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The Effect of Some Variables on Mathematical Resilience: A Regression Model

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Abstract

In the present study, it was aimed to determine the power of mathematics belief, and epistemological belief to predict mathematical resilience. Relational survey model was used in the research conducted with quantitative paradigm. The sample of the research consists of pre-service teachers. “Mathematical Resilience Scale”, “Epistemological Beliefs Scale”, and “Mathematics Beliefs Scale” were used as measurement tools. Regression analysis was performed to find answers to the research questions. Four different models were tested in the study. As a result, mathematics belief, and epistemological belief were found to be significant predictors of mathematical resilience. In addition, the factors of belief that learning depends on ability, belief that learning depends on effort, and usefulness were found to have high predictive power for mathematical resilience. Accordingly, as a result of the study, it is suggested that pre-service teachers should develop positive attitudes towards mathematics and have high levels of epistemological beliefs in order to develop mathematical resilience. In addition, it is suggested that pre-service teachers' developing beliefs that learning mathematics requires effort, that mathematics is useful, and that learning mathematics is related to ability will positively affect their mathematical resilience levels.

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Introduction

Mathematics is generally seen as an area that arouses feelings such as fear, anxiety, and panic among individuals, and is difficult to study. Mathematical resilience enables students to protect themselves from feelings of anxiety, fear or learned helplessness that may arise when learning mathematics becomes difficult, and to manage these feelings (Lee & Johnston-Wilder, 2017). Mathematical resilience is a conceptual construct introduced to represent a positive attitude towards mathematics (Johnston-Wilder & Lee, 2010a). In this context, when we face a mathematical challenge, our ability to overcome the challenge is related to our mathematical resilience. Individuals with mathematical resilience have four basic characteristics: Growth mindset, value, knowing how to work in mathematics, knowing how to recruit support (see Figure 1) (Johnston-Wilder et al., 2014).

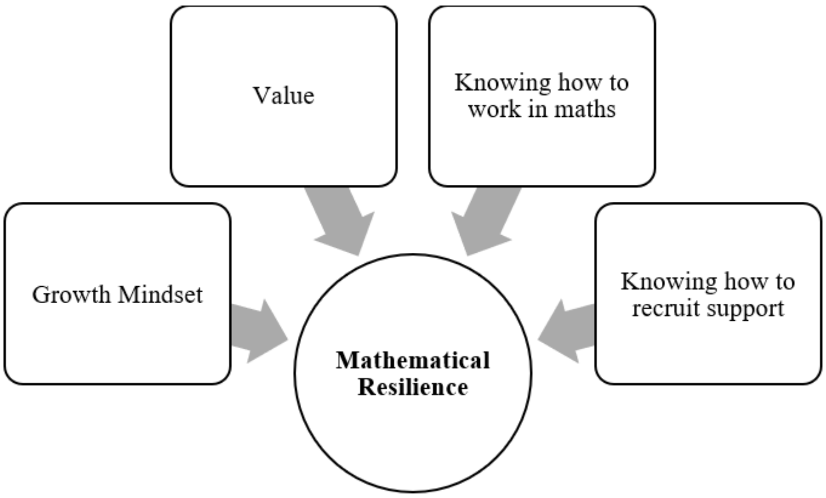


Figure 1. Four Basic Characteristics of Individuals with Mathematical Resilience

The growth mindset dimension is based on the idea that an individual's brain capacity can grow. Brain capacity is not fixed and can grow (Johnston-Wilder et al., 2014). Regardless of the capacity of the individual, it is possible to achieve success in mathematics when the individual shows the necessary dedication (Lee & Johnston-Wilder, 2013). The value dimension is generally related to seeing mathematics as a valuable field and consists of two sub-dimensions; the first one is understanding the value of mathematics (Lee & Johnston-Wilder, 2015; Johnston-Wilder et al., 2013) and the other one is seeing oneself as a valuable part of the mathematical community (Lee & Johnston-Wilder, 2017). Both situations are related to the value the individual places on mathematics. The dimension of knowing how to work in mathematics, as the name suggests, is related to how students can work in mathematics. Anyone dealing with mathematical problems may make mistakes or encounter difficulties. What is important is the reaction to them. Students with mathematical resilience know that they need to struggle and persevere when faced with these difficulties and errors (Lee &

Johnston-Wilder, 2015). The dimension of knowing how to get support is related to students' knowledge about where and how they can get support when they encounter difficulties. That is, the student knows how to get support from peers, teachers, other adults, books, information, and communication technologies (ICT), the Internet, etc. to support mathematical learning (Johnston-Wilder et al., 2013).

The resilience required to learn mathematics has a particular structure because of several factors (Johnston-Wilder & Lee, 2010b), such as the type of teaching used (Nardi & Steward, 2003), the nature of mathematics and widespread beliefs that mathematical ability is “fixed” (Dweck, 2010, Lee, 2006). To determine students' mathematical resilience, it is important to identify the factors affecting mathematical resilience. In this sense, it will be possible to ensure the development of students' mathematical resilience; making changes in the sub-factors that directly affect mathematical resilience and strengthening these aspects of the student will contribute to the development of mathematical resilience. However, there are no model development studies in the literature that will enable us to predict mathematical resilience. The present study takes an important step towards filling this gap in literature. The research is a strong and original study in this respect.

The theory of mathematical resilience is based on the idea that anyone can achieve success in mathematics when the necessary effort is made. Individuals with mathematical resilience are expected to have high belief towards mathematics and science and it is thought that these two conceptual structures will contribute to the prediction of mathematical resilience. There are no studies in literature examining the relationship between these factors and mathematical resilience. Therefore, in order to determine mathematical resilience, it is important to determine the power of belief towards mathematics and/or beliefs about knowledge to predict mathematical resilience. For this reason, the present study aimed to determine the predictive power of the concepts of mathematics belief and epistemological belief on mathematical resilience. In line with this purpose, an answer to the question "What is the predictive power of mathematics belief and epistemological belief factors for mathematical resilience?" is sought. The sub-problems of the research are as follows:

1. What is the predictive power of mathematics belief on mathematical resilience?
2. What is the predictive power of epistemological belief on mathematical resilience?
3. What is the predictive power of mathematics belief and epistemological belief together on mathematical resilience?
4. What is the predictive power of mathematics belief and epistemological belief sub-dimensions on mathematical resilience?

Method

Research Design

The present study was designed in accordance with the survey model based on the quantitative paradigm. The survey model is a quantitative description of the universe through research conducted on the sample (Cresswell, 2012). In the survey model, the event, individual or object that is the subject of the research is described within its own conditions without any change. The researcher does not endeavor to influence or change the relevant subject (Karasar, 2006). In the present study, relational screening model was used to determine the relationship between variables. The research is predictive relational research since it examines the power of different variables to predict a variable by examining the relationship between variables. In the predictive procedure, starting from a known value of a variable, the unknown value of another variable is tried to be determined (Büyüköztürk et al., 2017).

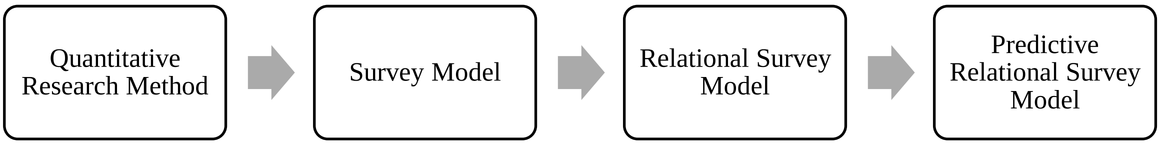


Figure 2. Scheme of Research Design

Participants

The study group of the research consists of 259 pre-service teachers (207 females and 52 males) studying in the department of elementary mathematics teaching at universities in the Central Anatolia Region in the 2021-2022 academic year. In the selection of the sample, convenience sampling was preferred. Convenience sampling saves time and money. It also saves the researcher the effort of finding less suitable participants (Cohen et al., 2007). The distribution of the participants according to grade level is as follows: 58 (48 female and 10 male) 1^{st} grade students, 86 (70 female and 16 male) 2^{nd} grade students, 62 (49 female and 13 male) 3^{rd} grade students, and 53 (40 female and 13 male) 4^{th} grade students (see Table 1). The pre-service teachers participated in the study voluntarily.

Table 1. Distribution of Participants

	1^{st} grade students	2^{nd} grade students	3^{rd} grade students	4^{th} grade students	Total
Female	48	70	49	40	207
Male	10	16	13	13	52
Total	58	86	62	53	259

Data Collection Tools

The data collection tools used in the study are 'Mathematical Resilience Scale', 'Epistemological Beliefs Scale', and 'Mathematics Beliefs Scale'. The Mathematical Resilience Scale developed by Kooken et al. (2016) was used to determine pre-service teachers' mathematical resilience. Gürefe and Akçakalın (2018) adapted this scale for Turkish university students and conducted a validity-reliability study. This study was conducted on 834 undergraduate students studying at the faculties of education and engineering of a university located in the Aegean Region of Türkiye. While the original form of the mathematical resilience scale consists of 24 items, the form adapted to Turkish culture includes 19 items. During adaptation, 5 items with low factor loadings were removed from the original form. The mathematical resilience scale consists of three factors: Value, Struggle, and Growth. The scale is a 7-point Likert-type scale ranging from (1) strongly disagree to (7) strongly agree. The reliability coefficients of the dimensions in the original scale vary between 0.73 and 0.94 (Kooken et al., 2016). The Cronbach Alpha internal consistency coefficients of the adapted scale were calculated as 0.92 for the first factor, 0.80 for the second factor, 0.76 for the third factor, and 0.87 for the whole scale (Gürefe & Akçakalın, 2018). The Cronbach Alpha internal consistency coefficients calculated in the current study were 0.88 for the first factor, 0.81 for the second factor, 0.84 for the third factor, and 0.81 for the whole scale.

The Epistemological Belief Scale developed by Schommer (1990) was used to determine pre-service teachers' epistemological beliefs. The adaptation of this scale on Turkish university students was conducted by Deryakulu and Büyüköztürk (2002). This study was conducted on 595 undergraduate students studying in various departments of education, communication, science-literature and engineering faculties of universities in Ankara. The scale consists of 35 items. In its original form, the scale consisted of 4 sub-dimensions, but when it was adapted to Türkiye, due to cultural differences, it consisted of three dimensions: "belief that learning depends on effort", "belief that learning depends on ability", and "belief that there is only one truth". The scale is a 5-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. The reliability coefficients of the dimensions in the original scale vary between 0.63 and 0.85 (Schommer, 1993). Cronbach Alpha internal consistency coefficients of the adapted scale were calculated as 0.83 for the first factor, 0.62 for the second factor, 0.59 for the third factor, and 0.71 for the whole scale (Deryakulu & Büyüköztürk, 2002). The Cronbach Alpha internal consistency coefficients calculated in the current study were 0.82 for the first factor, 0.81 for the second factor, 0.75 for the third factor, and 0.81 for the whole scale.

The Mathematics Belief Scale developed by Steiner (2007) was used to determine pre-service teachers' beliefs about mathematics. Masal and Takunyacı (2012) adapted this scale for Turkish university students and conducted a validity and reliability study. The scale consists of 34 items and five factors: Time, Steps, Understanding, Usefulness, and Sense of Self. The scale is a 5-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. The reliability coefficients of the dimensions in the original scale vary between 0.71 and 0.91 (Steiner, 2007). The Cronbach Alpha internal consistency coefficient of the adapted scale was calculated as 0.87 and the reliability coefficient obtained by the split-half method was calculated as 0.92 (Masal & Takunyacı, 2012). The Cronbach Alpha internal consistency coefficient calculated in the current study was 0.87.

Data Analysis

Regression analysis was performed to determine the predictive power of the independent variables for the dependent variable. If the number of independent variables is one, a linear regression model is used and if the number of independent variables is two or more, a multiple linear regression model is used. With this statistic, it is determined which of the independent variables affects the value of the dependent variable more (Alpar, 2011).

In multiple linear regression analysis, all independent variables may not significantly predict the dependent variable. Forward selection method, backward selection method, and stepwise selection methods can be used to make the model meaningful (Kayaalp et al., 2015). The backward selection method is one of the most basic and widely used feature selection algorithms available (Borboudakis & Tsamardinos, 2019). Therefore, a backward selection method is used in this study. This method starts with all available variables and then removes unnecessary variables step by step until some stopping criteria are met (Borboudakis & Tsamardinos, 2019; Pierna et al., 2009). First, all variables are included in the model. Then, the independent variables with the least contribution to the model are identified and removed from the model sequentially, one variable at each stage. When each variable is removed, the contribution of the removed variable to the model is analyzed.

Ethics Committee Approval

In line with the decision of Necmettin Erbakan University Ethics Committee Commission dated 11/02/2022 and numbered 2022/58, the current study was approved by the Ethics Committee.

Results

In this section, the results of the analysis related to the main problem of the research are presented. Within the scope of the research, four different models were tested. In the first model, the level of mathematics belief predicting mathematical resilience was examined, while in the second model, the level of epistemological beliefs predicting mathematical resilience was examined. In the third model, the power of mathematics belief and epistemological belief values together to predict mathematical resilience; in the fourth model, the level of prediction of mathematical resilience by mathematics belief and epistemological belief sub-dimensions was examined. When the fourth model was tested, it was determined that not all the independent variables influenced the dependent variable, and the model was created with the backward selection method. The variables contributing to the model were determined as usefulness, belief that learning depends on effort and belief that learning depends on ability.

As a result of the linear regression analysis, it was determined that there was a positive moderate relationship between mathematical resilience and mathematics belief (0.554) and a positive moderate relationship between mathematical resilience and epistemological belief (0.571); when mathematics belief and epistemological belief were evaluated together, these two conceptual constructs were positively related to mathematical resilience at a moderate level (0.624). When mathematics belief and epistemological belief sub-dimensions were evaluated together, it was found that the sub-dimensions of usefulness, belief that learning depends on effort (effort) and belief that learning depends on ability (ability) had a positive, moderate (0.688) relationship with mathematical resilience (see Table 2).

Table 2. Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.554[a]	.307	.304	.48711
2	.571[b]	.326	.324	.48032
3	.624[c]	.389	.384	.45837
4	.688[d]	.473	.467	.42657

a. Predictors: (Constant), Mathematics belief

b. Predictors: (Constant), Epistemological belief

c. Predictors: (Constant), Epistemological belief, Mathematics belief

d. Predictors: (Constant), Usefulness, Effort, Ability

When the table is examined, the change in mathematics belief explains 30.7% of the change in students' mathematical resilience and the change in epistemological belief explains 32.6% of the change in students' mathematical resilience. The change in mathematics belief and epistemological belief together explains 38.9% of the change in students' mathematical resilience. When usefulness, the belief that learning depends on effort, and the belief that learning depends on ability are evaluated together, the change that occurred explains 47.3% of the change in students' mathematical resilience. The regression models for these relationships are given below:

$$Mathematical\ resilience = 2.941 + 0.776 * Mathematics\ belief \quad \text{(Model 1)}$$

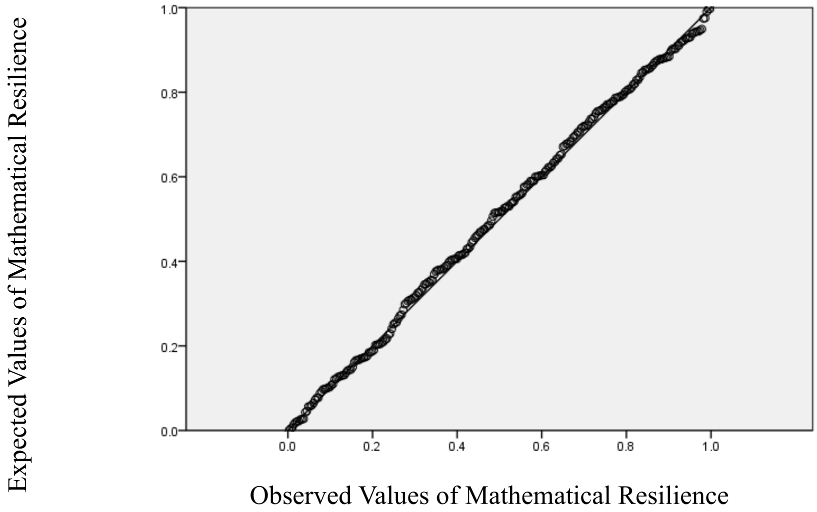
$$Mathematical\ resilience = 2.416 + 0.925 * Epistemological\ belief \quad \text{(Model 2)}$$

$$Mathematical\ resilience = 1.934 + (0.596 * Epistemological\ belief) + (0.451 * Mathematics\ belief) \quad \text{(Model 3)}$$

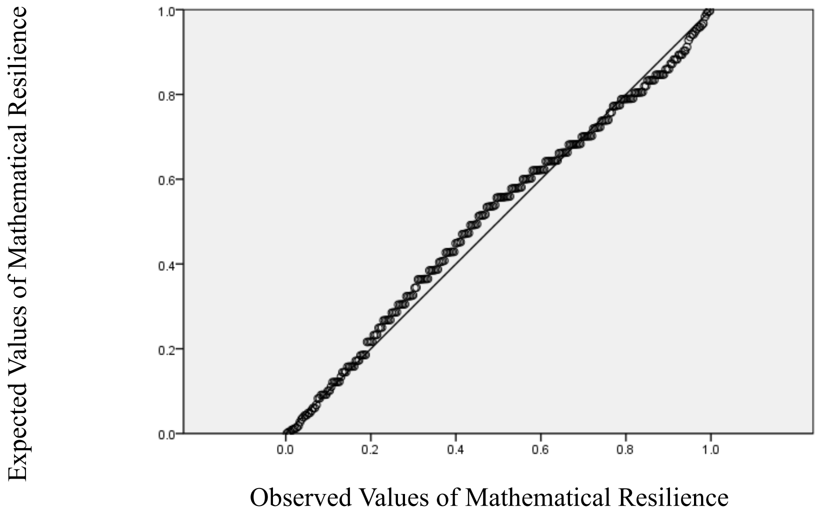
$$Mathematical\ resilience = 1.709 + (0.266 * Usefulness) + (0.590 * Effort) + (0.150 * Ability) \quad \text{(Model 4)}$$

The fits between the mathematical resilience value predicted from the above equations and the actual mathematical resilience value are shown in Figure 3, respectively.

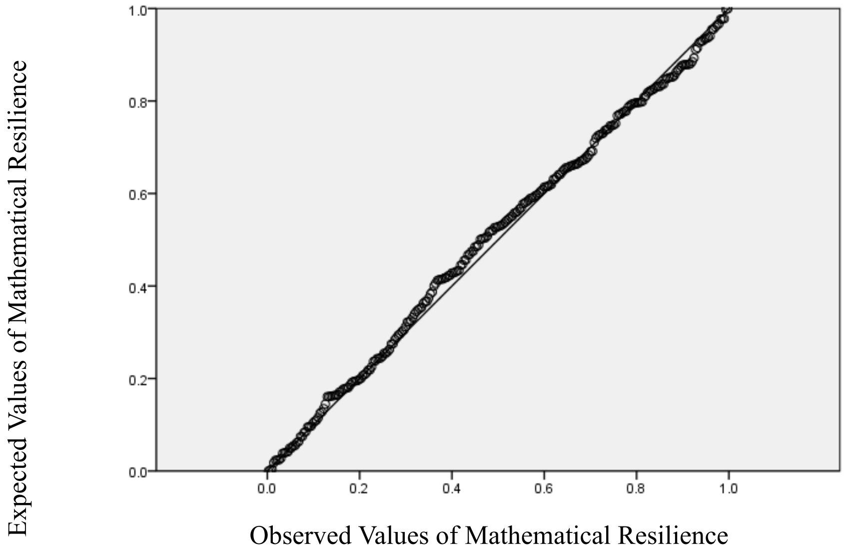
Model 1.



Model 2.



Model 3.



Model 4.

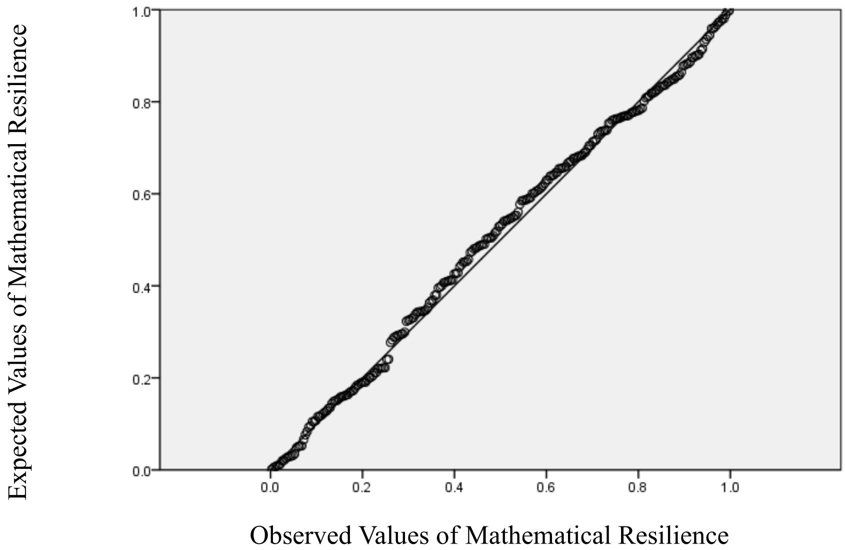


Figure 3. Relationship between Predicted and Actual Values

As can be seen from the figures, there is a good agreement between the mathematical resilience values predicted because of the equations obtained by regression analysis and the actual mathematical resilience values. That is, the prediction performance of the obtained models is high. The significance levels of the regression coefficients in the relationships in the models were analyzed with t and F tests at α=0.01 significance level. The results of the t-test are given in Table 3.

Table 3. T-test results of the regression model[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. (p)
		B	Std. Error	Beta		
1	(Constant)	2.941	.279		10.543	.000
	Mathematics belief	.776	.073	.554	10.672	.000
2	(Constant)	2.416	.314		7.702	.000
	Epistemological belief	.925	.083	.571	11.156	.000
3	(Constant)	1.934	.314		6.163	.000
	Epistemological belief	.596	.102	.368	5.851	.000
	Mathematics belief	.451	.088	.322	5.119	.000
4	(Constant)	1.7009	.292		5.844	.000
	Usefulness	.266	.051	.295	5.192	.000
	Effort	.590	.074	.419	8.018	.000
	Ability	.150	.039	.191	3.813	.000

a. Dependent Variable: Mathematical Resilience

As can be seen from Table 3, the significance levels obtained for the t values in the regression analysis are smaller than $\alpha=0.001$ error level. Thus, it is understood that the regression coefficients in the relationships established for the prediction of mathematical resilience value are different from zero and that the relationships between the dependent variable and the independent variables exist. When the first model is examined in detail, a 1-point change in mathematics belief causes a 0.776-point change in mathematical resilience. Similarly, in the second model, a 1-point change in epistemological belief leads to a 0.925-point change in mathematical resilience. In the third model in which mathematics belief and epistemological belief were evaluated together, a 1-point change in epistemological belief affected mathematical resilience by 0.596 points, while a 1-point change in mathematics belief affected it by 0.451 points. A 1-point increase in epistemological belief and mathematics belief increases mathematical resilience by a total of 1.047 points. In the model created with the sub-dimensions, a 1-point change in the usefulness factor affects mathematical resilience by 0.266 points, a 1-point change in the effort factor affects mathematical resilience by 0.590 points and a 1-point change in the ability factor affects mathematical resilience by 0.150 points. A 1-point increase in each factor increases the individual's level of mathematical resilience by a total of 1.006 points. Regarding the significance of the established models, whether the independent variables have a linear relationship with the dependent variable was evaluated with the help of the F test. The test results are given in Table 4.

Table 4. F test results of the regression model[a]

Model		Sum of Squares	df	Mean Square	F	Sig. (p)
1	Regression	27.025	1	27.025	113.896	.000[b]
	Residual	60.980	257	.237		
	Total	88.005	258			
2	Regression	28.712	1	28.712	124.453	.000[c]
	Residual	59.292	257	.231		
	Total	88.005	258			
3	Regression	34.218	2	17.109	81.429	.000[d]
	Residual	53.787	256	.210		
	Total	88.005	258			
4	Regression	41.605	3	13.868	76.215	.000[e]
	Residual	46.400	255	.182		
	Total	88.005	258			

a. Dependent Variable: Mathematical resilience

b. Predictors: (Constant), Mathematics belief

c. Predictors: (Constant), Epistemological belief

d. Predictors: (Constant), Epistemological belief, Mathematics belief

e. Predictors: (Constant), Usefulness, Effort, Ability

According to Table 4, the results of regression analyses for mathematical resilience value were calculated as F_1= 113.896; F_2= 124.453; F_3= 81.429 and F_4= 76.215, respectively. All the significance levels calculated for these F values are less than α=0.001 error level. This shows that at least one independent variable in the models influences the dependent variable. Tolerance and VIF values were used to check whether there is a multicollinearity problem among the independent variables in the relationships between the variables established in the multiple regression model. Data on the calculated Tolerance and VIF values are given in Table 5.

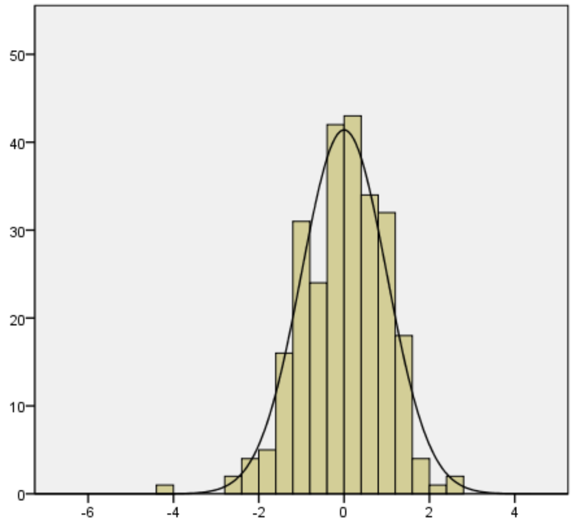
Table 5. Tolerance and VIF values for Multicollinearity Diagnosis

Model (Constant)		Tolerance	VIF
3	Epistemological belief	.603	1.659
	Mathematics belief	.603	1.659
4	Usefulness	.642	1.557
	Effort	.758	1.319
	Ability	.825	1.212

When the Tolerance and VIF values for the models were analyzed, it was observed that the Tolerance was not smaller than 0.1 for any variable and none of the VIF values was higher than 10. This shows that there is no linkage problem between the independent variables (Çokluk et al., 2016; Tabachnick & Fidel, 2013). The distribution of regression residuals for the fit of the models and that the regression assumptions are not seriously violated is given in Figure 4.

Dependent Variable: Mathematical Resilience

Model 1.

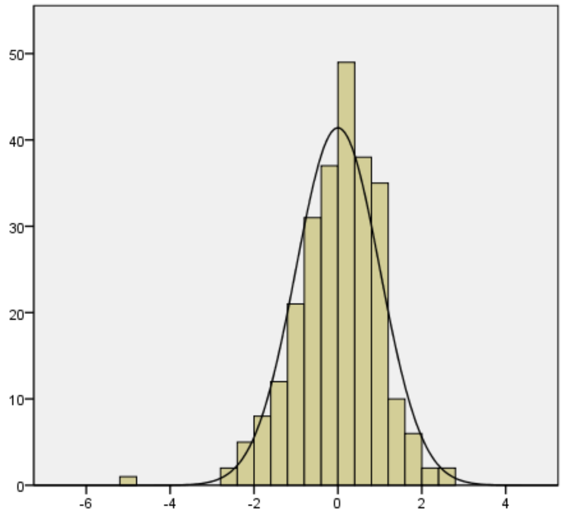


Regression Standardised Residuals

Mean= 1.32E-15
Standard Deviation= 0.998
N= 259

Dependent Variable: Mathematical Resilience

Model 2.

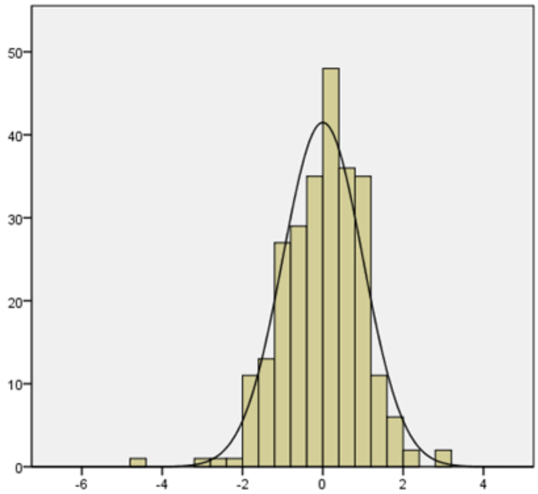


Regression Standardised Residuals

Mean= 6.79E-15
Standard Deviation= 0.998
N= 259

Dependent Variable: Mathematical Resilience

Model 3.



Mean= 4.06E-15
Standard Deviation= 0.996
N= 259

Regression Standardised Residuals

Dependent Variable: Mathematical Resilience

Model 4.

Mean= 1.08E-14
Standard Deviation= 0.994
N= 259

Regression Standardised Residuals

Figure 4. Regression Residuals Distribution

In a regression model, the distribution of errors (residuals) should be normally distributed with zero mean and constant variance. As seen in Figure 4, the distributions of the models are approximately bell curve shaped. In other words, the residuals in the models have a normal distribution. As a result, it can be said that the regression models obtained for the prediction of mathematical resilience are significant and valid.

Discussion and Conclusion

In the study, four models were developed to predict pre-service teachers' mathematical resilience by using mathematics belief and epistemological belief variables. Among the models developed, the model with the least accuracy is the first model. As new models were developed, the accuracy level increased. Therefore, the model with the highest accuracy was determined as the fourth model.

The individual with mathematical resilience sees mathematics as a valuable subject area. Therefore, it is important for her to do, learn, and master mathematics (Johnston-Wilder et al., 2014). The findings of the current study also confirm this. As a result of the research, it was determined that the level of beliefs that the individual has towards mathematics and doing mathematics is a statistically significant predictor for mathematical resilience. This indicates that the mathematics belief factor has a high predictive power for the level of mathematical resilience. Parallel to this result obtained from the study, Morkoyunlu and Ayhanöz (2023) also found that mathematics beliefs positively and significantly predicted mathematical resilience in middle school students.

Epistemological belief, which represents the belief in what knowledge is and how learning takes place, was also found to have a statistically significant predictive effect on mathematical resilience. This implies that the epistemological belief factor has a high predictive power for the level of mathematical resilience. The fact that epistemological belief is one of the factors predicting mathematical resilience can be explained by the fact that individuals with epistemological belief have a sense of confidence in mathematics and mathematical problems. Studies indicate that each sub-dimension of epistemological belief is related to self-confidence in mathematics (Delice et al., 2009) and belief in mathematical problem solving (Hacıömeroğlu, 2011). An individual who is confident about something does not give up and never loses hope. So, he keeps on trying until he solves the problem he faces. Continuing to strive without giving up is one of the most important aspects of mathematical resilience. Effort is the path that leads the individual to success and allows for the development of his/her talent (Beere, 2019; Baruch-Feldman, 2017). Therefore, an individual with epistemological beliefs will strive to overcome mathematical difficulties because of his/her self-confidence. This indicates that the individual has mathematical resilience. Therefore, epistemological belief appears as one of the factors predicting mathematical resilience.

As a result of the study, it was found that the predictive power of epistemological belief on mathematical resilience was higher than mathematics belief. When these two factors, which were found to have a direct effect on mathematical resilience, were evaluated together, a significant model (model 3) was obtained. The predictive power of this model for mathematical resilience was higher than the predictive power of mathematics belief (model 1) and epistemological belief (model 2) alone. Therefore, it is important to evaluate mathematics belief and epistemological belief together for mathematical resilience.

There are many dimensions to the variables of mathematics belief and epistemological belief. Some of these factors may have a high predictive power for mathematical resilience, while others may not have a significant predictive effect on mathematical resilience. For this reason, the sub-dimensions of mathematics belief and epistemological belief, which have a high power to predict mathematical resilience, were examined and it was determined which sub-dimensions had a significant effect on mathematical resilience. There are five sub-dimensions of mathematics belief. Of these, only the usefulness sub-dimension was found to have a high predictive power for mathematical resilience. Epistemological belief has three sub-dimensions. Among these, the sub-dimensions of “belief that learning depends on effort (effort)” and “belief that learning depends on ability (ability)” were found to have high predictive power for mathematical resilience. When the factors in the model are evaluated, it is seen that the factor with the highest effect on mathematical resilience is “belief that learning depends on effort”. The model created with the dimensions of usefulness, effort and ability (model 4) explains the individual's level of mathematical resilience more strongly than the other three models. Similar to this result, in the study conducted in Morkoyunlu and Ayhanöz (2023), it was determined that the usefulness and effort sub-dimensions of the mathematics belief scale (Çiftçi & Yıldız, 2020) predicted mathematical resilience.

The model with the dimensions of usefulness, effort, and ability (model 4) predicts mathematical resilience more strongly than the model with mathematics belief and epistemological belief (model 3). This is because there are some sub-dimensions within the factors that do not contribute to predicting mathematical resilience. These sub-dimensions reduce the power of the model to predict mathematical resilience. While obtaining Model 4, the model was made significant by using the backward selection method. The sub-dimensions in Model 3 that had low predictive power for mathematical resilience were removed from the model. Therefore, the predictive power of the model increased when the sub-dimensions with the least effect were removed from the model.

The effect of the belief that learning depends on effort, and ability on mathematical resilience can be explained by the growth mindset dimension of mathematical resilience. According to the growth mindset, an individual's brain capacity and math ability can be developed (Dweck, 2010). From this, it is understood that mathematics depends on ability, but that ability can be developed with effort. Individuals with this mindset see effort as important for developing ability (Murphy & Dweck, 2016). With the necessary dedication and effort, anyone can achieve success in mathematics, regardless of their brain capacity (Lee & Johnston-Wilder, 2013).

The usefulness factor, which was found to have an effect on mathematical resilience, expresses that mathematics is useful and beneficial in daily life. The effect of the usefulness factor on mathematical resilience can be explained by the value dimension of mathematical resilience. Value is the extent to which an individual finds mathematics important in achieving current or future goals (Deci et al., 1991). According to this dimension, mathematics is a part of everyone's life and is beneficial for everyone. Therefore, it makes sense that usefulness predicts mathematical resilience.

Recommendations

In the current study, the affective characteristics of mathematics belief and epistemological belief, which are thought to have an effect on mathematical resilience, were taken into consideration. This constitutes the limitation of the study. However, the lack of studies in the literature on determining the predictors of mathematical resilience makes the current study important. The present study takes an important step towards understanding the building blocks of mathematical resilience. In future studies, it may be recommended to conduct similar studies with a different sample population and a larger sample size. It is also recommended to conduct new regression studies with different affective, psychological or epistemological variables that are thought to have an effect on mathematical resilience.

As a result of the research, in order to improve students' mathematical resilience, it is recommended to support the development of mathematics beliefs, and epistemological beliefs. Specifically, instilling in students that the ability to learn can be improved, and that mathematics is a useful, and rewarding field is crucial for the development of mathematical resilience. For students to acquire these beliefs, it is recommended that both parents should conduct activities at home, and teachers should conduct activities in the classroom.

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