Journal for the Education of Gifted
Young Scientists, 11(2), 249-262, June 2023
e-ISSN: 2149- 360X
jegys.org
dergipark.org.tr/jegys

Young Wise Publishing
youngwisepub.com
gencbilgeyayincilik.com
© 2023

Research Article

Examination of EPGBU model proposed for academically gifted student with structural equation model[1]

Baran Savaş[2], Derya Gogebakan Yildiz[3],, and Hasan Said Tortop[4*]

Interdisciplinary Disabled Program, Social Sciences Institute, Trakya University, Edirne, Turkiye

Article Info

Received: 27 March 2023
Accepted: 28 June 2023
Available online: 30 June 2023

Keywords
Education program for gifted
EPGBU model
Gifted students
Structural Equation Model

Abstract

The fact that gifted education programs have certain standards, include evaluation, and are based on theoretical foundations ensure that these programs are real programs. Therefore, it is necessary to test the effectiveness of the programs put forward for gifted education and to determine their social validity. The Education Program for Gifted Bridge with University (EPGBU), developed by Tortop (2013), is a university-based program aimed at raising gifted students in the academic field. This research is in a descriptive survey model, and the characteristics of gifted students studying at the Science and Art Center in Turkey in the components of the EPGBU model were analyzed with the Structural Equation Model (SEM). EPGBU model values; $\chi2$=4.328, df=5, p=.000; RMSEA, 0.000; $\chi2$/df=,866; NFI=.951; CFI=.50; GFI=0.983; PCLOSE= .000 was found. Accordingly, it is seen that the EPGBU model is a fit model.

To cite this article:

Savaş, B., Gogebakan Yildiz, D. & Tortop, H.S. (2023). A Examination of EPGBU model proposed for academically gifted student with structural equation model. *Journal for the Education of Gifted Young Scientists*, *11*(2), 249-262. DOI: http://dx.doi.org/10.17478/jegys.1303383

Introduction

Gifted education has been on the agenda of general education as it has increased rapidly in recent times. In this area, besides student characteristics, teacher characteristics, guidance and psychological counselling and guidance, education programs have also been created on how to train these children. There are many discussions about how these training programs should be, and it is explained that the training program prepared for the gifted should have some features. Real gifted education programs should also have high social validity and studies should be conducted on their effectiveness. In addition, the education model prepared for the gifted should be theoretically testable. Sak (2010) opened up for discussion what the standards of the programs developed for the gifted should be and the characteristics of the real gifted education program. Besides, one of the main problems of gifted education in Turkey is the lack of education program. Education Program for Gifted Bridge with University (EPGBU), developed by Tortop (2013) to fill the gap in this area; With its curriculum components in five different fields and 120 educational achievements, it is a program that can be implemented not only for Turkey but also worldwide.

[1] This study was produced for first author master thesis.
[2] Science teacher, E-mail: :baransavas@gmail.com
[3] Assoc.Prof.Dr., Department of Educational Sciences, Education Faculty, Manisa Celal Bayar University, Manisa, Turkiye. E-mail: dgogebakann@cbu.edu.tr ORCID: 0000-0002-8831-8878
[4] Corresponding author: PhD student, Interdisciplinary Disabled Program, Social Sciences Institute, Trakya University, Edirne, Turkiye. E-mail:hsaidtortop@trakya.edu.tr ORCID: 0000-0002-0899-4033

EPGBU Model Structure

In developing countries, it is seen that most of the gifted children's potential is directed to academic fields (such as medicine, engineering) in line with both the guidance of the families and the preferences of the children. This situation causes the educational needs of gifted children in the academic field to arise. Turkey is one of the examples of this situation. In the Science and Art Center (SAC) model of the Ministry of National Education of Turkey (MoNET), gifted children are mostly supported in the academic field. EPGBU was put forward with the idea of evaluating the situation of universities having the necessary infrastructure for the education of gifted children. EPGBU is therefore a university-based program.

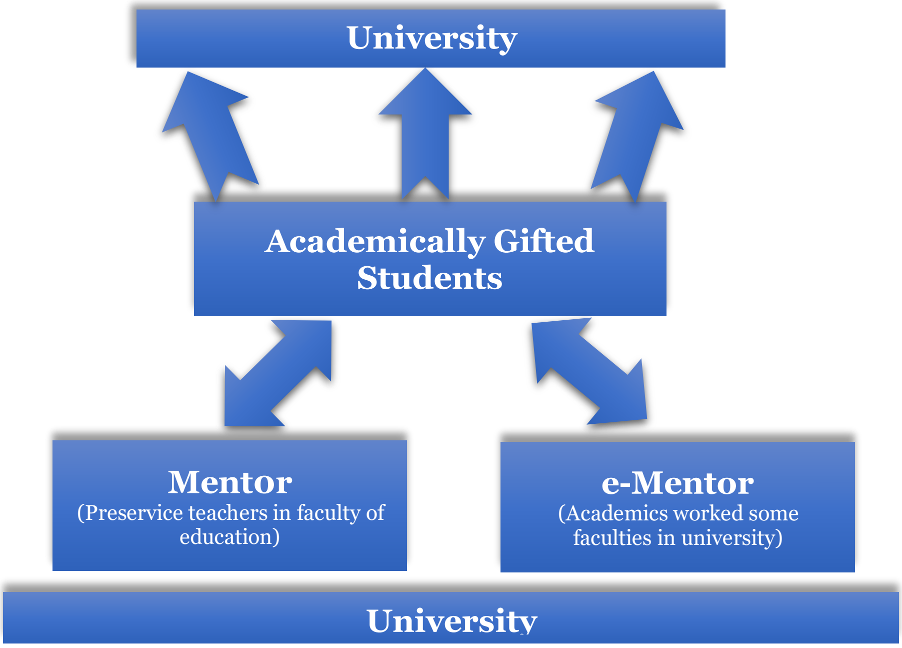

Figure 1. University-based structure of EPGBU Model (Tortop, 2018)

The social validity of the EPGBU training program, which was put forward by Tortop (2013, 2015) for gifted educa on in the academic field, was found to be high. In addition, in the structure of EPGBU consisting of 5 components; Scientific Creativity, Self-Regulation Skills in Learning Science, Thinking Skills, Scientific Research and Process Skills, History and Philosophy of Science.

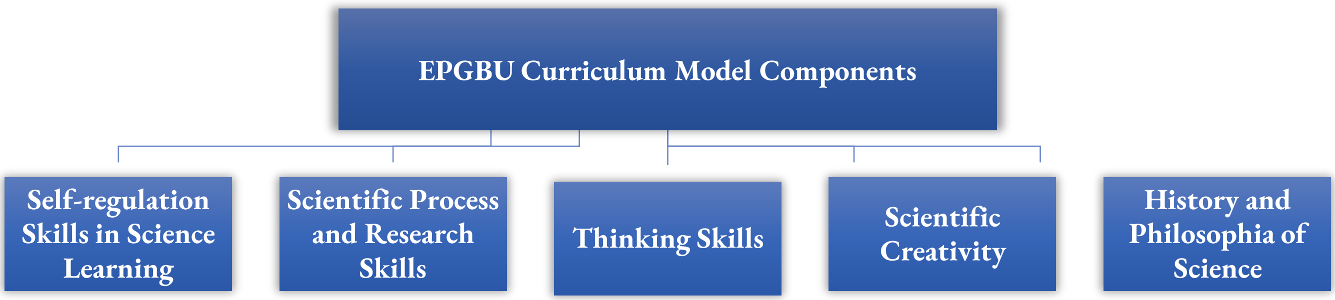

Figure 2. EPGBU curriculum model components (Tortop, 2018)

EPGBU has chosen the educational content necessary for the education of a gifted student in the academic field as gifted young scientists, on the axis of the theories of giftedness. "Self-regulated learning skills" for motivation and commitment to the task in all theories, the skills a scientist uses while carrying out his scientific research, research skills, "creativity" or creative thinking skill in all theories, and "self-regulated learning skills" found in Renzulli and Sternberg's theories. In order to develop the field of wisdom", it is necessary to determine the educational attainments related to fields such as "history and philosophia of science".

Problem of Study

Testing the relationships between the structural components of the EPGBU model is very important for the validity of this model. In this research, it is aimed to test whether the EPGBU model is a compatible model with the structural equation model. The problem of the research is

- Is it a model in a structure compatible with all the components of the EPGBU model?

Method

Research Model

In this study, since it was aimed to model the different characteristics of the students studying in Science and Art Centers, the research was descriptive and the survey model was chosen as the design (Buyukozturk et al, 2011). In the study, the model made by showing the interactions of the variables with each other with a diagram is called the path analysis technique. Path analysis can be done in two different types: observed variable and latent (Bryne, 2010). Within the scope of this study, gifted students; Since the variables that determine the features such as self-regulation skills in science learning, scientific research and process skills, knowledge of the history of science and philosophy, thinking skills and scientific creativity are an observable variable, the type of path analysis made with the observed variables was chosen.

Structural Equation Modelling

The definition of Structural Equation Modelling (SEM) can be made as follows. A theoretical model, framed or designed by a researcher, is testing the compatibility of the hypothesis in the light of the obtained data (Schumacker & Lomax, 2010). In fact, it is a hypothesis testing technique, the researcher describes and tests the relationship between the observable and latent variables in the model he developed with the collected data.

Path Analysis Process with SEM

First of all, with any of the statistical package programs for the analysis of the path analysis technique with SEM, which are; Lisrel are programs like AMOS, variables need to be defined. In the path analysis process, it is decided whether the analysis will be done with observed variables or latent variables. After this stage, if the path analysis is to be done with observed variables, the variables should be defined with rectangles, and if it will be done with latent variables, they should be defined in the statistical package program with ellipses or circles. While performing the analysis, data is obtained from the correlation matrix of the variables in the data set if the analysis is to be made over the observable variables, and from the scale items of the latent variables if the analysis is to be made with the latent variables. After that, the probability of the hypothesis model is tested. In the model testing process in path analysis, the primary goal is to examine the fit of the model between the data obtained from the sample, with the criteria described as Goodness Fit Indices and giving an idea about the model fit. While testing the model with the data obtained from the sample, a difference arises and this is expressed as a residual. We can formulate it as follows; "Data = Model + Residual" . Here is the data; scores of observable variables taken from the sample, model; hypothesis about the situation based on the relationships between the variables, the remainder; It is the difference between the model presented as a hypothesis and the fit of the observable variables (Bryne, 2010). The smallness of the remainder indicates the fit between the hypothetical model and the data set. In this respect, the model is interpreted as the better. There are the following stages in the SEM process; Defining the model, Estimating the model, Examining the fit of the model, Correcting the model. Identification of the model; It includes the researcher's tasks such as deciding which of the parameters will be constant or zero. Therefore, the researcher should place the model he considers theoretically and the variables in the model very well. An important issue to be considered at this stage is that the sample or data set is a certain number (Bryne, 2010). Estimation is made with the covariance matrix statistical program of the sample regarding the parameters that are considered as constant or zero in the model. The purpose of this estimation is to test the difference between the population covariance matrix formed by the sample and the population covariance model created with the parameters in the model with the null hypothesis. Likewise, the smaller the difference, the stronger or better the fit between the model and the data set (Bryne, 2010).

Examination of model fit; At this stage, model test statistics are used. Statistical estimations, conceptualized as model test statistics or fit indices, are statistics that allow the interpretation of the fit between the model created by the researcher and the data obtained by examining them according to certain criteria. There are many compliance statistics within the framework of SEM, some of which are as follows; Chi-square, the main purpose of this fit statistic is to test the fit of the universe covariance matrix and the sample covariance matrix. The number of samples is important for this statistical analysis (Tabachnick & Fidell, 1989).

Standardised Root Mean Square Residual (SRMR) is a criterion for examining the standardized differences between the variance and covariance of the variables measured in the studied model. It is formulated by calculating the square root of the difference between the sample covariance matrix and the hypothesis covariance model. As the SRMR value approaches 0, it indicates good fit (Bryne, 2010; Hooper, Coughlan, & Mullen, 2008).

Root Mean Square Error of Approximation (RMSEA) is a criterion that shows how complex the model is in terms of degrees of freedom. The cut-off point for RMSEA is recommended as .06. Being below this value indicates a good fit in model tests (Bryne, 2010; Distefano & Hess, 2005; Hoyle, 2000). It is expected that the lower limit RMSEA value of the tested model is close to 0, and the upper limit RMSEA value does not exceed 10 (Hooper, Coughlan, & Mullen, 2008). AGFI - GFI (Goodnes of Fit Index) is a substitute for the chi-square test. is the test. It indicates the overall amount of covariance between observed variables calculated in the model under test. If this criterion is over 90, it indicates a good fit of the model (Bryne, 2010; Hoyle, 2000). CFI (Comparative Fit Index) is a criterion based on comparing the covariance matrix estimated by the model under test and the covariance matrix of the model tested with the null hypothesis (Hoyle, 2000). A value above .90 for this criterion indicates a good fit of the model (Bryne, 2010; Hoyle, 2000).

NFI (Normed Fit Index) is a criterion based on the comparison of the chi-square value of the tested model with the chi-square value of the zero model (Hooper, Coughlan, & Mullen, 2008). The NFI value of the tested model indicates acceptable fit for between .80 and .95, and perfect fit for >.95 (Hu & Bentler, 1999). Non-normed Fit Index (NFI); It is a criterion based on comparing the chi-square / degree of freedom ratios of both the observed model and the zero model. A value above .90 indicates a good fit of the model (Bryne, 2010; Hoyle, 2000)]. These fit statistics serve to examine the fit of the tested model with the data set by considering certain aspects. In general, it is necessary to look at all of these statistics, not just one.

Correction of the model; If the estimated covariance matrix in the model does not sufficiently match the sample covariance matrix, this model needs to be revised. In this process, it may be necessary to draw a path in the model or to delete an existing path. In this process, operations are performed on a criterion known as the modification index. Here, the change in the chi-square value of any path added to the model gives clues to the researcher. What needs to be done is to determine the paths that provide the highest decrease in the chi-square value of the model and define them to the model.

Study Group

The study group of the research consisted of a total of 102 gifted and talented 60 girls and 42 boys attending the 6th, 7th and 8th grades who were studying at the Science and Art Center in Manisa and Diyarbakır during the 2016-2017 and 2017-2018 academic years. created a child.

Information of the students in the study group in this study is given in Table 1.

Table 1. Characteristics of the students involved in the study

Demographic variables		**f**	**%**
Gender			
	Female	60	58.8
	Male	42	41.2
Age			
	10 years	14	13.7
	11 years	39	38.2
	12 years	18	17.6
	13 years	30	29.4
	14 years	1	1.0
Grade			
	5th	24	23.5
	6th	42	42.5
	7th	36	35.3
Family income			
	0-1250 TL	8	7.8
	1250-3000 TL	55	53.9
	3000-5000 TL	21	20.6
	5000 TL +	18	17.8
Mother Education Status			
	Illiterate	35	34.3
	Primary school	26	25.5
	Secondary school	14	13.7
	High school	14	13.7
	University	13	12.7
Father Education Status			
	Illiterate	8	7.8
	Primary school	23	22.5
	Secondary school	30	29.4
	High school	22	21.6
	University	16	15.7
	Master	3	2.9
Favorite Courses			
	Science	47	46.1
	Mathematic	37	36.3
	Social sciences	12	11.8
	Turksih language	6	5.9
Science achievement grades			
	80-85	5	4.9
	86-90	16	15.7
	91-95	21	20.6
	96-100	60	58.8
	Total	112	100

Data Collection Tools

In the study, "Scientific Creativity Test", "Scientific Epistemological Beliefs Scale", "Problem Solving Inventory for Children", "Scientific Process Skills Test", "Critical Thinking Evaluation Rubric" and "Self-regulation Skills in Learning Science" were used in the process of collecting quantitative data in the study.

Scientific Creativity Test

The "Scientific Creativity Test" developed by Hu and Adey (2002) and adapted into Turkish by Kadayici(2008) was applied to determine the scientific creativity levels of the students. The test, which consists of seven open-ended questions, measures all sub-dimensions of the process (imagining, thinking), character (fluency, flexibility, originality) and product (technical product, science, science phenomenon, science problem), which are the main dimensions of the Scientific Creativity Construct Model. . Each question in the test measures multiple sub-dimensions. The answers given to the questions are scored in terms of fluency, originality and originality. In order to ensure the construct validity of the test, factor analysis was carried out by Kadayifçı (2008) to ensure the construct validity of the test, and it was determined that the test measures a main factor and the factor load of all questions is more than 0.300. The reliability coefficient of the test developed by Hu and Adey was calculated as 0.89. The reliability coefficient of the test adapted to Turkish by Kadayifçı (2008) was calculated as 0.735.

Scientific Epistemological Beliefs Scale

When we look at the literature, it is seen that the scientific epistemological beliefs scale created by Conley et al., (2004) is mostly used in studies conducted with secondary school students and field-oriented scientific epistemological beliefs in science (Ozkok, 2005). From this point of view, a 26-item five-point Likert-type scientific epistemological beliefs scale, which was originally developed by Conley, et al., (2004) for the primary school group consisting of 5th grade students, and adapted into Turkish by Kurt (2009), was used. In this original scale created by Conley et al., 26 items are included in the four-factor structure. The factors in the scale are named as resource dimension (source), precision dimension (certainly), justification dimension and development dimension. The items in the scale were expressed with a five-point Likert type rating scale, which was stated as strongly disagree (1), disagree (2), undecided (3), agree (4) and strongly disagree (5). As a result of the scale, high scores indicate that students have developed/mature scientific epistemological beliefs, while low scores indicate that students have immature/immature scientific epistemological beliefs. The reliability coefficient of this scale for all items is Cronbach Alpha 0.80.

Problem Solving Inventory for Children

The problem solving inventory for children was developed by Serin, Serin and Saygili (2010) to determine the level of self-perception of secondary school students regarding problem solving skills. The scale consists of 3 sub-dimensions and 24 items. The sub-dimensions of this scale consist of confidence in problem solving skills, self-control and avoidance factors. 12 items of the scale were designed for "Confidence in Problem Solving Skills", 7 items for "Self-Control" and 5 items for "Avoidance" factor. This scale, developed by Serin, Serin and Saygili (2010), was applied to a total of 568 students in eight primary schools. As a result of the factor analysis, the Cronbach Alpha reliability coefficient of the inventory was determined as 0.80. Each item was categorized as "Never", "Rarely", "Sometimes", "Often" and "Always" in the scale created in a five-point Likert type. Evaluation, "I never act like this (1)", "I rarely act like this (2)", "I act like this sometimes (3)", "I often act like this (4)", "I always act like this (5) " was designed and scored. Evaluation of negative items is "I never act like this (5)", "I rarely act like this (4)", "I sometimes act like this (3)", "I often act like this (2)", "I always act like this (It is rated as "1)". Serin, Serin, and Saygılı (2010) arranged the items as 32 positive statements and 32 negative statements, a total of 64 statements [25]. As a result of this arrangement, the final version of the scale was developed as 24 items. While the maximum score that the student can get from this scale is 120, the minimum score he can get is 24.

Scientific Process Skills Test

The "Scientific Creativity Test" developed by Enger and Yager (1998) and adapted into Turkish by Koray, Koksal, Ozdemir and Presley (2007) was applied to determine the development of students' scientific process skills. For the reliability study of the scale, it was applied to 300 students with similar characteristics. With the ITEMAN program, 5 items with low reliability were removed from the scale. As a result of this arrangement, the final version of the scale was developed as 31 items. The test consists of scientific process skills, "Observing" (2 questions), "Space/Time relation" (3 questions), "Classification" (3 questions), "Using numbers" (3 questions), "Making measurements" (3 questions). question), "associating" (3 questions), "Prediction" (3 questions), "Controlling Variables" (3 questions), "Interpreting data" (2 questions), "Creating a hypothesis" (3 questions), "Defining"(1 question) and "Experiment" (2 questions). The content validity of the test was provided by taking expert opinions, and the KR-21 reliability coefficient was found to be 0.81. Its validity and reliability were tested and the internal consistency coefficient Cronbach alpha value was found to be 0.77. In the test, 1 point is awarded for each correct answer. Therefore, the highest score that can be obtained from the test is 31.

Critical Thinking Assessment Rubric

In this study, the reading passage (How Will We Choose the Astronaut?) developed by Schreglmann (2016) was applied to determine the development of students' critical thinking skills. This reading passage, which was prepared in accordance with the sixth grade levels of secondary school, was created by Schreglmann (2016) with the help of relevant field experts, and a draft text was created. During the pilot study, 10 sixth grade students were asked to read the reading passage and answer the related questions in 1 class hour. After this process, each student was interviewed individually and they were asked to state their thoughts and suggestions about the reading piece. As a result of the suggestions received from the students, the reading piece was rearranged and took its final form. This reading piece, which took its final form, was taught to students within the scope of the research. Immediately after the reading passage was read, the students answered the above-mentioned six separate questions, after examining 5 different solution proposals related to this passage. The most interesting point here is that students are given multiple solutions ready together. The questions are based on the evaluation of ready-made solutions. These questions consist of open-ended questions. It contains indicators that will enable the evaluation of students' critical thinking skills. When the critical thinking assessment rubric is examined, it is seen that the measurement tool includes important critical thinking elements (defining the problem, making comparisons, suggesting a solution, identifying weaknesses and deficiencies, developing ideas, reflecting).

Scale of Self-regulation Skills in Learning Science

The main purpose of this scale, Self-regulation Skills in Science Learning Scale developed by Tortop (2013, 2015), is to determine students' self-regulation skills in learning science. It is a self-report scale that measures students' self-learning skills. This scale consists of 4 sub-dimensions and a total of 21 items and is a five-point Likert scale. Sub dimensions; These are Metacognitive Skills, Motivation Skills, Cognitive Skills and Management Skills. Cronbach's alpha internal consistency coefficient of the sub-dimensions of the scale, respectively; .87, .85, .87, .87. The Cronbach's alpha coefficient for the overall scale was found to be .94 (Tortop, 2015).

Results and Discussion

In this part of the study, the data collected from the "Scientific Creativity Test", "Scientific Epistemological Beliefs Scale", "Problem Solving Inventory for Children", "Scientific Process Skills Test", "Critical Thinking Evaluation Rubric" and "Self-Regulation Skills in Learning Science" tools The findings obtained as a result of statistical calculations in the SEM process are presented.

Descriptive Statistics for Independent Variables

Table 2. Descriptive statistics of participants' EPGBU model variables scores

	N	Min	Max	$\bar{X}$	Ss
Critical Thinking Score	102	.17	3.50	1.5359	.68963
Epistemological Belief Scale	102	2.77	4.88	3.9540	.46991
Problem Solving Scale for Children	102	2.96	5.00	4.2831	.55319
Self-Regulation Skills in Learning Science Scale	102	3.62	5.00	4.6494	.39828
Scientific Process Skills Test	102	.42	.90	.6584	.09655
Scientific Creativity Scale	102	.71	10.86	5.0812	2.10298

As seen in Table 2, the Critical Thinking Skills Mean Scores of the participants regarding the EPGBU Model components $\bar{X}$= 1.53, the Epistemological Beliefs Scale Mean Scores $\bar{X}$= 3.95, the Children's Problem Solving Scale Mean Scores $\bar{X}$ =4.28, the Self-Regulation Skills in Science Learning Scale Mean Scores $\bar{X}$ = 4.64, Scientific Process Skills Test Mean Scores $\bar{X}$=.65, Scientific Creativity Scale Mean Scores $\bar{X}$= 5.08. In this study, the compatibility of the EPGBU Model proposed by Tortop (2013, 2015) with the Structural Equation Model for the training of gifted students as scientists was investigated.

The number of samples in the model is 110, and the observed variables are Self-regulation skills in learning science (SSLS), Scientific process skills (SPS), Epistemological Belief Scale (EBS), Scientific Creativity Test (SCT), Problem Solving Skills Test (PSST). There are 11 variables, 5 observed and 6 non-observed, 6 echogenic and 5 endogenous variables in the model.

Two scales were used to obtain data on the "Thinking Skills" dimension related to the model. One of them is the Problem Solving Skills Test and the other is the Critical Thinking Skills Test. It was decided to exclude the Critical Thinking Skills Test (CTSTs) from these tests, since it is a scale that is scored between 1-4 points in testing the model.

Examining Normal Distributions of Data

First of all, it was checked whether the distribution of the data obtained from the scales used to determine the characteristics of the participants was normal. In Table 2, normality values related to the data obtained from the scales are given.

Table 3. Normality values of variables in the model

Variables	Min	Max	skew	c.r.	kurtosis	c.r.
SSLS	71,000	120,000	-,457	-1,956	-,877	-1,878
SCT	9,000	106,000	,533	2,283	-,102	-,217
CTST	72,000	130,000	,099	,426	-,393	-,842
SPS	13,000	28,000	-,328	-1,405	-,113	-,243
SSLS	22,000	117,000	-2,993	-12,813	15,152	32,438
Multivariate					14,126	8,854

SSLS: Self-regulation Skills in Learning Science **SPS** : Scientific Process Skills **EBS**: Epistemological Belief Scale **SCT**: Scientific Creativity Test **PSST**: Problem Solving Skills Test **CTST**: Critical Thinking Skills Test

When Table 3 is examined, it is seen that the variables are at a sufficient level in terms of normality (normal distribution).

Confirmatory Factor Analysis Results of the Model

For the model, the values of fit indices were investigated and interpreted in CFA (Byrne, 2011). Statistical values for Chi-Square Fit Index (χ2), Comparative Fit Index (CFI), Good Fit Index (GFI), Normized Fit Index (NFI), and Root Mean Errors of Approximate (RMSEA) statistical values were determined in the CFA application (Byrne, 2011). The fact that the χ2/df ratio is 3 or less, the GFI, CFI, NFI values are higher than .90, and the RMSEA significance level is less than .06 indicates that the factor structure of the model is compatible (Hoe, 2008; Kline, 1998).). Researchers stated that GFI, AGFI and CFI values of .90 and above are a good fit (Arbuckle, 2012). RMSEA value of .05 is the critical value and values below are preferred (Hoe, 2008). As a result of the analysis in CFA, the first model is as follows.

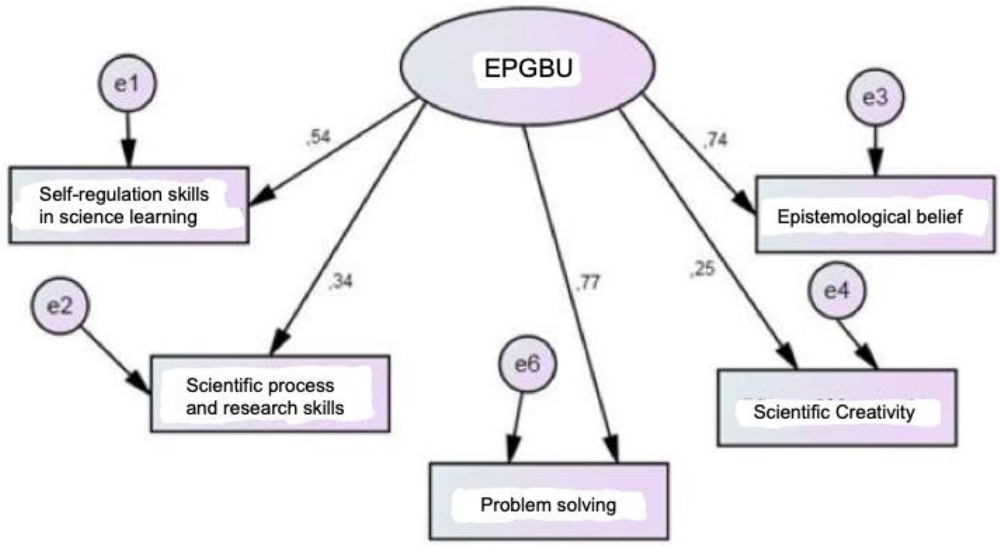

Figure 3. EPGBU Model to Structural Equation Model

χ2=4.328, df=5, p=.000; RMSEA, 0.000; χ2/df=,866; NFI=.951; CFI=.50; GFI=0.983; PCLOSE= .000 was found.

It is seen that the Structural Equation Model and CFA are a compatible model according to the situation stated in the literature (Hoe, 2008; Arbuckle, 2012).

Table 4. Standardized regression loads of variables

			Estimate	S.E.	C.R.	P	Label
SSLS	<---	F1	1,000				
SSLS	<---	F1	,162	,057	2,856	,004	
EBS	<---	F1	1,530	,331	4,626	***	
SCT	<---	F1	,805	,375	2,147	,032	
PSST	<---	F1	1,680	,364	4,610	***	

SSLSs: Self-regulation Skills in Learning Science **SPSs** : Scientific Process Skills **EBSs**: Epistemological Belief Scale **SCTs**: Scientific Creativity Test **PSSTs**: Problem Solving Skills Test

As seen in Table 4, the standardized regression loads of the variables in the model were found to be significant ($p<.05$).

Table 5. Fit Indices for the Model

CMIN Index					
Model	**NPAR**	**CMIN**	**DF**	**P**	**CMIN/DF**
Default model	10	4,328	5	,503	,866
Saturated model	15	,000	0		

RMR, GFI Index				
Model	**RMR**	**GFI**	**AGFI**	**PGFI**
Default model	6,090	,983	,950	,328
Saturated model	,000	1,000		
Independence model	39,800	,727	,590	,484

Comparisons					
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,951	,902	1,008	1,017	1,000
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Criteria			
Model	PRATIO	PNFI	PCFI
Default model	,500	,475	,500
Saturated model	,000	,000	,000

CMIN Index					
Model	NPAR	CMIN	DF	P	CMIN/DF
Independence model		1,000		,000	,000

CP Index			
Model	NCP	LO 90	HI 90
Default model	,000	,000	8,346
Saturated model	,000	,000	,000
Independence model	78,175	51,820	112,000

FMIN Index				
Model	FMIN	F0	LO 90	HI 90
Default model	,040	,000	,000	,077
Saturated model	,000	,000	,000	,000
Independence model	,809	,717	,475	1,028

RMSEA Index				
Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,000	,000	,124	,645

AIC Index

Model	AIC	BCC	BIC	CAIC
Default model	24,328	25,493	51,333	61,333
Saturated model	30,000	31,748	70,507	85,507
Independence model	98,175	98,757	111,677	116,677
ECVI Index				
Model	ECVI	LO 90	HI 90	MECVI
Default model	,223	,229	,306	,234
Saturated model	,275	,275	,275	,291
Independence model	,901	,659	1,211	,906
HOELTER				
Model			HOELTER.05	HOELTER.01
Default model			279	380
Independence model			23	29

As seen in Table 5, the criteria for testing the Model are CMIN Index, RMR Index, GFI Index, Parsimony-Adjusted Criteria, CP Index, FMIN Index, RMSEA Index, AIC Index, ECVI Index, HOELTER. Fit index findings related to testing the model; $\chi 2$=4.328, df=5, p=.000; RMSEA, 0.000; $\chi 2$/df=,866; NFI=.951; CFI=.50; GFI=0.983; PCLOSE= .000 and CMIN, RMSEA, NFI, CFI, GFI index values were examined.

Conclusion and Recommendations

There are models in our country regarding the education of gifted children. Among them, EPGBU is an example of university-based programs. It is very important to test the theoretical foundations of these programs experimentally. It is seen that scientific knowledge is constantly expanding, technological innovations are progressing rapidly, in today's information and technology age, activities in science are seen clearly in our daily lives, and science education is very important in people's planning for the future (MoNET, 2005).

Science is a discipline in which gifted children can develop advanced cognitive learning situations such as problem solving, analytical, self-regulation, productive, questioning and critical thinking. In this context, the science education of gifted individuals should include interesting and interesting subjects, focus on understanding concepts instead of memorizing, make students feel that they have an active researcher structure, and develop scientific thinking skills by trying to make them love science (Van Tassel-Baska, 1994). One of the most important aims of science education is to discover and support students' interests and abilities in the field of science. Science education has a structure that covers the interest and level of gifted students well.

Gifted students are children who learn faster and in different ways than their peers. In this context, the education to be given to gifted children should be spread over a shorter period of time, the content should be more enriched, and the education/training programs should be differentiated and created with a new model. In this respect, it is important to create models for the training of gifted young scientists. In this study, the EPGBU model was experimentally tested with the structural equation model. There are studies on the social validity of this model. The purpose of examining social validity is to determine the sustainability of the education program (Schwartz & Baer, 1991). By examining the social validity of the program, the values of various features of the program are found in the thoughts of the program participants, and the factors that may cause the students to leave the training program are determined. The social validity of the programs created for the education of gifted students is as important as the effectiveness of the programs. The effectiveness of the program improves the academic success of the student and enables the development of inquiring and creative thinking skills. In this direction, it can be thought that the program is in realizing its scientific goals. As a result, even if the programs with social validity below the normal level are effective, their continuity and widespread effects may be lost for a while (Sak, 2011). When EPGBU is examined in terms of student opinions, it can be said that it is a program with high social validity (Tortop, 2014). In the light of the interviews with the teachers, about the EPGBU model; They stated that the students participating in the EPGBU program had characteristics such as exhibiting positive behaviors, spending their time productively, improving their research and observation skills, sharing what they learned, regularity, trying to be more successful (Tortop & Ersoy, 2015). These views show that the model is a model with high social validity.

In this study, in the structural equation model study on EPGBU, the values of fit indices in CFA for the Model were investigated and interpreted (Byrne, 2011). Statistical values for Chi-Square Fit Index ($\chi2$), Comparative Fit Index (CFI), Good Fit Index (GFI), Normized Fit Index (NFI), and Root Mean Errors of Approximate (RMSEA) statistical values were determined in the CFA application (Byrne, 2011). The fact that the $\chi2/df$ ratio is 3 or less, the GFI, CFI, NFI values are higher than .90, and the RMSEA significance level is less than .06 indicates that the factor structure of the model is compatible (Hoe, 2008; Kline, 1998). Researchers stated that GFI, AGFI and CFI values of .90 and above are a good fit (Arbuckle, 2012). RMSEA value of .05 is the critical value and values below are preferred (Hoe, 2008). When the results of the analysis in CFA were also examined, it was seen that the model was a compatible model. The criteria for testing the model are CMIN Index, RMR Index, GFI Index, Parsimony-Adjusted Criteria, CP Index, FMIN Index, RMSEA Index, AIC Index, ECVI Index, HOELTER. Fit index findings related to testing the model; $\chi2$=4.328, df=5, p=.000; RMSEA, 0.000; $\chi2$/df=,866; NFI=.951; CFI=.50; GFI=0.983; PCLOSE= .000 and CMIN, RMSEA, NFI, CFI, GFI index values were examined.

EPGBU model is a model applied by Tortop (2015) for 3 years at Zonguldak Bulent Ecevit University Special Education Application and Research Center. The fact that the structural equation model related to the model is a compatible model has promising results regarding the applicability of the model in other universities or centers. It is stated that there are many problems in our country regarding the education of gifted children. According to Sak (2010, 13), gifted children experience difficulties in this regard during their school years because they cannot receive the education that will fully meet the individual needs of gifted and talented individuals. Gifted children have problems such as unexpectedly low achievement, lack of attention, adaptive problems, and the desire to stay away from school (Clark, 2013; Ozbay, 2013). In order to provide out-of-school education support to gifted students in Turkey, the Ministry of National Education of Turkey opens Science and Art Centers and increases their number. Science and Art Centers are the most popular institutions in the country where gifted students are educated.

It has been established as institutions that can develop the basic abilities and mental capacities of students. However, the fact that these institutions do not have differentiated programs to meet the interests and needs of students hinders their intended functioning. Şahin (2014) states that there is a need for sustainable education programs at a level that can meet the advanced education needs of gifted and talented individuals, an education staff that can effectively transfer these education programs, and a management staff that can evaluate education programs and teachers (Şahin, 2014). There are a limited number of programs on the education of gifted students in Turkey. It is seen that these are short-term programs. In this respect, quantitative and qualitative inadequacies regarding the education of gifted students stand out (Sak, 2009; Sak, 2010). Tortop (2013) states that the field of gifted education has been neglected for many years in Turkey, except for the limited implementations of only a few program types. He also states that there are two university-based educational program models in Turkey. He stated that one of them was EPGBU. In the creation of EPGBU, it was aimed to create a model suitable for Turkey, its infrastructure and culture by taking into account contemporary models related to gifted education. In EPGBU, it is a comprehensive university-based education program consisting of a unique combination of diagnostics, curriculum components, mentor training and student identification criteria. The EPGBU model is a three-stage education program in the form of academic calendars of 10-12 weeks on the basis of primary, secondary and high school (Tortop, 2013; Tortop and Eker, 2014). It is seen that the education programs applied for gifted students in Turkey are insufficient in the academic field and in raising scientists. The EPGBU model is important in terms of eliminating these inadequacies and giving a different perspective to the education of gifted students. It is thought that the EPGBU model will make an important contribution to the deficiency in the field.

When the problems related to science education in Turkey are examined, it is seen that there are deficiencies in terms of practical orientation and mentoring. The content of Tortop (2015) mentoring concept; a guide showing the way to success for the student, a consultant for the decisions they will make during the development process, a model that they follow carefully in the field they want to educate themselves, an expert in a certain field, an educator to provide students with knowledge and skills, a friendly and reliable friend who establishes sincere relations with his student. stated that it is like (Tortop, 2015). According to some studies, students who have mentors are more effective at school, are less absent from classes, are more interested in school, have higher self-confidence, and are more likely to enter university than students who do not have mentors. It is seen that mentoring is one of the most productive methods in the education of students with special abilities. Many positive benefits of mentoring in talent training have also been noted in research (Nash, 2001; Siegle, 2005; Torrance, 1984). Giving mentoring practices online over the internet is expressed as e-mentoring. (Nash, 2001). Single and Muller (2001) stated that mentoring is a natural relationship formed by helping a non-experienced person through electronic communication by an experienced person. EPGBU can be an effective program in talent development as it has an approach that includes mentoring and e-mentoring.

One of the studies on the training of gifted young scientists in Turkey is science high schools and social sciences high schools. However, serious criticisms about these high schools are also included in many studies. It does not provide any other education to students selected for science high schools, except for a few additional math and science courses compared to regular high schools. In addition, while it should provide an education that is individualized or differentiated according to the individual speed, interest and learning style of the student and that allows him to explore his creativity, it has become a single-level education in science and mathematics (Akarsu, 2004). In line with the results of the research, the following suggestions can be made.

Recommendations for Further Research

For this research, it can be suggested to re-evaluate the working status of the model by increasing the sample group of 102 people. In addition, it can be done by determining a wider sample for other regions in terms of socio-economic level in the sample of Turkey. In addition, the working status of the model for primary, secondary and high school student groups can also be tried. In our research, the epistemological beliefs scale was used for the history and philosophy of science dimension. Instead, the scale of the history and philosophy of science can be developed and the model can be tried again. The scale of critical thinking skills used is rubric, and the model can be tested by ensuring that it is suitable for a 4-point rating, but using a 5-point Likert-type scale.

Recommendations for Applicants

Experimental studies can be conducted on whether the EPGBU model is an effective model for the education of gifted young scientists. By creating thematic units related to all dimensions of the model with the integration of EPGBU gains within these thematic units, tests can be made with the effectiveness of the model. Sample applications related to the EPGBU model can be turned into projects under the leadership of the university or the Ministry of National Education of Turkey.

Acknowledgment

The necessary permissions for the application of the scales in this study; It was allowed to be implemented with the decision of Manisa Provincial Directorate of National Education dated April 14, 2023 and numbered 5136218, and all ethical issues were complied with.

References

Akarsu, F. (2004). Üstün yetenekliler. *Üstün Yetenekli Çocuklar Seçilmiş Makaleler Kitabı (Gifted)*. Ed.: Mustafa Ruhi Şirin, Adnan Kulaksızoğlu & Ahmet Emre Bilgili, Çocuk Vakfı Yayınları, (s. 516).

Arbuckle, J.L. (2012). *IBM SPSS Amos 19 User's guide*. http://amosdevelopment.com/download/amos.pdf

Bryne, B.M. (2010). *Structural equation modelling with AMOS: Basic concepts, applications, and programming*, 2nd Ed.: Routledge Taylor, Francis Group.

Buyukozturk, S., Cakmak, E. Kilic, A., Ozcan, E., Karadeniz, S., & Demirel, F. (2011). *Bilimsel araştırma yöntemleri (Scientific research methods)*, Pegem Akademi.

Byrne, B.M. (2011). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Second Edition. Mahwah, LEA.

Clark, K.R. (2013). *Examining the effects of the flipped model of instruction on student engagement and performance in the secondary mathematics classroom: An action research study.* Doctoral Thesis.

Conley, A.M., Pintrich, P.R., Vekiri, I., & Harrison, D. (2004). Changes in epistemological beliefs in elementary science students. *Contemporary Educational Psychology*, *29*, 186–204. https://doi.org/10.1016/j.cedpsych.2004.01.004

Distefano, S., & Hess, B. (2005). Using confirmatory factor analysis for construct validation: An empirical review. *Journal of Psychoeducational Assessment, 23*, 225-241. https://doi.org/10.1177/073428290502300303

Enger, S.K., & Yager, R.E. (1998). *The Iowa assessment handbook*. The Iowa- SS&C Project, Science Education Center, The University of Iowa, Iowa City.

Gokdere, M., & Cepni, S. (2005). Üstün yeteneklilerin Fen öğretmenlerine yönelik hazırlanan bir hizmet içi eğitimin çalışmasının öğrenme ortamına yansımaları. *The Turkish Online Journal of Educational Technology, 4*(4), 204-217.

Hoe, S.L. (2008). Issues and procedures in adopting structural equation modeling technique. *Journal of Applied Quantitative Methods, 3*(1), 76-83. https://jaqm.ro/issues/volume-3,issue-1/pdfs/hoe.pdf

Hooper, D., Coughlan, J., & Mullen, M.R. (2008). Structural equation modelling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*(1), 53-60. https://core.ac.uk/download/pdf/297019805.pdf

Hoyle, R. H. (2000). Confirmatory factor analysis. Edited by Tinsley, H.E.A., Brown S.D. *Handbook of Applied Multivariate Statistics and Mathematical Modelling*. Academic Press, (p. 465 – 497).

Hu, W., & Adey, P.A. (2002). Scientific creativity test for secondary school students. *International Journal of Science Education. 24*(4), 389-404.

Hu, L.T., & Bentler, P.M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Kadayifci, H. (2008). *Yaratıcı düşünmeye dayalı öğretim modelinin öğrencilerin maddelerin ayrılması ile ilgili kavramları anlamalarına ve bilimsel yaratıcılıklarına etkisi (The effect of an instructional model based on creative thinking on students' conceptual understanding of separation of matter subject and their scientific creativity)*. Doctoral dissertation Gazi University, Ankara, Turkiye.

Kline, R. B. (1998). *Principles and practice of structural equation modeling*, The Guildford Press.

Koray, O., Koksal, M.S., Ozdemir, M., & Presley, A.I. (2007). The effect of creative and critical thinking based laboratory applications on academic achievement and science process skills. *Elementary Education Online, 6*(3), 377-389. https://dergipark.org.tr/tr/download/article-file/90994

Kurt, F. (2009). *Investigating students' epistemologcal beliefs through gender, grade level, and fields of study*. Master thesis, Middle East Technical University, Ankara, Turkiye.

Ministry of National Education of Turkiye (MoNET) (2005). *İlköğretim Fen ve Teknoloji dersi öğretim programı (Elementary Science and Technology course curriculum)*. Milli Eğitim Basımevi.

Nash, D. (2001). Enter the mentor. *Parenting for High Potential, 12*, 18-21.

Ozbay, H.E. (2016). *Ortaokul öğrencilerinin akademik başarılarının bilimsel epistemolojik inançlar ve zihinsel risk alma davranışları ile ilişkisinin incelenmesi (Investigation of association among scientific epistemological beliefs, intellectual risk taking and science achievement of middle school students)*. Doctoral Thesis. Inonu University, Malatya, Turkiye.

Ozkok, A. (2005). Disiplinler arası yaklaşıma dayalı yaratıcı problem çözme öğretim programının yaratıcı problem çözme becerisine etkisi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28*, 159-167.

Sak, U. (2009). *Üstün yetenekliler eğitim programları*. Maya Akademi Yayınevi.

Sak, U. (2010). *Üstün zekâlılar özellikleri tanılanmaları eğitimleri*. Maya Akademi Yayınevi.

Sak, U. (2011). Üstün Yetenekliler Eğitim Programları Modeli (ÜYEP) ve sosyal geçerliği. *Eğitim ve Bilim, 36*(161), 213-229. http://egitimvebilim.ted.org.tr/index.php/EB/article/view/893

Schreglmann, S. (2016). *Konu temelli eleştirel düşünme öğretimi özelliğine sahip eğitsel arayüz ile desteklenmiş eğitim yazılımının akademik başarı, düşünme eğilimi ve düzeyine olan etkisi (The effect of instructional software packages that was supported by educational interface with subject based critical thinking teaching feature on the critical thinking skill and the academic achievement in the science course)*. Master Thesis. Cukurova University. Adana, Turkiye.

Schumacker, R.E., & Lomax, R.G. (2010). *A beginner's guide to structural equation modeling*. Taylor and Francis Group.

Schwartz, L.S., & Baer, D.M. (1991). Social validity assessments: Is current practice state of the art?, *Journal of Applied behavior Analysis, 24*(2), 189-204.

Serin, O. Serin, N.B., & Saygili, G. (2010). İlköğretim düzeyindeki çocuklar için problem çözme envanterinin geliştirilmesi. *İlköğretim Online, 9*(2), 446-458

Siegle, D. *Developing for mentorhip programs for gifted students*. TX. Prufrock Press, Inc.

Single, P.B., & Muller, C.B. (2001). When email and mentoring unite: the implementation of a nationwide electronic mentoring program. Ed.: Linda Kyle Stromei, *Creating mentoring and coaching programs (Alexandria, VA, American Society for Training and Development)*, p. 107-122.

Sahin, F. (2014). Yaratıcılık–zekâ ilişkisi: Yeni deliller, *İlköğretim Online, 13*(4), 1516- 1530. https://www.researchgate.net/publication/280927332_Yaraticilik_-_Zeka_Iliskisi_Yeni_Deliller

Tabachnick, B.G., & Fidell, L.S. (1989). *Using multivariate statistics*, Harper Collins Publischer.

Torrance, E.P. (1984). *Mentor relationship: How they aid creative achievement, endure, change and die*. Bearly Limited.

Tortop, H.S., & Eker, C. (2014). Üstün yetenekliler eğitim programlarında öz düzenlemeli öğrenme neden yer almalıdır?, *Journal of Gifted Education Research, 2*(1), 23-41. https://www.academia.edu/31830398/%C3%9Cst%C3%BCn_Yetenekliler_E%C4%9Fitim_Programlar%C4%B1nda_%C3%96z_d%C3%BCzenlemeli_%C3%96%C4%9Frenme_Neden_Yer_Almal%C4%B1d%C4%B1r

Tortop, H.S., & Ersoy, B. (2015). Üstün Yetenekliler Üniversite Köprüsü Eğitim Programı'na (ÜYÜKEP) katılan üstün yetenekli öğrencilerin sınıf öğretmenlerinin ÜYÜKEP hakkındaki görüşleri. *Üstün Zekalılar Eğitimi ve Yaratıcılık Dergisi, 2*(1), 17-24. https://dergipark.org.tr/tr/pub/jgedc/issue/38679/449352

Tortop, H.S. (2013). A New model program for academically gifted students in Turkey: Overview of the education program for the gifted students' bridge with university (EPGBU). *Journal for the Education of the Young Scientist and Giftedness, 1*(2), 21-31.

Tortop, H.S. (2014). Gifted students views about first stage of Education Program For Gifted Student's Bridge with University (EPGBU). *Turkish Online Journal of Distance Education TOJDE, 15*(2), 62-74.

Tortop, H. S. (2015). *Üstün zekâlılar eğitiminde farklılaştırılmış öğretim müfredat farklılaştırma modelleri*. Genç Bilge.

Van Tassel-Baska, J. (1994). Science curriculum for the gifted. Ed.: Van Tassel- Baska, *Comprehensive curriculum for gifted learners*, Needham Heights, Allyn and Bacon, p. 231-261.