A Structural Equation Modelling of Factors Affecting the Prospective Teachers' Innovativeness Level

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Abstract

This study aims at investigating the factors affectıng the prospectıve teachers 'ınnovatıveness level by structural equatıon modelıng. For this purpose, the predictive relationships between gender, grade level, department, and risk-taking behaviors, and pre-service teachers' innovativeness levels were analyzed by path analysis. The correlational predictive design was used to investigate the relationship between variables in the study. The participants of the study consisted of 293 science, social studies, and prospective elementary teachers. The Innovativeness Scale and the Academic Risk Taking Scale (ART) were used to collect the data. The results of the study suggest that grade level is not a statistical predictor of both risk taking and innovativeness. However, gender has a significantly small effect on Academic Risk Taking. Furthermore, it was concluded that risk-taking behavior is an important predictor of the pre-service teachers' level of innovativeness. So it can be suggested that prospective teachers should be planned to increase their risk-taking behaviors during the teaching process.

Keywords: Innovativeness, Risk-taking, Prospective teachers, Structural equation modeling, path analysis

Introduction

With the paradigm shifts in education in the 21st century, the skills expected from students changed. In the 21st century, students are expected to have higher-order thinking skills such as critical thinking, entrepreneurship, creativity, risk-taking, and reasoning. One of these skills, risk-taking behavior, which is one of the basic characteristics of innovative individuals (Jaeger et al., 2010) plays an important role in the progress, development, and pioneering of societies despite it having positive and negative consequences. In this respect, individuals should be taught the basic rules and principles related to risk-taking. Innovative individuals can contribute to the development of their community by taking risks. In the 21st century world, which is called the age of technology and where a generation called Z-generation grows, an innovative product emerges at any moment. Therefore, it is important to have innovative behavioral features and risk-taking in the process of accepting and spreading these products.

Innovation is one of the features that the modern labor market seeks for its employees due to its characteristics mentioned (Mykhailyshyn, Kondur & Serman, 2018). In this respect, institutions providing high-level education such as universities, have important roles in developing innovative behavioral characteristics of students. Especially, education faculties where teachers are trained who are responsible for the training of future generations should be organized their curriculum within this framework. However, Shantz (1995) stated that many education faculties design educational programs from an innovative point of view, but they also use traditional methods in practice. For this reason, researching the factors affecting the innovativeness of prospective teachers seems to be important to eliminate this difference between theory and practice. Therefore, this study aimed to examine the predictive relationships between gender, grade level, department and risk-taking behaviors, and prospective teachers' innovation levels with structural equation modeling. For this purpose, the following theoretical model was created.

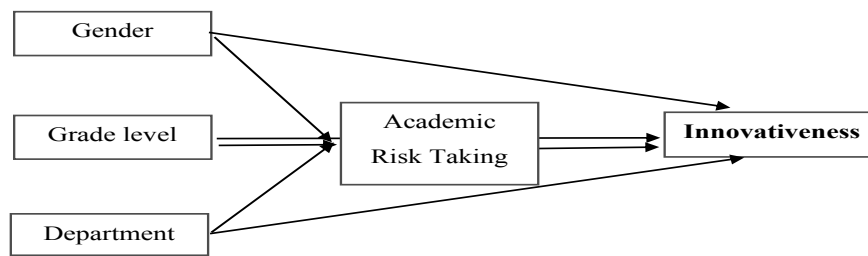[**] Corresponding Author: *Esra Açıkgül Fırat, eacikgul@adiyaman.edu.tr*

Figure 1. The theoretical model of the study

Theoretical Framework

Innovation

Societies have consistently produced new things in line with their needs and curiosities from past to present. These productions are sometimes produced to meet daily needs, such as clothes, food, and technological devices, and sometimes emerge to develop the mental world of people, such as a thought, knowledge, phenomenon, approach, or theory. Whatever the reason, individuals have always been in search of innovation. Buijs (2007) defined innovation as changing the old from a different perspective or doing something that has not been tried before. Innovation is seen as the key to -being, being ahead of others, and developing individual development, both institutional and social (Kılıçer, 2011). In this respect, innovations lead to better quality services in areas such as education, work, health, or transportation in human life and thus improve the quality of life of individuals (Kemer & Altuntaş, 2017). However, innovations bring about a rapid change in society. While some of individuals in society adapt to this change rapidly, others either fall back to adapt to these innovations or resist not adapting. In the face of innovations and rapidly increasing knowledge in the 21st century world, individuals are expected to accept these innovations without showing resistance and have an innovative identity. Therefore, these innovations that emerged in all areas of society have also affected the characteristics of individuals. The most important of these features is the concept of "innovativeness", which is defined as "adapting to a new situation before others" (Rogers, 2003).

Individuals are expected to accept the changes in the 21st-century world without resistance and to have an innovative identity. Because the aim of innovation is not to destroy the old but to find a solution to an unresolved problem or to make more quality and use an existing situation or service (Konukman, Yokuş & Yanpar Yelken, 2016). Innovation refers to behavioral change rather than cognitive or attitude change (Burns & Krampf, 1992). Kavas (2017) stated that innovative individuals should have the characteristics of recognizing, supporting, and creating an innovative environment. When the literature is examined, some of the features of innovative individuals have been determined. Risk-taking, research and innovation, need for originality, and cosmopolitanism are among these features (Roberts, 2015). Besides, some of the important features of innovative individuals are enjoying new experiences and trying new products (Rogers, 2003). Innovative people are more tolerant of risk-taking against new things, accept innovation, and are open to new experiences. According to Rogers (2003), innovation is generally distributed in a society and people are divided into 5 categories at this point. These categories are defined as follows:

- *Innovators*: Individuals take risks and want to try new ideas. They also have different visions than others.
- *Early Adopters*: They are technology-oriented people who keep other people informed about innovations.
- *Early majority*: They are ready for innovations, but they do not want to take risks.
- *Late majority*: They suspect innovations.
- *Laggards*: They bias the innovations and eventually accept the innovations.

Innovation and Risk-Taking

Theoretically, it is never accepted if an innovation does not fit its target audience. However, if an innovation has a reward value by the social system, it often reveals people who are willing to give up traditional behavior and attempt some change. As Rogers (2003) stated, this increases the tendency of individuals to try new ideas for innovation and take risks. In this regard, innovative individuals are expected to engage in risk behaviors. Hurt, Joseph, and Cook (1977) stated that risk-taking has an important effect on the conceptualization of innovation. In

this respect, risk-taking behavior is very important in forming an innovative society. So risks and risk-taking behaviors are basic components of innovation change (Jaeger et al., 2010).

There are several definitions of risk or risk-taking behavior in the current literature. Risk is defined as how the personerson evaluates the probability of facing a negative result evaluates the probability of facing a negative result (Horvath & Zuckerman, 1993). According to Le Fevre (2014), risk-taking is a behavior that can change in any situation, and risk-taking offers uncertainty about the future. Therefore, risk-taking is often seen as a sensational personality trait or a personal trend for new, diverse, complex, and intensive experiences (Horvath & Zuckerman, 1993). When the definitions are examined, it can be said that risk-taking behavior constitutes a perception that it contains negative results. However, risk-takings should not be associated with only negative consequences. Risk-taking should be perceived as an accepted failure and as an action likely to succeed (Badger, 2009). Le Fevre (2014) stated that risk-taking is a natural aspect of changes in education. He also stated that risk-taking in educational reform processes should be among the important factors to consider.

Individuals take risks, consciously, or unconsciously, in the decision-making process in their daily lives. Risks can sometimes make people happy, sometimes irritated, or busy (Sharma, 2015). Because every risk has positive and negative results in itself, but it can also lead to very important successes. Therefore, individuals need to know the importance of taking risks (Sharma, 2015). However, each risk contains uncertainty, as the risk-taking situations have no definitive consequences. As the perception of harm increases, their risk rate will increase (Le Fevre, 2014). In this case, individuals may have a fear of failure. This fear is one of the most important factors that prevent individuals' risk-taking behavior. In addition to the fear of failure, what people think, others' disapproval, and fear of uncertainty play an important role in the behavior of risk-takers (Pierre, 2015).

Academic Risk-Taking

One of the basic objectives of education is to train individuals who have meta-cognition skills can keep up with digital transformation and make fast decisions using these skills. Therefore, it is aimed to teach students new information, skills, values, and concepts requiring the use of higher-order thinking skills. Every new information contains uncertainty for students (Robinson, 2011). Uncertainty and confusion require taking risks due to unknown output (Badger, 2009). That is because asking questions, sharing ideas, or making new suggestions in learning environments, especially when learning new knowledge, skill, or concept, is risky behavior for students (Beghetto, 2009). It can be defined as academic risk-taking that students take risks and display these behaviors in learning environments. Beghetto (2009) expresses academic risk-taking behavior as being willing to share ideas that are not sure of accuracy, ask questions, and try new and alternative solutions. House (2002) stated that academic risk-taking includes the chance to answer a question correctly that the student does not know the exact answer. Taylor (2010) stated academic risk-taking as a decision-making process that positively affects learning, even though it is uncertainty for the student. Clifford (1988), which is theoretically based on this study, defined academic risk-taking behavior as the options or opportunities students use while making academic choices. In another study, Clifford (1991) discussed risk- taking under four dimensions: Behaviors reflecting the tendency to have negative emotions after failure (NEAF), behaviors reflecting the tendency to prefer difficult tasks (DT), behaviors reflecting the tendency to recover after failure (RAF), and behaviors reflecting the tendency to do homework.

Academic risk-taking involves evaluating the results of a learning activity's known and unknown and making choices about their participation based on the possible benefits and outcomes of participation (Robinson, 2011; Robinson & Bell, 2012). These choices can sometimes lead students to success while sometimes causing failure. However, risk and success are two closely related concepts, and the success of a society is directly related to the willingness of its members to participate in risk-taking practices (Badger, 2009). Therefore, teaching students with the ability to take an academic risk can contribute positively to the development of their risk-taking behavior in daily life. Also, academic risk-taking is critical to improving academic performance. House (2002) stated that students who hesitate to take an academic risk prevent their future chances of success. Attempts to increase academic risk-taking tendencies of students can significantly improve the quality of learning (House, 2002). Therefore, students should be encouraged about academic risk-taking behavior. Korkmaz (2002) stated that academic risk-taking behavior in 'the learning environment shows the students' courage, willingness, or reluctance about their problems. Clifford (1991) stated that students who are more willing to take an academic risk have a higher chance of success than unwilling students. For this reason, it is necessary to determine which variables affect academic risk-taking behavior first and thus these variables should be guided successfully in increasing students' academic risk-taking behavior (Taylor, 2010).

Academic Risk-Taking Behavior of Teachers

Academic risk-taking positively affects students' achievement and entrepreneurship skills both in school life and in their daily lives. In this respect, it is important to teach students about this behavior. Therefore, learning environments should be designed to improve risk-taking behavior. However, in a study between schools, McNeil (1986) stated that schools were traditionally stifling in general and they resisted risk-taking and change. So it requires risk for administrators and teachers in ensuring this change (Ponticell, 2003).

Risk-taking for teachers means going beyond traditional teaching styles (Ponticell, 2003). Risk-taking requires teachers to try new ideas and approaches. However, the fact that administrators do not support teachers in this regard and do not involve them in the decision-making process about organizing educational environments negatively affects teachers' risk-taking behavior (Olorunsola & Olayemi, 2011). Teachers' feeling of underutilization of new technologies is one of the important factors that negatively affect their risk-taking. Risk-taking behavior contributes to the development of creativity, innovation, critical thinking skills, and most importantly, it offers opportunities for positive learning experiences (Pierre, 2015). In this respect, it is thought that there is a positive relationship between academic risk-taking behavior and innovativeness. Because individuals who can take risks are adapt to innovation more quickly. To gain these required behaviors to teachers, the academic risk-taking behaviors of prospective teachers should be improved in the pre-service period because prospective teachers who will be future teachers are also expected to have these features.

Importance of the Study

Köksal & Köseoğlu (2019) stated that prospective teachers' effective use of technology in their teaching processes will support their intellectual risk-taking behaviors. Research has revealed that prospective teachers' risk-taking levels are related to their study skills, fear of negative criticism, active participation in lessons, knowledge creation, and the development of moral imagination (Brown, Parsons & Worley, 2005). Therefore, learning environments should be designed to support prospective teachers' teachers' risk-taking behavior. Another study also found that academic risk taking was associated with innovation behavior (Kontoghiorghes, Awbrey & Feurig, 2005). However, a predictive relationship between academic risk-taking and innovation was not specified in this study. Therefore, determining the variables predicting innovativeness and academic risk with this study is seen as important for prospective teachers to develop their innovation skills.

House (2002) stated that gender affects academic achievement and emphasized that the relationship between academic achievement and academic risk taking is important. Based on this result, determining the relationship between gender and academic risk taking may reduce academic achievement between genders. Furthermore, there are studies in the literature investigating the relationship between gender and class level, and risk-taking or innovativeness (Akdağ et al.; Beghetto, 2009; Byrnes, Miller & Schaffer, 1999; Clifford, Lan, Chou & Qi, 1989; Çuhadar, Bülbül & Ilgaz, 2013; Koloba & May, 2014, Spence, Yore & Williams, 1999; Aydın & Ubuz, 2010). The studies reviewed generally focused on the relationship between the two variables. However, in this study, unlike other studies, all the variables determined by structural equation modeling were included in the model and the causal relationships between the variables were examined holistically. So, it is thought that this aspect will contribute to the literature.

Purpose of the Study

This study aims to determine the relationship between prospective teachers' academic risk-taking, innovativeness, grade level, department, gender.
Accordingly, the hypotheses of the study are stated below.
- Hypothesis 1: ART is a statistically significant predictor of Innovativeness.
- Hypothesis 2: Grade level is a statistically significant predictor of ART.
- Hypothesis 3: Gender is a statistically significant predictor of ART.
- Hypothesis 4: Department is a statistically significant predictor of ART.
- Hypothesis 5: Grade level is a statistically significant predictor of Innovativeness.
- Hypothesis 6: Gender is a statistically significant predictor of Innovativeness.
- Hypothesis 7: Department is a statistically significant predictor of Innovativeness.

Method

The study used quantitative research methods to determine the relationship between prospective teachers' academic risk-taking, innovativeness, and demographic variables. The correlational predictive design was used to investigate the relationship between variables. If there is a sufficiently large relationship between two variables, it is possible to estimate the score on one variable if a score in the other variable is known (Fraenkel, Wallen &

Hyun, 2012). In the study, the relationship between variables was determined using path analysis, a form of structural equation modeling (Fraenkel et al., 2012). While the endogenous variable of the study is innovativeness, exogenous variables of the model are gender, grade level, department, and ART.

Participants

The study participants consisted of 293 science, social studies, and prospective elementary teachers, determining with a purposive sampling method, studying at a public university in the South East of Turkey during the 2019–2020 school year. Teacher training programs are required to know different disciplines in Turkey. These content knowledges are related to science and social sciences. In this respect, prospective teachers with different content knowledge were included in the study. Therefore, purposeful sampling was used as the sampling method in the study (Fraenkel et al., 2012). The distribution of the participants by gender, department, and grade level are given in Table 1.

Table 1. The distribution of the participants

		N	%
Grade level	1. grade	61	20,8
	2. grade	49	16,7
	3. grade	105	35,9
	4. grade	78	26,6
	Total	293	100
Department	Science	69	23,5
	Social Studies	132	45,1
	Elementary	92	31,4
	Total	293	100
Gender	Female	206	70,3
	Male	87	29,7
	Total	293	100

Data collection tools

In this study, prospective teachers' academic risk-taking was determined using the Academic Risk-Taking Scale developed by Clifford (1991) and translated into Turkish by Korkmaz (2002); individual innovation behavior was determined using the Innovativeness Scale developed by Hurt et al. (1997) and translated into Turkish by Kılıçer and Odabaşı (2010).The Innovativeness Scale consists of 20 items. 12 of the scale items were positive (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18 and 19), 8 of them were negative items (4, 6, 7, 10, 13, 15, 17 and 20). The Cronbach alpha reliability coefficient of the scale was 0.82 and test-retest reliability was 0.87. According to the results of this research, the Cronbach alpha reliability coefficient is 0.82 and the Guttman Split-half reliability coefficient is 0.82. The Scale of Academic Risk-taking is composed of 4 factors (behaviors reflecting the tendency to have negative emotions after failure (NEAF), behaviors reflecting the tendency to prefer difficult tasks (DT), behaviors that reflect the tendency to recover after failure (RAF). These behaviors reflect the tendency to do homework) and 36 items. The Cronbach alpha reliability coefficient of the scale was 0.89, NEAF was 0.77, DT was 0.73, RAF was 0.78, and Homework was 0.45. According to the results of this research, the Cronbach alpha reliability coefficient is 0.73 and the Guttman Split-half reliability coefficient is 0.73.

Data Analysis

Before the analysis phase, all items were converted to standard z-scores and z-scores less than 3.0 or higher than + 3.0 were considered as outliers (Çokluk, Şekercioğlu & Büyüköztürk, 2010). Means and standard deviation values were calculated, the Kolmogorov-Smirnov test was performed, skewness and kurtosis values were calculated, and histogram / Q-Q plots were examined to determine the suitability of the data for normal distribution. As a result of the analysis, it was decided that the data showed normal distribution in terms of gender, department, and grade level variables, and therefore two-way ANOVA was applied from parametric tests. In the research, the level of significance was determined as 0.05. The multivariate kurtosis coefficient calculated to determine whether the data provided the assumption of multivariate normality was 2.47 for using the path analysis. Bentler (2006) stated that multivariate kurtosis coefficient values of less than 5 data provide multivariate normality.

Correlation coefficients between variables were calculated and a path diagram was drawn. Prior to the path analysis, the one-dimensional usability of the scale was tested by a second-order confirmatory factor analysis to include the one-dimensional variable innovativeness in the path analysis.Then, the hypothesized model was tested with path analysis as a structural equation modeling (SEM). The system of variables can be statistically tested by concurrent analysis to determine how consistent the hypothesized model is with the data in SEM (Byrne, 2016). Since the data corresponds to the multivariate normal distribution, the model was tested using the Maximum Likelihood method (Kline, 2010). The fit indices (χ2/df, GFI, AGFI, RFI, NFI, NNFI, IFI, CFI, RMSEA, RMR, and SRMR) were calculated in the evaluation of model fit and model fit indexes were evaluated in terms of criteria (Çokluk et al., 2010; Hu & Bentler, 1999; Kline, 2010; Schermelleh-Engel, Moosbrugger & Müller, 2003; Tabachnick & Fidell, 2012). R^2 effect-size values were calculated to determine the practical significance of the results. When evaluating effect sizes, R^2: 0.0196 small effects, R^2 =0.193 moderate effect, R^2 =0.2600 was evaluated as a large effect (Cohen, 1988).

Findings

Confirmatory Factor Analysis Results of Innovation Scale

A second-order confirmatory factor analysis tested the one-dimensional usability of the scale to incorporate the one-dimensional innovativeness scale in the path analysis. The fit indices for the innovativeness scale were calculated by drawing a path diagram. The path diagram is in Figure 2.
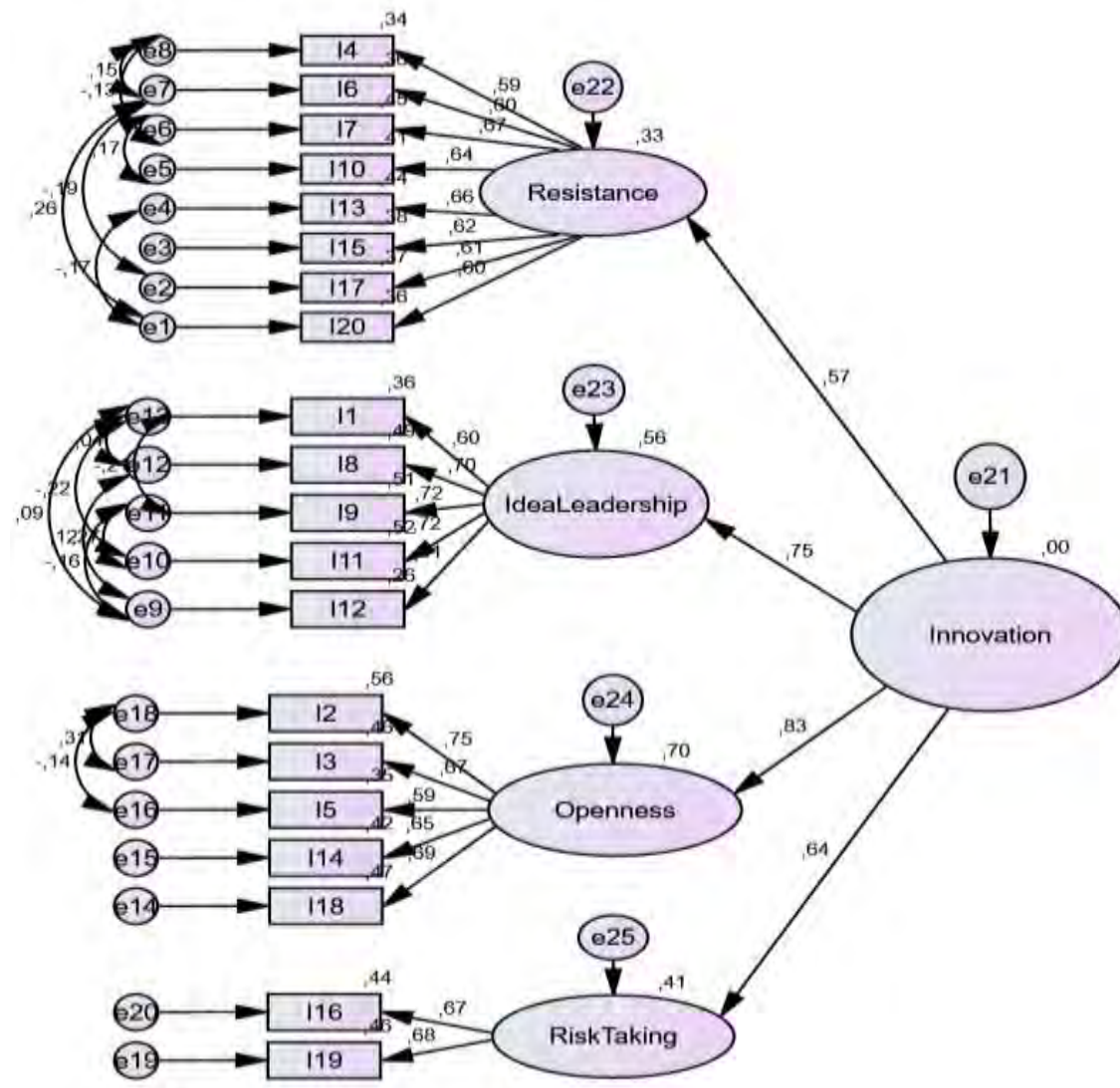
Figure 2. Path diagram of the innovativeness scale

According to the results, the value of $\chi 2$ / df value is 1.67. The standardized factor loadings of the scale ranged from 0.51 to 0.84. It is estimated that the openness factor explains 70 percent of innovation variance the most. Other factors explain idea leadership (56%), risk-taking (41%), and resistance (33%) of the innovation variance, respectively. The fit indices are represented in Table 2.

Table 2. Fit indices of the innovativeness scale

	Good Fit Values	Acceptable Fit Values	Model
$\chi2$/df	$0 \leq x^2/df \leq 2$	$2 \leq x^2/df \leq 3$	1.67
RMSEA	$0 \leq RMSEA \leq .05$	$.05 \leq RMSEA \leq .08$	0.048
NFI	$.95 \leq NFI \leq 1$	$.90 \leq NFI \leq .95$	0.85
IFI	$.95 \leq IFI \leq 1$	$.90 \leq IFI \leq .95$	0.94
CFI	$.97 \leq CFI \leq 1$	$.95 \leq CFI \leq .97$	0.94
GFI	$.95 \leq GFI \leq 1$	$.90 \leq GFI \leq .95$	0.91
AGFI	$.90 \leq AGFI \leq 1$	$.85 \leq AGFI \leq .90$	0.89

When the fit index values were examined, it was determined that the one-dimensional structure of the innovation scale was confirmed by second-order CFA (Schermelleh-Engel et al., 2003).

Descriptive Analysis Results

Descriptive analysis was performed before path analysis to check the distribution of variables and normality. The descriptive analysis of the variables is represented in Table 3.

Table 3. Descriptive analysis of the variables

		N	%	$\bar{x}$ (Innovativeness)	$\bar{x}$ (ART)
Gender	Female	206	70.3	3.68	3.39
	Male	87	29.7	3.63	3.28
Grade level	1. grade	61	20.8	3.66	3.36
	2. grade	49	16.7	3.65	3.30
	3. grade	105	35.8	3.61	3.32
	4. grade	78	26.6	3.74	3.44
Department	Science Education	69	23.5	3.62	3.35
	Social Studies	132	45.1	3.67	3.34
	Primary Education	92	31.4	3.64	3.40

	Innovativeness	NEAF	DT	RAF	Homework	ART
N	293	293	293	293	293	293
Mean	3.67	3.09	3.27	3.78	3.24	3.36
Std. Deviation	.46	.66	.61	.58	.76	.43
Skewness	.005	-.132	-.031	-.507	-.284	-.129
Kurtosis	.387	-.284	.073	.143	.141	.244

According to the descriptive analysis, the mean test score for innovativeness is 3.67 and the mean score on the ART scale was 3.36. Furthermore, mean scores of innovativeness for 1st, 2th, 3th, and 4th grades were 3.66, 3.65, 3.61, and 3.74, respectively. When the data were analyzed in terms of gender, the mean score of boys was higher than girls.

Findings for Testing the Hypothesized Model

Correlation coefficients of all variables were calculated after preliminary analyzes. Point Biserial correlation values were calculated by controlling their assumptions since gender, grade level and department variables are categorical variables. The correlation between continuous variables was calculated using the Pearson correlation coefficient (Table 4).

Table 4. correlation coefficients between observed variables

		Innovativeness	NEAF	DT	RAF	Homework
Gender	r	-,059	,076	-,173**	-,149*	-,193**
Gradelevel	r	,049	,035	-,002	,124*	,011
Department	r	,050	,032	-,036	,042	,190**
Innovativeness	r	1	,179**	,422**	,553**	,269**

When the table is examined since there is no significant relationship between the independent variables and the Innovativeness variable, hypotheses 5, 6 and 7 were rejected and these paths were deleted. In addition, since it was determined that there was no significant relationship between grade level and NEAF, DT and homework sub-dimensions, it was not included in the model. Thus, the model was updated and the hypothesized model was created.

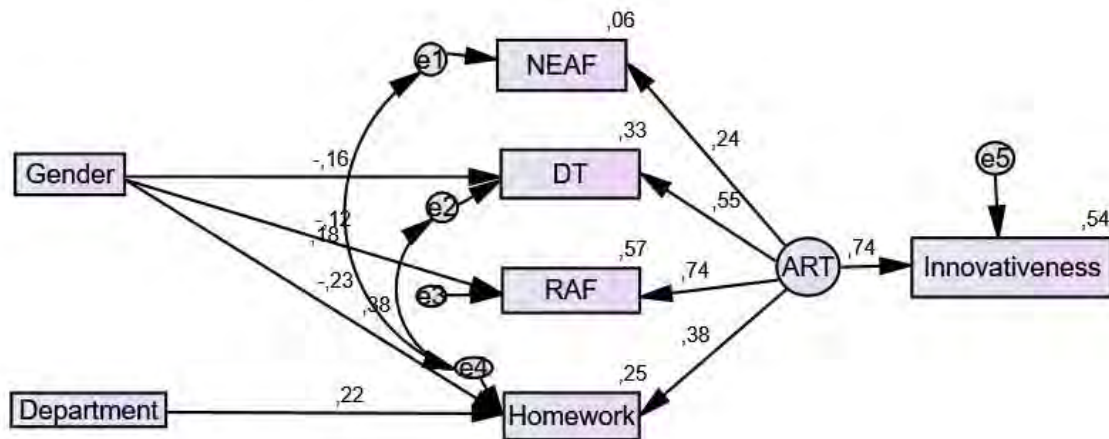The hypothesized model is also presented in Figure 3.

Figure 3. The hypothesized model

The values obtained from testing the hypothesized model are presented in Table 5.

Table 5. Reliability coefficients of the variables and standardized factor loadings of the items

			B	β	S.E.	C.R. (t)	P
Innovativeness	<---	ART	2.135	.736	.611	3.497	***
Homework	<---	ART	1.823	.375	.533	3.422	***
RAF	<---	ART	2.700	.736	.772	3.496	***
DT	<---	ART	2.151	.556	.631	3.407	***
NEAF	<---	ART	1.000	.241			
Homework	<---	Gender	-.379	.230	.087	-4.382	***
RAF	<---	Grade level	.054	.102	.025	2.191	.028
DT	<---	Gender	-.204	-.155	.069	-2.961	.003
Homework	<---	Department	.228	.219	.049	4.658	***
RAF	<---	Gender	-.162	-.130	.060	-2.717	.007

***The probability of getting a critical ratio as large as 3,497 in absolute value is less than 0,001.

The paths that are not statistically significant are deleted one by one to give the final version of the model. The final model was tested and it was concluded that all the paths were significant, as shown in Table 6. The modified path diagram of the model is given in Figure 4.
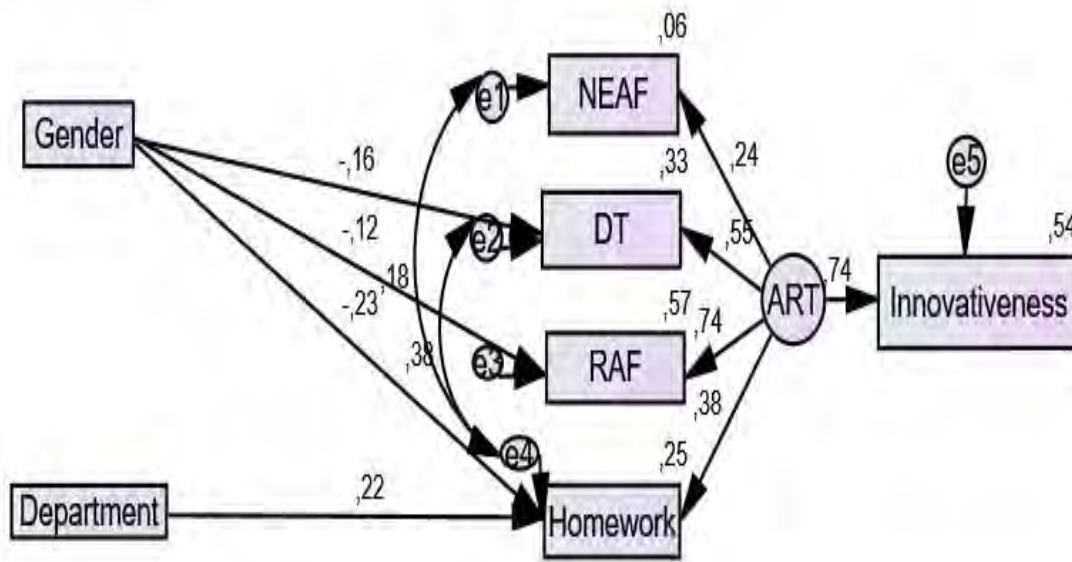
Figure 4. The final model

The standardized regression coefficients and the significance of the regression coefficients are given in Table 6.

Table 6. Reliability coefficients of the variables and standardized factor loadings of the items

			B	β	S.E.	C.R. (t)	P
Innovativeness	<---	ART	2.126	,735	.606	3.511	***
Homework	<---	ART	1.842	,380	.535	3.443	***
RAF	<---	ART	2.718	,742	.774	3.509	***
DT	<---	ART	2.134	,554	.624	3.418	***
NEAF	<---	ART	1.000	,242			
Homework	<---	Department	.229	,220	.048	4.761	***
Homework	<---	Gender	-.379	-,230	.085	-4.451	***
DT	<---	Gender	-.204	-,156	.069	-2.960	.003
RAF	<---	Gender	-.155	-,124	.060	-2.578	.010

***The probability of getting a critical ratio as large as 3,497 in absolute value is less than 0,001.

The results of the analysis showed that ART seems to be positively associated with innovativeness (β=0.74, c.r.=11.339573, p <.01). It is estimated that the predictors of innovativeness explain 54 percent of its variance.. In other words, the error variance of innovativeness is about 46 percent of the variance of innovativeness itself. Therefore, a large effect is observed (Cohen, 1988). When the sub-dimensions of ART were examined, it was found that RAF ($R^2 = 0.58$) predicted ART the most. Other predictive sub-dimensions are DT (%32), Homework (%18), and NEAF (% 0.5), respectively. According to the findings, none of the indirect effects are statistically significant. The fit indices of the final model values are given in Table 7.

Table 7. Fit indices of the final model

	Good Model Fit	Acceptable Fit Values	Model
χ2/df	$0 \leq x^2/df \leq 2$	$2 \leq x^2/df \leq 3$	1.75
p			0.06
RMSEA	$0 \leq RMSEA \leq .05$	$.05 \leq RMSEA \leq .08$	0.05
RFI	$.95 \leq RFI \leq 1$	$.90 \leq RFI \leq .95$	.90
NFI	$.95 \leq NFI \leq 1$	$.90 \leq NFI \leq .95$	.95
NNFI/TLI	$.97 \leq NNFI \leq 1$	$.95 \leq NNFI \leq .97$	.95
IFI	$.95 \leq IFI \leq 1$	$.90 \leq IFI \leq .95$	.98
CFI	$.97 \leq CFI \leq 1$	$.95 \leq CFI \leq .97$	.98
GFI	$.95 \leq GFI \leq 1$	$.90 \leq GFI \leq .95$	.98
AGFI	$.90 \leq AGFI \leq 1$	$.85 \leq AGFI \leq .90$	.95

When the fit indices were examined, the model was accepted as the values were within the range of "good fit values" (Çokluk et al., 2010; Hu & Bentler, 1999; Kline, 2010; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2012). The standardized total effects are given in Table 7.

Table 8. Standardized total effects

	Gender	Department	ART
NEAF	.000	.000	.242
DT	-.156	.000	.554
RAF	-.124	.000	.742
Homework	-.230	.220	.380
Innovativeness	.000	.000	.735

According to Table 8, ART's standardized total (direct and indirect) effect on Innovativeness is 0.74. That is. due to ART's direct (unmediated) and indirect (mediated) effects on Innovativeness, when ART goes up by 1 standard deviation, Innovativeness goes up by 0.74 standard deviations. Furthermore, ART's standardized total (direct and indirect) effect on RAF is 0.74. Due to both direct (unmediated) and indirect (mediated) effects of ART on RAF, when ART goes up by 1 standard deviation, RAF goes up by 0.74 standard deviations.

Discussion and Conclusion

This study is predictive research designed to examine the relationship of prospective teachers' academic risk-taking and innovativeness, and demographic variables. The endogenous variable of the study is innovativeness, and exogenous variables are gender, grade level, department, and ART. The hypothesized model in the research was tested by drawing a path diagram with structural equation modeling. The innovativeness variable was included in the hypothesized model as an observed variable. Therefore, to control the computability of the mean total score of the innovativeness scale, a second-order CFA was used for the one-dimensional structure of the scale. According to the fit indices obtained from the second-order CFA results, the four-dimensional model was found in the "Good Fit Values" ranges and the model was verified (Çokluk et al., 2010; Hu & Bentler, 1999; Kline, 2010; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2012).

Furthermore, the model was created by drawing paths between the variables with statistically significant relationships by calculating the relationships between the variables. After the hypothesized model was tested, paths drawn from grade level were deleted because this path was not significant and the final model was created. Therefore, according to the results of this study, it is concluded that grade level is not a statistical predictor of risk-taking. When the literature is analyzed, it has been determined that, unlike this study, grade level variable affect ART (Açıkgül & Şahin, 2019; Aydın & Ubuz, 2010; Beghetto, 2009; Byrnes, Miller & Schaffer, 1999). Beghetto (2009) stated that students' intellectual risk-taking skills decreased as their grades increased. The results are different from this study may be due to the sample of this study being in different age categories. Because when the studies in the literature are examined, it is determined that the studies are generally carried out at the secondary and high school levels, and ART decreases as the grade level increases in these samples (Akdağ, Köksal & Ertekin, 2017; Beghetto, 2009; Beghetto & Baxter, 2012; Daşçı & Yaman, 2014; Hasan, Sobnom & Uzzaman, 2019). Beghetto (2009) stated that the reasons for the decrease in intellectual risk-taking as the age of the students increases and external pressures such as obtaining a good degree, the expectation for high exam results and the completeness of learning. Daşçı and Yaman (2014), on the other hand, stated that a small child cannot learn without risk, experience success and failure, and the development in this process requires problem-solving, inventing new products, and discovering new events. Therefore, in this study, the lack of difference in grade grade-level among prospective teachers can be explained as the decrease in exam stress and pressure, and learning pressures in this age group and the factors affecting risk-taking between grade levels disappeared. Yapıcı (2016) also reached similar findings from his study.

According to the research results, gender has a significantly small effect on ART. Çuhadar, Bülbül and Ilgaz (2013) found no significant difference in terms of gender variable for the individual innovation characteristics of prospective teachers. Clifford, Lan, Chou and Qi (1989) likewise stated that taking academic risk differs little by gender, similar to this study. Yapıcı (2016) also stated that in their study with prospective biology teachers, girls have higher levels of individual innovation than boys. However, Akdağ et al. (2017) stated that gender did not have a significant effect onsignificantly affect ART. Koloba and May (2014), on the other hand, concluded that there is no difference between boys and girls in terms of innovativeness.

The final model was tested by path analysis and it was found that the values obtained were within the good fit values range and the model was compatible (Çokluk et al., 2010; Hu & Bentler, 1999; Kline, 2010; Schermelleh-

Engel et al., 2003; Tabachnick & Fidell, 2012). Moreover, as a result of testing the final model with path analysis, all paths were found to be significant. According to the findings, when ART goes up by 1 standard deviation, innovation goes up by 0.74 standard deviations. It is estimated that the ART explains 54 percent of innovativeness's variance. So, it can be said that the relationship between innovativeness and ART has a large effect in practice (Cohen, 1988). Therefore, according to these results, it was concluded that prospective teachers' risk-taking levels are a significant predictor in determining their innovativeness. In their study, Kontoghiorghes et al. (2005) found that there was a relationship between innovative behavior and taking an academic risk in a similar way to this study. In addition, this result supports the knowledge that risk-taking by Hurt et al. (1977) has an important effect on the conceptualization of innovation. At the same time, this study proved in practice that risk-taking is a critical component of innovativeness (Jaeger et al., 2010). Roberts (2015) also stated that innovative individuals have risk-taking, research innovation, need for originality, and cosmopolitanism features. Rogers (2003), on the other hand, categorized innovativeness into 5 categories and stated that innovative individuals take risks and want to try new ideas. This study is important because it supports all the theoretical information in the literature and reveals that taking risks predicts innovation at a high level in practice.

In conclusion, this study contributes to the literature by identifying the variables and predictive relationships that affect innovation and risk-taking behavior, which are important determinants of entrepreneurship (Koloba & May, 2014). It can be suggested that risk-taking behavior is an important predictor of the pre-service teachers' level of innovativeness. The prospective teachers should be planned to increase their risk-taking behaviors during the teaching process. This is because risk-taking behavior also contributes to the development of creativity, innovation, and critical thinking, and most importantly, it provides positive learning experiences (Pierre, 2015).Since it is determined that grade level does not predict the risk-taking behaviors of prospective teachers, it may be recommended to arrange teaching processes by organizing the same activities in all grades. According to the results, gender has a significantly small effect on ART and does not affect innovativeness. For this reason, activities that will improve academic risk-taking skills can be organized according to gender in teacher education. Therefore, researchers recommend that they conduct experimental studies to determine these activities according to gender.

In addition, the level of predicting innovation and risk-taking behaviors of different variables can be investigated. This study is limited to prospective teachers. Factors affecting risk-taking and innovation behaviors can be investigated in different sample groups and ages. As a result of this study, only the predictive relational level was determined. With the experimental studies to be conducted, learning environments that will increase the risk-taking behaviors of prospective teachers can be organized, and their innovativeness can be investigated. In these learning environments that provide academic risk-taking, students are primarily directed to taking moderate academic risks and are interested in risk-taking tasks, which enable students to learn with more effort in the learning process (Clifford, 1991).

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Please declare if there are any potential conflicts of interest.

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References

Açıkgül, K. & Şahin, K. (2019). Investigation of secondary school students' perceptions on their mathematics-orıented academic risk taking behaviors in terms of gender, grade level, metacognition and attitude variables. *Adıyaman University Journal of Social Sciences, 32*, 1-30.

Akdağ, E. M., Köksal, M. S., & Ertekin, P. (2017). Investigating gifted middle school students' intellectual risk taking behaviors in learning science across gender and grade. *Adnan Menderes University Journal of Social Sciences Institute*, *4*(2), 16-25.

Aydin, U., & Ubuz, B. (2010). Turkish version of the junior metacognitive awareness ınventory: An exploratory and confirmatory factor analysis. *Education and Science, 35*(157), 30-45.

Badger, E. H. (2009). *The influence of risk-taking on student creation of mathematical meaning: Contextual risk theory* (Doctoral Dissertation). Brigham Young University, Department of Mathematics Education.

Beghetto, R. A. (2009). Correlates of intellectual risk-taking in elementary school science. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 46*(2), 210-223.

Beghetto, R. A., & Baxter, J. A. (2012). Exploring student beliefs and understanding in elementary science and mathematics. *Journal of Research in Science Teaching, 49*(7), 942-960.

Bentler, P. M. (2006). *EQS structural equations program manual.* Encino, CA: Multivariate software, Inc.

Brown, P. U., Parsons, S. C., & Worley, V. (2005). Pre-service teachers write about diversity: a metaphor analysis. *Scholar-Practitioner Quarterly, 3*(1), 87-102.

Buijs, J. (2007). Innovation leaders should be controlled schizophrenics. *Creativity and Innovation Management, 16*(2), 203-210.

Burns, D. J., & Krampf, R. F. (1992). Explaining innovative behaviour: Uniqueness-seeking and sensation-seeking. *International Journal of Advertising, 11*(3), 227-237.

Byrnes, J.P., Miller, D., & Schafer, W. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin, 125*, 367 – 383.

Clifford, M. M. (1988). Failure tolerance and academic risk-taking in ten-to twelve-years-old students. *British Journal of Educational Psychology, 58*, 15-27.

Clifford, M. M. (1991). Risk-taking: Theoretical, empirical, and educational considerations. *Educational Psychologist, 26*(3-4), 263-297.

Clifford, M. M., Lan, W. Y., Chou, F. C., & Qi, Y. (1989). Academic risk-taking: Developmental and cross-cultural observations. *The Journal of Experimental Education, 57*(4), 321-338.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New Jersey: Lawrence Erlbaum.

Çokluk, Ö., Şekercioğlu, G., & Büyüköztürk, Ş. (2010). *Multivariate statistics for the social sciences: SPSS and LISREL applications.* Ankara: Pegem Akademi.

Çuhadar, C., Bülbül, T., & Ilgaz, G. (2013). Exploring of the relationship between individual innovativeness and techno-pedagogical education competencies of pre-service teachers. *Elementary Education Online, 12*(3), 797-807.

Daşcı, A. D., & Yaman, S. (2014). Investigation of intellectual risk-taking abilities of students according to Piaget's stages of cognitive development and education grade. *Journal of Theoretical Educational Science, 7*(3), 271-285.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *Internal validity. How to design and evaluate research in education.* New York: McGraw-Hill.

Hasan, N., Sobnom, S., & Uzzaman, S. The effect of risk taking behavior in gender and educational level (Secondary and higher secondary). *International Journal of Research and Innovation in Social Science (IJRISS), 3*(5), 15-21.

Horvath, P., & Zuckerman. M. (1993). Sensation seeking, risk appraisal, and risky behavior. *Personality and Individual Differences, 14*(1), 41-52.

House. D. J. (2002). *Investigation of the effects of gender and academic self-efficacy on academic risk-taking for adolescent students* (Doctoral Dissertation). Oklahoma State University.

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

Hurt, H. T., Joseph. K., & Cook. C. D. (1977). Scales for the measurement of innovativeness. *Human Communication Research, 4*(1), 58-65.

Jaeger, D. A., Dohmen, T., Falk, A., Huffman, D., Sunde, U., and Bonin, H. (2010). Direct evidence on risk attitudes and migration. *Rev. Econ. Stat.* 92, 684–689.

Kavas. M. (2017). A quantitative and qualitative research on factors affecting ındividual ınnovative personality and ınnovative behavior. *Science Journal of Turkish Military Academy, 27*(2), 137-156.

Kemer, A. S., & Altuntas, S. (2017). Adaptation of the Individual Innovativeness Scale in Nursing Profession: Turkish Validity-reliability study. *Journal of Education and Research in Nursing, 14*(1), 52-62.

Kılıçer, K. (2011). *Individual innovativeness profiles of prospective teachers in computer education and instructional technology* (Doctoral Dissertaion). Anadolu University, Eskişehir.

Kılıçer, K. & Odabaşı H.F. (2010). Individual innovativeness scale (IS): The study of adaptation to Turkish, validity and reliability. *Hacettepe University Journal of Education, 39*, 150-164.

Kline, R. B. (2010). Promise and pitfalls of structural equation modeling in gifted research. In B. Thompson & R. F. Subotnik (Eds.), *Methodologies for conducting research on giftedness (pp. 147-169).* Washington, DC, US: American Psychological Association.

Koloba, H. A. & May, C. (2014). Innovation and risk-taking propensity of generation Y students in South Africa. *Mediterranean Journal of Social Sciences*, *5*(21), 19-26.

Kontoghiorghes, C., Awbrey, S. M., & Feurig, P. L. (2005). Characteristics and change adaptation, ınnovation and organizational performance. *Human Resource Development Quarterly, 16*(2), 165-211.

Konukman, G. Y., Yokuş, G., & Yelken, T. Y. (2016). The effect of designing ınnovative material on the elementary school pre-service teachers' ınnovativeness. *Bartin University Journal of Faculty of Education, 5*(3), 857-878.

Korkmaz, H. (2002). *Fen eğitiminde proje tabanlı öğrenme yaklaşımının ilköğretim öğrencilerinin yaratıcı düşünme, problem çözme ve akademik risk alma düzeylerine etkisi* (Doctoral Dissertaion). Hacettepe University, Ankara.

Köksal, M. S., & Köseoğlu, P. (2019). Intellectual risk taking when learning about technology: case of prospective science teachers. *Gazi University Journal of Gazi Educational Faculty (GUJGEF)*, *39*(1), 37-61.

Le Fevre, D. M. (2014). Barriers to implementing pedagogical change: The role of teachers' perceptions of risk. *Teaching and Teacher Education, 38*, 56-64.

McNeil, L. M. (1986). *Contradictions of control: School structure and knowledge*. New York: Methuen/Routledge & Kegan Paul.

Mykhailyshyn, H., Kondur, O., & Serman, L. (2018). Innovation of education and educational innovations in conditions of modern higher education institution. *Journal of Vasyl Stefanyk Precarpathian National University*, *5*(1), 9-16.

Pierre, Y. (2015). Academic risk-taking in higher education. https://digitalcommons.fiu.edu/cgi/viewcontent.cgi?article=1427&context=sferc retrieved on 03.07.2020.

Olorunsola, E. O., & Olayemi, A. O. (2011). Teachers' participation in decision-making process in secondary schools in Ekiti State, Nigeria. *International journal of educational administration and policy studies, 3*(6), 78-84.

Ponticell, J. A. (2003). Enhancers and inhibitors of teacher risk-taking: A case study. *Peabody Journal of Education*, *78*(3), 5-24.

Rogers, E. M. (2003). *Diffusion of innovations* (Fifth Edition). New York: Free Press.

Roberts, A. M. (2015). *What's new? A different way to describe innovators* (Doctoral Dissertation). University of Missouri, Columbia.

Robinson, L. E. (2011). *Academic risk-taking in an online environment* (Doctoral Dissertation). University of Connecticut.

Robinson. L. E.. & Bell. A. (2012, June). Exploring adult risk propensity and academic risk-taking within the online learning environment. *Paper presented at Adult Education Research Conference. Saratoga*, 258-264.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of psychological research online, 8*(2), 23-74.

Shantz, D. (1995). Teacher education: Teaching innovation or providing an apprenticeship? *Education*, *115*(3), 339-344.

Sharma, S. (2015). Promoting risk-taking in mathematics classrooms: The importance of creating a safe learning environment. *Mathematics Enthusiast, 12* (2), 290–306.

Tabachnick, B. G., Fidell, L. S., (2012). *Principal components and factor analysis. In Using Multivariate Statistics*. London: Pearson.

Taylor, M. E. (2010). *Teaching efficacy, innovation, school culture and teacher risk taking* (Doctoral Dissertation). The University of Louisville.

Yapıcı, İ. Ü. (2016). Investigation of the individual innovativeness levels of the pre-service biology teachers. *Journal of Research in Education and Teaching, 5*(4), 348-353