of mothers from Azerbaijan are secondary school graduates; 36.8% of fathers from Türkiye are high school graduates and 42.5% of fathers from Azerbaijan are secondary school graduates; 61.0% of mothers from Türkiye are not working and 52.5% of mothers from Azerbaijan are working; 89.0% of fathers from Türkiye are working and 91.3% of fathers from Azerbaijan are working; 86.3% of the families in Türkiye have a medium economic level and 71.3% of the families in Azerbaijan are at a medium level have been seen.

2.3. Data Collection Tool

In the research; The "Demographic Information Form" was used to learn the demographic information of the participants, and the "Mathematics Self-Efficacy Scale" prepared by Umay (2001) was used to determine the students' self-efficacy towards mathematics. The scale consists of 14 items and is a 5-point Likert scale in which students choose their level of agreement with these items as "always", "often", "sometimes", "rarely" and "never". There are 8 positive (1, 2, 4, 5, 8, 9, 13, 14) and 6 negative (3, 6, 7, 10, 11, 12) items on the scale. Responses to the scale were scored with a rating of 1-5. This scoring was scored using 5,4,3,2,1 from "always" to "never" for positive items and 1, 2, 3, 4, and 5 from "always" to "never" for negative items. The highest score that can be obtained from the scale is 70, and the lowest score is 14. A high score indicates that the perception of mathematics self-efficacy is high. The scale

consists of three sub-dimensions defined as mathematics self-perception (MSP), awareness of behavior in mathematics subjects (ABMS), and ability to transform mathematics into life skills (ATMLS).

The validity and reliability analyses of the scale were carried out by the researcher. In the analyzes made for the validity of the scale, the median of the validity coefficients of the items in the scale was found to be 0.64 by the researcher, and this value was accepted as a criterion for the validity of the entire scale. In the analysis of the reliability of the scale by the researcher, the internal consistency coefficient (Cronbach's alpha) was calculated as 0.88. This value shows that the reliability of the scale is high.

2.4. Ethics

Before starting the data collection process, necessary permissions were obtained from the developer for the "Mathematics Self-Efficacy Scale" to be used in the research, and from the relevant institutions of the Ministry of National Education for the implementation in schools. Before starting the research, administrators, and students in the schools included in the sample were informed about the application.

2.5. Analysis

The numerical data obtained with the data collection tools were analyzed using the SPSS 26.0 program. To use appropriate tests in the data analysis phase, first of all, the normality test was conducted. Normality test results are shown in Table 2:

Table 2

Normality Test Results of Data

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mathematics Self-Efficacy Perception Scores (Azerbaijan)	.07	80	.200	.98	80	.37
Mathematics Self-Efficacy Perception Scores (Türkiye)	.05	182	.200	.99	182	.314

$p > .05$

Kolmogorov-Smirnov results were taken into account since the number of data was greater than 30 ($n > 30$) in the tests conducted. When the table is examined, it is seen that the data obtained from both Azerbaijan and Türkiye showed a normal distribution, since $p > 0.05$ ($\text{sig} = 200$). In the analysis of the data, a t-test was used for two-category variables from parametric tests, and a one-way analysis of variance (ANOVA) was used in the analysis of variables with three or more categories.

The arithmetic mean limits of the scores that determine the self-efficacy perception level of the students according to the answers given to the items in the 5-point Likert scale, in which the research data were collected, are given in Table 3.

Table 3

Evaluation Range of Arithmetic Means by Scale

Expression	Score	Score Range	Value
Never	1	1,00 – 1,80	Very Low
Rarely	2	1,81 – 2,60	Low
Sometimes	3	2,61 – 3,40	Medium
Often	4	3,41 – 4,20	High
Always	5	4,21 – 5,00	Very High

Since the item scores on the scale are between 1 and 5, it was accepted that the perceived level of mathematics self-efficacy is higher as the mean score approaches 5.00, and lower self-efficacy perception levels as it approaches 1.00.

3. Results

3.1. Findings and Comments Related to the First Sub-Problem

The descriptive analysis to determine the mathematics self-efficacy perceptions of the students participating in the research is presented in Table 4:

Table 4

Mathematics Self-Efficacy Perceptions of Secondary School Students Studying in Türkiye and Azerbaijan

	N	Min.	Max.	\bar{X}	Std. Deviation
AZ-Mathematics Self-Efficacy Perceptions	80	1,93	4,60	3,30	,64
TR-Mathematics Self-Efficacy Perceptions	182	1,33	5,00	3,38	,74

When Table 4 is examined, it has been determined that the mathematics self-efficacy perceptions of students in Azerbaijan ($\bar{X}=3.30$) and in Türkiye ($\bar{X}=3.38$) are at a moderate level. Although the self-efficacy perceptions of the students in Türkiye are relatively higher than the self-efficacy perceptions of the students in Azerbaijan, it is seen that the averages are close to each other.

3.2. Findings and Comments Related to the Second Sub-Problem

The descriptive analysis conducted to determine the level of mathematics self-efficacy perceptions of the students participating in the study according to the sub-dimensions of mathematics self-perception, awareness of their behavior in mathematics, and ability to transform them into life skills is presented in Table 5:

Table 5

Self-Efficacy Perceptions of Secondary School Students Studying in Türkiye and Azerbaijan According to the Scale Sub-Dimensions

	N	Min.	Max.	\bar{X}	Std. Deviation
AZ-Mathematics Self Perception	80	1,80	5,00	3,68	,83
AZ-Awareness of Behavior in Mathematics Subjects	80	1,67	4,50	3,12	,65
AZ-Transforming into Life Skills	80	1,50	4,75	3,10	,70
TR-Mathematics Self Perception	182	1,00	5,00	3,78	,90
TR-Awareness of Behavior in Mathematics Subjects	182	1,00	5,00	3,20	,82
TR-Transforming into Life Skills	182	1,25	5,00	3,13	,79

When Table 5 is examined, it is seen that the secondary school students studying in Azerbaijan have a high level of self-perception in mathematics ($\bar{X}=3.68$), and both their perception of awareness of their behavior in mathematics ($\bar{X}=3.12$) and their perception of transforming it into life skills ($\bar{X}=3.1$) are at a moderate level. Similarly, it is seen that while secondary school students studying in Türkiye have a high level of self-perception in mathematics ($\bar{X}=3.78$), their perception of awareness ($\bar{X}=3.20$) and the ability to transform into life skills ($\bar{X}=3.13$) in their behavior in mathematics are moderate. It is seen that the sub-dimension with the highest average in Azerbaijan is mathematical self-perception ($\bar{X}=3.68$), and the sub-dimension with the lowest average is the dimension of transforming into life skills ($\bar{X}=3.10$). It is seen that the sub-dimension with the highest average in Türkiye is mathematics self-perception ($\bar{X}=3.78$), and the sub-dimension with the lowest average is the dimension of transforming into life skills ($\bar{X}=3.13$).

3.3. Findings and Comments Related to the Third Sub-Problem

3.3.1. Findings and Comments According to Gender

The results of the t-test conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the gender variable are shown in Table 6:

Table 6

T-Test Results of Mathematics Self-Efficacy Perception Scores by Gender

Group	n	\bar{X}	S_x	Mean Difference	t	sd	p
AZ-Female	42	46,38	9,37	,43	,21	78	,833
AZ- Male	38	46,82	9,00				
TR-Female	94	47,56	10,76	,25	,16	180	,870
TR-Male	88	47,81	10,16				

$p>.05$

When Table 6 is examined, it is seen that the mathematics self-efficacy perception scores of students studying in both Azerbaijan and Türkiye do not show a statistically significant difference according to the gender variable ($t_A(78)=0.21$; $p>.05$), $t_T(180)=0.16$; $p>.05$)).

3.3.2. Findings and Comments According to Mother's Employment Status

The results of the t-test conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the mother employment status variable are shown in Table 7.

Table 7

T-Test Results of Mathematics Self-Efficacy Perception Scores According to Mother's Employment Status

Group	n	\bar{X}	S_x	Mean Difference	t	sd	p
AZ-Working	42	46,45	9,39	-,28		78	,891
AZ- Not Working	38	46,74	8,99				
TR-Working	71	45,55	11,18	-3,50		180	,027*
TR-Not Working	111	49,05	9,76				

* $p < .05$

When Table 7 is examined, it is seen that the mathematics self-efficacy perception scores of the students studying in Azerbaijan do not show a statistically significant difference according to the mother employment status variable ($t_A(78) = -0.14$; $p > .05$).

It is seen that the mathematics self-efficacy perception scores of the students studying in Türkiye differ statistically according to the mother's employment status variable ($t_T(180) = -2.23$; $p < .05$). When the mathematics self-efficacy perception mean score of the students whose mothers are working ($\bar{X} = 45.55$) and whose mothers are not working ($\bar{X} = 49.05$) are examined, it is seen that the mean difference is higher in favor of the students whose mothers are not working.

3.3.3. Findings and Comments According to Father's Employment Status

The t-test results, which were conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the variable of father employment status, are shown in Table 8:

Table 8

T-Test Results of Mathematics Self-Efficacy Perception Scores According to Father's Employment Status

Group	n	\bar{X}	S_x	Mean Difference	t	sd	p
AZ-Working	73	46,92	9,14	3,77	1,04	78	,300
AZ- Not Working	7	43,14	9,14				
TR-Working	162	47,88	10,48	1,73	,70	180	,487
TR-Not Working	20	46,15	10,36				

$p > .05$

When Table 8 is examined, it is seen that the mathematics self-efficacy perception scores of students studying in both Azerbaijan and Türkiye do not show a statistically significant difference according to the variable of father employment status ($t_A(78) = 1.04$; $p > .05$, $t_T(180) = 0,70$; $p > .05$).

3.3.4. Findings and Comments According to Age

The results of the ANOVA conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the age variable are shown in Table 9:

Table 9

ANOVA Results of Mathematics Self-Efficacy Scores by Age

	Variance Source	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
AZ-Mathematics Self-Efficacy Scores	Between groups	1150,72	3	383,57	5,34	,002*	11 ages>13 age
	In-group	5456,67	76	71,80			11 ages>14 age
	Total	6607,39	79				

TR-Mathematics Self-Efficacy Scores	Between groups	909,458	4	227,37	2,13	,078	-
	In-group	18857,69	177	106,54			
	Total	19767,15	181				

* $p < .05$

When Table 9 is examined, it is seen that the mathematics self-efficacy perception scores of the students studying in Azerbaijan differ statistically according to age groups [$F(3,76) = 5.34; p < .05$]. Tukey's test, one of the posthoc tests, was used to determine between which groups the difference was. According to the test results, there is a significant difference between 11 years and 13 years and between 11 years and 14 years, and also it is found that Mathematics self-efficacy perception mean scores of 11-year-old students ($\bar{X} = 54.20$) are statistically significantly higher than 13-year-old students' math self-efficacy perception mean scores ($\bar{X} = 45.70$) and 14-year-old students' math self-efficacy perception mean score ($\bar{X} = 41.68$). It is observed that the mathematics self-efficacy perception scores of the students studying in Türkiye did not differ statistically according to age groups [$F(4,177) = 2.13; p > .05$].

3.3.5. Findings and Comments According to Mother's Educational Status

The results of the ANOVA conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the mother's educational status variable are shown in Table 10:

Table 10

ANOVA Results of Mathematics Self-Efficacy Scores by Mother's Educational Status

	Variance Source	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
AZ-Mathematics Self-Efficacy Scores	Between groups	885,96	9	98,44	1,20	,306	-
	In-group	5721,43	70	81,74			
	Total	6607,39	79				
TR-Mathematics Self-Efficacy Scores	Between groups	1144,83	8	143,10	1,33	,232	-
	In-group	18622,32	173	107,64			
	Total	19767,15	181				

$p > .05$

When Table 10 is examined, it was seen that the mathematics self-efficacy perception scores of the students studying in Azerbaijan did not show a statistically significant difference according to the educational status groups of mothers [$F(9,70) = 1.20; p > .05$].

Similarly, it is observed that the mathematics self-efficacy perception scores of the students studying in Türkiye did not show a statistically significant difference according to the mother's educational status groups [$F(8,173) = 1,33; p > .05$].

3.3.6. Findings and Comments According to Father's Educational Status

The results of the ANOVA conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the variable of father education status are shown in Table 11.

Table 11

ANOVA Results of Mathematics Self-Efficacy Scores by Father's Educational Status

	Variance Source	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
AZ-Mathematics Self-Efficacy Scores	Between groups	831,43	9	92,38	1,12	,361	-
	In-group	5775,96	70	82,51			
	Total	6607,39	79				
TR-Mathematics Self-Efficacy Scores	Between groups	707,97	9	78,66	,71	,699	-
	In-group	19059,18	172	110,81			
	Total	19767,15	181				

$p > .05$

When Table 11 is examined, it is seen that the mathematics self-efficacy perception scores of the students studying in Azerbaijan did not show a statistically significant difference according to the father's educational status groups [F (9,70) =1,12; $p > .05$].

Similarly, it is seen that the mathematics self-efficacy perception scores of the students studying in Türkiye did not show a statistically significant difference compared to the father's educational status groups [F (9,172) =0.71; $p > .05$].

3.3.7. Findings and Comments According to Socio-Economic Status

The results of the ANOVA conducted to determine whether there is a significant difference between the mathematics self-efficacy perception scores of the students participating in the research in Azerbaijan and Türkiye and the socio-economic status variable are shown in Table 12:

Table 12

ANOVA Results of Mathematics Self-Efficacy Scores by Socio-Economic Status

	Variance Source	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
AZ-Mathematics Self-Efficacy Scores	Between groups	208,72	2	104,36	1,26	,291	-
	In-group	6398,67	77	83,10			
	Total	6607,39	79				
TR-Mathematics Self-Efficacy Scores	Between groups	90,68	2	45,34	,41	,663	-
	In-group						
	Total						

In-group	19676,47	179	109,92
Total	19767,15	181	

$p > .05$

When Table 12 is examined, it is seen that the mathematics self-efficacy perception scores of students studying in both Azerbaijan and Türkiye did not show a statistically significant difference according to the socio-economic status variable groups [($F_A(2.77) = 1.26$; $p > .05$), ($F_T(2.179) = 0.41$; $p > .05$)].

4. Discussion

Mathematics, which is seen as an important science in most parts of the world, is also taught as a basic subject in schools. Many basic concepts and principles in mathematics are similar across countries and cultures, although there are some differences in content and teaching methods. In the context of mathematics, self-efficacy refers to a person's belief in their ability to understand and perform mathematical tasks. Individuals with high self-efficacy in mathematics are more likely to approach mathematics problems with confidence, persistence, and willingness to learn from mistakes. They are also more likely to accept challenges as opportunities for growth rather than obstacles to avoid.

In this study, in which the mathematics self-efficacy perceptions of students studying in Azerbaijan and Türkiye were examined according to various variables, the following results were obtained: Mathematics self-efficacy perceptions of secondary school students studying in both Türkiye and Azerbaijan are moderate. Secondary school students studying in both Türkiye and Azerbaijan have high self-efficacy perceptions in the mathematics self-perception sub-dimension; Self-efficacy perceptions are at a moderate level according to the sub-dimensions of awareness in their behavior in mathematics and transforming them into life skills.

Mathematics self-efficacy perceptions of students in Azerbaijan and Türkiye do not differ significantly according to gender, mother's education level, father's education level, father's employment status, and socio-economic status. The self-efficacy perceptions of secondary school students studying in Azerbaijan differ significantly only according to the age variable, and the self-efficacy perceptions of 11-year-old students are significantly higher than the self-efficacy perceptions of 13- and 14-year-old students. The self-efficacy perceptions of secondary school students studying in Türkiye differ significantly only according to the employment status of their mothers, and the mathematics self-efficacy perceptions of the students whose mothers are not working are significantly higher than those of the students whose mothers are working.

5. Conclusion

Based on these results, the following recommendations are presented for researchers:

- Mathematics self-efficacy perception levels were found to be moderate in both Azerbaijan and Türkiye. By investigating the reasons for this situation, it can be investigated what studies can be done to increase the perception of self-efficacy towards the mathematics course?
- Although mathematics is a universal course, each country has its curriculum, teaching methods and techniques, and application principles. One of the results obtained in the study, the fact that the self-efficacy perceptions of the students towards the mathematics course decrease as they get older may be an indication that the current curriculum has deficiencies. The reasons for this situation can be investigated and various adjustments and updates can be made.

- Based on the finding that students whose mothers do not work in Türkiye have higher mathematical self-efficacy perceptions, arrangements can be made so that working mothers can spend more time with their children, and various applications or information can be made in this direction.
- This research, which was carried out with secondary school students, can be carried out by selecting students from different age groups.
- The research on country comparison can be expanded by adding different subjects such as mathematics achievement and mathematics anxiety.
- The scope of the research can be expanded by including more than one country.

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