Individual Innovativeness Levels of Science Teacher Candidates

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Abstract

This study is intended to detect the level of individual innovativeness among science teacher candidates and to demonstrate whether levels of individual innovativeness differ based on different variables like gender, grade level, reception or lack of preschool education and daily time spent on the internet. Survey model, one of quantitative research models, was used in this study. The sample this research is 154 science teacher candidates studying at a state university in eastern Turkey. In this research, Individual Innovativeness Scale has been used as a data collection tool. It was observed in the study that majority of science teacher candidates are individually innovative at medium level and that they could be placed in the category of "questioning" people as far as their individual innovativeness are concerned. As a result of this research, it is seen that male teacher candidates are more resistant to innovations compared to female ones. Moreover, it has been observed in the study that reception or lack of preschool education did not have an impact on the individual innovativeness, and that the more time teacher candidates spend on the internet, the less their individual innovative levels are.

Keywords: Individual Innovativeness, Science Teacher Candidates, Science Education

Introduction

The century in which we live forces us to consume fast and replace another thing instead of the consumed one. That creates the necessity and even obligation of thinking about and developing the next step in advance (Yoz, 2020). In this process, skills required of individuals have changed and it has turned into a task of human beings to improve what is traditional, and to try, follow and adopt what is new. This changing definition of task leads us to the concept of innovativeness. The concept of innovativeness has been defined differently by different researchers. To Rogers, innovativeness can be defined as "the degree to which an individual adopts a new innovation relatively earlier than other members of his system" (Rogers, 2003, p. 242). While Adair (2007) defines innovativeness as creation or introduction of a new idea or means, Smith, Glor, and Brodtrick (2001) consider it a process in which new ideas are applied and used. As can be understood from these definitions, individual has a crucial role in the emergence of a new idea, application or product (Kocasaraç, 2021; Tabak, Erkuş & Meydan, 2010, Yeniay Üsküplü, 2019). It brings the concept of individual innovativeness to the fore.

Individual Innovativeness

The concept of individual innovativeness focuses on the necessity of examining innovativeness as based on individual. Individual innovativeness is defined as adapting to what is new, showing tolerance, taking risks, being open to the experiences possessed by what is new and adoption (Hurt, Joseph & Cook, 1977), as the desire of seeking and finding innovations individually (Hirschman, 1980), as a way of perceiving an innovation and reacting to it (Yi, Fiedler & Park 2006), as adopting innovation, integrating it to one's life

and applying it in daily life (Yuan & Woodman, 2010), and as the degree of adopting an innovation before everyone else (Kılıçer, 2011). Rogers (2003) defines five types of individuals based on the way individuals adopt innovation. These are 1) innovative people who are willing to try new ideas and take risks, 2) leading people who inform people around them and lead them, 3) questioning people who treat innovations cautiously and do not want to take risk 4) skeptical people who approach innovations with doubts in their minds and 5) traditional people who are prejudiced against innovations and change (Gökçearslan, Karademir & Korucu, 2017; Kılıçer, 2011).

Innovativeness and Education

The most important factor that affects raising of necessary human resources and adapting to changing conditions is education. There is a strong relation between the process of education and innovativeness (Kavacık, Yelken & Sürmeli, 2015). In our own times, the purpose of innovative education is to raise children who think creatively, have self-confidence and skill of communication, like working in a team and have the ability of using technology (Keskin, 2021). While innovativeness increases the quality of education, education affects the improvement and shaping of innovativeness (Kılıçer, 2011).

Henderman and Cantner (2018) consider individual innovativeness a sign of individual job performance. As innovation in education is primarily a task of teachers, it might be argued that individual innovativeness of teachers is very important both in education and in society in general (Akdeniz, 2020). Innovative education could be achievable with innovative teachers. Because contemporary education intends to raise qualified individuals who are open to innovations, teachers must also be open to innovations as they have the primary role in education (Gökçearslan, Yildiz Durak, & Atman Uslu, 2022).

An innovative teacher is the one who is open to professional improvement, who try alternatives and different approaches in the process of learning, who is not dependent upon one way of teaching and who apply new methods (Ritchhart, 2004). Teachers are expected to set an example for society and students

in terms of innovativeness, be open to innovations and improve themselves continually (Özgür, 2013). It becomes possible for teachers to keep up with the process of innovations if they concentrate on their professional development through innovativeness in the face of changing expectations (Grigoropoulos & Gialamas, 2018; Sun & Shi, 2018). Therefore, it is necessary for faculties of teacher training to follow changing conditions all over the world and studies about innovations in order to raise contemporary and innovative teachers who can think creatively and critically (Apaydın & Güven, 2022). It is thus crucial to study the levels of individual innovativeness among teacher candidates to get an idea about how innovative different sections of a society are (Akcanca, 2022). In this respect, more responsibility falls on science teacher candidates as their field is especially connected with innovations and changes. It is important to study innovativeness academically among science teacher candidates (Erkoç & Kert, 2013) because innovativeness has turned into the most important element affecting a country's science, technology, competitive capacity and general performance (Huifeng & Yunjie, 2017). Such academic studies are important in that they aim to reveal the level of individual innovativeness among science teacher candidates when they are students themselves. When they become teachers, this level of individual innovativeness will affect improvement of their professional skills and qualifications.

There are studies in the literature done with teacher candidates (Bitkin, 2012; Brahier, 2006; Can Ayvaz, 2020; Erden & Erden, 2020; Kılıçer, 2011; Özgür, 2013; Şahin, 2016; Yılmaz et al. 2014) and teachers (Abbak, 2018; Akın-Kösterelioğlu & Demir, 2014; Demir-Başaran & Keleş, 2015; Kaya, 2017; Kılıç & Ayvaz-Tuncel, 2014; Könings et al. 2007; Loogma et al. 2012; Yılmaz-Öztürk & Summak, 2014). However, there are no studies focusing on science teacher candidates. In addition, this study is believed to contribute to the literature with respect to the independent variables examined in the study.

This study is intended to detect the level of individual innovativeness among science teacher candidates and to demonstrate whether levels of individual innovativeness differ based on different variables. Accordingly, following research questions were tried to be answered:

- What are the levels of individual innovativeness among science teacher candidates?
- Does the level of innovativeness among science teacher candidates vary according to gender, grade level, reception or lack of preschool education and daily time spent on the internet?

Research Design and Methodology
Research Design

Survey model, one of quantitative research models, was used in this study. The purpose of survey model is to define and describe a situation as it is (McMillan & Schumacher, 2014). Therefore, it does not attempt to influence or change the situation that is studied (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2021). Survey model can be used to extract the general picture from a certain sample in studies with large populations (Metin, 2014) and to make assessments about a certain group (Karasar, 2007).

Study Group

Study group of the present study consists of 154 science teacher candidates studying at a state university in eastern Turkey. Convenience sampling, one of random sampling methods, was used in the formation of study group. The data were collected through face-to-face meetings. The characteristics of the study group are given in Table 1.

Table 1 Personal Characteristics of Science Teacher Candidates

Gender	N	%
Female	122	79.2
Male	32	20.8
Total	154	100
Grade level	N	%
1	58	37.7
2	58	37.7
4	38	24.6
Total	154	100
Reception of pre-school education	N	%
Yes	32	20.8
No	114	74.0
Missing	8	5.2
Total	154	100

Time spent on the internet daily	N	%
1-2 hours	52	33.8
2-4 hours	62	40.2
More than 4 hours	40	26.0
Total	154	100

Data Collection Tools

The data of the study were collected by means of two data collection tools:

Personal Information Form

This form was prepared and used by the researcher to obtain data about science teacher candidates' personal characteristics such as gender, grade level, reception of pre-school education and the time they spend on the internet a day.

Individual Innovativeness Scale

This scale was developed by Hurt et al. (1977) and adapted to Turkish by Kılıçer and Odabaşı (2010). The scale is made up of twenty items under four factors: a) resistance to change (eight items), b) opinion leading (five items), c) openness to change (five items) and d) risk-taking (two items). The scale is of five-point Likert type including five points as follows: "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree". 12 items in the scale are positive while 8 items are negative. Negative items are reverse-coded. In the scale adapted to Turkish, the Cronbach's alpha was calculated as 0,81 for resistance to change, 0,73 for opinion-leading, 0,77 for openness to experience, 0,62 for taking risk and 0,89 for the whole scale.

The level of innovativeness for individuals is determined by means of IIS and individuals are thus categorised based on their levels of innovativeness (Hurt et al. 1977). The formula of "42+ (total score of positive items) – (total score of negative items)" is used to calculate the scores of innovativeness (Kılıçer & Odabaşı, 2010). At the end of IIS application, those taking above 80 points are called innovative individuals. Those taking a point between 69 and 80 are called leading individuals while those taking a point between 57 and 68 are labelled as questioning individuals. The ones who take a point between 46 and 56 are regarded as skeptical individuals while

those with a point below 46 are called traditional individuals (Hurt et al. 1977). In addition, the individuals having a point of 64 and below are called "low-level innovative" while those with a point of 68 and above are called "high-level innovative". Those between 64 and 68 points are labelled as "medium-level innovative" (Hurt et al. 1977).

The reliability coefficient in the study was found to be 0,80 for IIS, 0,79 for "resistance to change" sub-dimension, 0,68 for "opinion leading" sub-dimension, 0,76 for "openness to experience" sub-dimension, and 0,58 for "taking risk" sub-dimension.

Analysis of Data

The data collected through quantitative data collection tools were examined based on descriptive and inferential statistics. In the descriptive analyses of the data, values of frequency, arithmetic average, standard deviation and percentage were used.

Normality tests were done to determine the appropriateness of the collected data for analyses (Tabachnick & Fidell, 2013). In order to determine normal distribution of the data, the central tendency measurements (mean and median), and the skewness and kurtosis values of the total scores obtained from each scale were examined and the related values are presented in Table 2.

Table 2 Descriptive Statistics and Normality Test Results of Scale

Scale	N	X	Ss.	Skewness	Kurtosis
Individual Innovativeness	154	3,5883	0,03383	0,805	0,325
Factors					
Resistance to change	154	2,8231	0,05403	0,043	0,348
Opinion-leading	154	3,7532	0,04639	0,614	-0,419
Openness to experience	154	4,0675	0,04134	0,084	-0,493
Risk-taking	154	3,6234	0,06744	-0,516	0,951

Table 2 shows that skewness and kurtosis values of IIS and its sub-dimensions do not exceed the range of +1 and -1, which are the acceptable values as far as parametric tests are concerned, and that the data set are distributed normally (George & Mallery, 2010; Tabachnick & Fidell, 2013).

The Independent Samples t Test was done to compare the points of scale on the basis of such variables as teacher candidates' gender and their reception or lack of preschool education. To compare the points of scale on the basis of such variables as grade level and the daily time spent on the internet, one-way analysis of variance (ANOVA) was used. Analyses of data set were done on the mean values of the scale items.

Findings

In this section, there are data and findings obtained at the end of the research intended to determine the level of individual innovativeness among science teacher candidates and to see whether individual levels of innovativeness differ based on different variables.

Levels of Individual Innovativeness among Science Teacher Candidates

General descriptive findings related to individual innovativeness among teacher candidates are explained. Table 3 shows descriptive statistical values related to teacher candidates' levels of IIS.

Table 3 Descriptive Statistics of Teacher Candidates' Levels of IIS and Related Categories

Categories	N	%	Levels	N	%
Innovative	2	1,3	High Level	30	19,5
Leading	28	18	Medium Level	28	18,2
Questioning	96	62	Low Level	96	62,3
Skeptical	28	18	Total	154	100
Traditional	0	0			
Total	154	100			

As far as teacher candidates' levels of IIS are concerned, Table 3 shows that 30 teacher candidates in the study (19,5 %) are high-level innovative, 28 teacher candidates (18,2 %) are medium-level innovative and 96 teacher candidates (62,3 %) are low-level innovative. It was also observed that 2 teacher candidates (1,3 %) are innovative; 28 teacher candidates (18,2 %) are leading; 96 teacher candidates (62,3 %) are questioning and 28 teacher candidates (18,2 %) are skeptical. No teacher candidates are in the category of traditional.

Analysis Results of Gender Variable in Individual Innovativeness

Independent t-test was used to find out how points teacher candidates obtained related to sub-dimensions of IIS and total points differed in terms of gender. Findings are given in Table 4.

Table 4 Results of the Effect of Gender Variable on IIS

Scale	Gender	N	X	Ss.	Sd.	t	p
Individual Innovativeness	Female	122	3.61	.42948	152	1.340	0.182
	Male	32	3.50	.38816			
Factors							
Resistance to change	Female	122	2.74	.64660	152	-2.933	0.004*
	Male	32	3.13	.68392			
Opinion-leading	Female	122	3.74	.60015	152	-.377	0.707
	Male	32	3.79	.49783			
Openness to experience	Female	122	4.04	.531440	152	-1.335	0.184
	Male	32	4.18	.44347			
Risk-taking	Female	122	3.63	.87513	152	.224	0.823
	Male	32	3.59	.71224			

*The mean difference is significant at the 0.05 level.

The table shows that resistance to change sub-dimension showed a significant difference based on the gender of teacher candidates (t[152]=2,933, p<0,05). It was observed that male teacher candidates are more resistant to changes (X=3,13) than female ones (X=2,74). In other dimensions and in the total score of the scale, there were no significant differences based on gender variable.

Analysis Results of Reception of Preschool Education Variable in Individual Innovativeness

Independent t-test was used to find out how points teacher candidates obtained related to sub-dimensions of IIS and total points differed in terms of receiving or lacking preschool education. Findings are given in Table 5.

Table 5 Results of the Effect of Preschool Education Variable on IIS.

Scale	Reception of preschool education	N	X	Ss.	Sd.	t	p
Individual Innovativeness	Yes	32	3.7000	.42274	144	1.616	.108
	No	114	3.5640	.41984			
Factors							
Resistance to change	Yes	32	2.6563	.58973	144	-1.697	.092
	No	114	2.8838	.69083			
Opinion-leading	Yes	32	3.9375	.62926	144	1.782	.077
	No	114	3.7333	.55601			
Openness to experience	Yes	32	4.1250	.57865	144	.659	.511
	No	114	4.0561	.50590			
Risk-taking	Yes	32	3.4688	.75067	144	-1.471	.144
	No	114	3.7018	.80298			

The table shows that total point of innovativeness and the points related to its sub-dimensions do not differ significantly based on the reception by teacher candidates of preschool education (t[144]= 1,616p>0,05; t[144]=-1,697 p>0,05; t[144]=1,782 p>0,05; t[144]=0,659 p>0,05; t[144]=-1,471 p>0,05).

Analysis Results of Grade Level Variable in Individual Innovativeness

Levene test was used to find out how points teacher candidates participating in the study obtained related to sub-dimensions of IIS and total points proved to be homogeneous in terms of grade level. The test is given in Table 6.

Table 6 Results of Levene Test Related to The Effect of Grade Level on IIS.
(Test of Homogeneity of Variance)

Scale	Levene Statistic	df1	df2	p
Individual Innovativeness	1.001	2	151	.970
Factors				
Resistance to change	.031	2	151	.001*
Opinion-leading	7.561	2	151	.033*
Openness to experience	3.485	2	151	.777
Risk-taking	.253	2	151	.370

*The mean difference is significant at the 0.05 level.

Table 6 shows that such sub-dimensions as openness to experience and risk taking, and individual innovativeness variances are homogeneous (p>0, 05). It is observed that there is no homogeneity as far as such sub-dimensions as resistance to change and opinion leading are concerned (p<0,05).

One-way analysis of variance (ANOVA) was used to find out how the variable of grade level caused the points teacher candidates obtained to differ. Results are given in Table 7.

Table 7 Results of One-Way Variance Analysis Related to Effect of Grade Level Variable on IIS.

		Sum of Squares	Sd.	Mean Square	F	p
Individual Innovativeness	Between Groups	1.439	2	.719	4.255	.016*
	Within Groups	25.530	151	.169		
	Total	26.969	153			
Factors						
Resistance to change	Between Groups	2.617	2	1.309	2.987	.053
	Within Groups	66.155	151	.438		
	Total	68.772	153			
Opinion-leading	Between Groups	3.410	2	1.705	5.444	.005*
	Within Groups	47.294	151	.313		
	Total	50.703	153			
Openness to experience	Between Groups	1.627	2	.814	3.180	.044*
	Within Groups	38.631	151	.256		
	Total	40.258	153			
Risk-taking	Between Groups	3.452	2	1.726	2.513	.084
	Within Groups	103.704	151	.687		
	Total	107.156	153			

*The mean difference is significant at the 0.05 level.

Table 7 shows that there is a significant difference between the total points of individual innovativeness and the sub-dimensions of opinion-leading and openness to experience based on grade level (F=4,255 p<0,05; F=5,444 p<0,05; F=3,180 p<0,05). However, there is not a significant difference between the total points of individual innovativeness and the sub-dimensions of resistance to change and risk-taking (F=2,987 p>0,05; F=2,513 p>0,05).

Post-hoc analysis techniques were used to define from which grade level the significant difference results. Accordingly, Tukey test was used for homogeneous variances and Games-Howell test was used for the variances that did not show a homogeneous distribution. Results are shown below:

Table 8 Games-Howell Test Results for Opinion-Leading and Openness to Experience Sub-Dimensions Based on Grade Level Variable

Dependent Variable	(I) grade	(J) grade	Mean Difference (I-J)	Std. Error	p
Opinion-leading	1	2	.33103*	.10566	.006*
		4	.07550	.12488	.818
	2	1	-.33103*	.10566	.006*
		4	-.25554*	.10169	.038*
	4	1	-.07550	.12488	.818
		2	.25554*	.10169	.038*
Openness to experience	1	2	.23448*	.09356	.036*
		4	.15100	.11151	.370
	2	1	-.23448*	.09356	.036*
		4	-.08348	.10053	.686
	4	1	-.15100	.11151	.370
		2	.08348	.10053	.686

*The mean difference is significant at the 0.05 level.

Table 8 shows that, at the end of the Games-Howell test, there is a significant difference in favour of the 1st grade between 1st and 2nd grades, and in favour of the 4th grade between the 2nd and 4th grades as far as opinion-leading sub-dimension is concerned. The table also shows that there is a significant difference in favour of the 1st grade between the 1st and 2nd grades as far as openness to experience sub-dimension is concerned.

Table 9 Tukey Test Results Showing the Effect off Grade Level on Individual Innovativeness Total Point

Dependent Variable	(I) grade	(J) grade	Mean Difference (I-J)	Std. Error	p
Individual Innovativeness	1	2	.15000	.07636	.125
		4	-.09074	.08582	.542
	2	1	-.15000	.07636	.125
		4	-.24074*	.08582	.016*
	4	1	.09074	.08582	.542
		2	.24074*	.08582	.016*

*The mean difference is significant at the 0.05 level.

Table 9 shows that at the end of post-hoc Tukey test, there is a significant difference in the total point of Individual Innovativeness between the 2nd and 4th grades in favour of the 4th grade.

Analysis Results of Daily Time Spent on the Internet Variable in Individual Innovativeness

Table 10 gives the results of the Levene test showing homogeneity of variances belonging to daily time spent on the internet variable.

Table 10 Levene Test Results Showing The Effect of Daily Time Spent on The Internet Variable on IIS.

Scale	Levene Statistic	df1	df2	p
Individual Innovativeness	2.591	2	151	.078
Factors				
Resistance to change	1.907	2	151	.152
Opinion-leading	1.277	2	151	.282
Openness to experience	1.532	2	151	.219
Risk-taking	.101	2	151	.904

Table 10 demonstrates that all sub-dimensions and individual innovativeness variances are homogeneous (p>0,05). One-way analysis of variance (ANOVA) was used to examine how the points obtained by the teacher candidates differed based on the daily time spent on the internet variable. The results of the analysis are given in Table 11.

Table 11 The Results of The One-Way Analysis of Variance Showing The Effect of Daily Time Spent on The Internet Variable on IIS.

		Sum of Squares	Sd.	Mean Square	F	p
Individual Innovativeness	Between Groups	2.429	2	1.214	7.472	.001*
	Within Groups	24.540	151	.163		
	Total	26.969	153			
Factors						
Resistance to change	Between Groups	1.441	2	.721	1.616	.202
	Within Groups	67.330	151	.446		
	Total	68.772	153			
Opinion-leading	Between Groups	4.599	2	2.300	7.532	.001*
	Within Groups	46.104	151	.305		
	Total	50.703	153			
Openness to experience	Between Groups	5.370	2	2.685	11.621	.000*
	Within Groups	34.888	151	.231		
	Total	40.258	153			
Risk-taking	Between Groups	3.482	2	1.741	2.536	.083
	Within Groups	103.673	151	.687		
	Total	107.156	153			

*The mean difference is significant at the 0.05 level.

Table 11 demonstrates that there is a significant difference between the total point of Individual Innovativeness and the sub-dimensions of opinion-leading and openness to experience based on the daily time spent by the teacher candidates on the internet variable (F=7,472 p<0,05; F=7,532 p<0,05; F=11,621 p<0,05, F=2.536 p<0,05). There is not a significant difference as far as the sub-dimensions of resistance to change and risk-taking based on the daily time spent by the teacher candidates on the internet variable (F=1,616 p>0,05, F=2,536p>0,05).

To define from which groups the difference results, Tukey test was used as one of the post-hoc analysis techniques. The results are presented below:

As far as individual innovativeness total point is concerned, Table 12 shows that, at the end of post-hoc Tukey test, there is a difference in favour of those who spend 1 to 2 hours on the internet compared to those who spend more than 4 hours on the net.In addition, there is a significant difference in favour of those who spend 1 to 2 hours on the internet daily compared to those who spend more than 4 hours on

the net daily especially as far as such sub-dimensions as opinion-leading and openness to experience are concerned.

Table 12 Tukey Test Results Related to The Effect of Daily Time Spent by The Teacher Candidates on The Internet Variable on Individual Innovativeness Total Point

Dependent Variable	(I) daily time spent on the net	(J) daily time spent on the net	Mean Difference (I-J)	Std. Error	p
Individual Innovativeness	1-2 hours	2--4 hours	.14721	.07581	.131
		More than 4 hours	.32769*	.08478	.000*
	2--4 hours	1-2 hours	-.14721	.07581	.131
		More than 4 hours	.18048	.08176	.073
	More than 4 hours	1-2 hours	-.32769*	.08478	.000*
		2-4 hours	-.18048	.08176	.073
Opinion-leading	1-2 hours	2--4 hours	.33424*	.10390	.004*
		More than 4 hours	.40231*	.11621	.002*
	2-4 hours	1-2 hours	-.33424*	.10390	.004*
		More than 4 hours	.06806	.11206	.816
	More than 4 hours	1-2 hours	-.40231*	.11621	.002*
		2-4 hours	-.06806	.11206	.816
Openness to experience	1-2 hours	2--4 hours	.31538*	.09039	.002*
		More than 4 hours	.46538*	.10109	.000*
	2--4 hours	1-2 hours	-.31538*	.09039	.002*
		More than 4 hours	.15000	.09748	.276
	More than 4 hours	1-2 hours	-.46538*	.10109	.000*
		2-4 hours	-.15000	.09748	.276

*The mean difference is significant at the 0.05 level.

Results and Discussion

This subtitle is intended to discuss the results obtained from the findings of the study in the light of the literature and make suggestions based on the results.

It was observed in the study that majority of science teacher candidates who participated in the study (62 %) are individually innovative at medium level and that they could be placed in the category of "questioning" (62 %) people as far as their individual innovativeness are concerned. The fact that they are at medium level demonstrates that teacher candidates are in search of innovation, are closer to achieving innovation, are motivated positively and are less anxious about innovation (Yorulmaz, Çokçalışkan, Çelik; 2018). It can be argued that the teacher candidates in the category of questioning people tend to be cautious about innovations, adopt innovations slower compared to other sections of society, are questioning, inclined to researching but away from enterprise (Keskin, 2022; Kılıç, 2015; Kılıçer, 2011; Özgür 2013; Rogers, 1995). There are studies done in Turkey demonstrating that science teachers/teacher candidates (Keskin, 2022) and teachers/teacher candidates in other fields of study belong to the category of questioning people as far as their individual innovativeness levels are concerned (Demir & Demir, 2022; Deniz, 2016; Korucu & Olpak, 2015; Könings et al., 2007; Köroğlu, 2014; Örün, Orhan, Dönmez & Kurt, 2015; Yılmaz, 2013; Kılıçer, 2011). That is not a desired thing especially for young teacher candidates. Environment, traditional educational approaches, inequality of opportunity and personal characteristics undoubtedly have an impact on this situation (Akcanca, 2022; Borasi & Finnigan, 2010; Messmann &Mulder, 2011; Zainal & Matore, 2019). The worry over being able to be employed as a teacher by the state is also considered to have an effect on it. It is thought that the worry among teacher candidates about being appointed as

a teacher after graduation directs the concentration of teacher candidates to the exam to be passed by teacher candidates to become teachers, not to the effort of being an innovative teacher. The category of "questioning" is followed by the categories of "skeptical" (18 %) and "innovative" (1,2 %). There are no teacher candidates that could be placed in the category of "traditional". It is notable that there are few "innovative" teacher candidates among the teacher candidates who participated in the study. Innovative people are those who are quite willing to experience and experiment with innovations, who try to reach reliable information directly, who can use technology, trust scientific information and who have higher skills of thinking (Keskin, 2022; Kılıç, 2015; Kılıçer, 2011; Özgür 2013; Rogers, 1995). Individual innovativeness among teachers and teacher candidates is very important because teachers and teacher candidates are supposed to stay up-to-date in a fast-changing world; it is also necessary in such a world for teachers and teacher candidates to welcome innovative approaches and new educational technologies in education with an innovative attitude, and to set an example for other sections of society in the process of increasing competitive capacities of societies, which once again makes individual innovativeness crucial (Thurlings, Evers & Vermeulen, 2015, p. 431). Teachers who can benefit from and use innovations properly will contribute to the process of learning positively and raise innovative individuals. Therefore, it is crucial to increase the number of innovative teacher candidates.

It is observed in the study that male teacher candidates are more resistant to innovations compared to female ones. It demonstrates that male teacher candidates accept new ideas cautiously, adopt innovations slower compared to females and are more skeptical of new situations. It is argued that the fast adoption of the change in women's roles in society have turned women into individuals open to innovations, which has in turn made women more tolerant of innovations (Yelkikalan, 2006).

It has been observed in the study that reception or lack of preschool education did not have an impact on the total point of individual innovativeness or its sub-dimensions among science teacher candidates. However, it might be thought that reception of preschool education indirectly affects individual innovativeness since most of a child's personality is formed in preschool period and personal characteristics are precursor to individual innovativeness.

Another result obtained in the study is that grade levels of science teacher candidates have an effect upon individual innovativeness. There is a significant difference on behalf of the 1st grade between the 1st and 2nd grades and on behalf of the 4th grade between 1st and 4th grades in the opinion-leading sub-dimension. There is also a significant difference on behalf of the 1st grade between 1st and 2nd grades in the openness to experience sub-dimension. In addition, there is a significant difference on behalf of the 4th grade between the 2nd and 4th grades in the total point of Individual Innovativeness. Thus, it might be argued that the teacher candidates in the 1st and 4th grade are more improved with respect to opinion leading. Opinion-leading people are different from other people in their environment and pioneers. The reason behind these results might be the fact that first grade teacher candidates intentionally try to show themselves as leading people while the fourth-grade teacher candidates rely on their background they have had during their undergraduate years. That might be the reason why the candidates in the second grade have obtained lower points in opinion-leading sub-dimension compared to the candidates in the 1st and 4th grades. Teacher candidates who are open to experience are those who improve themselves, think analytically, have a wide range of interests, are open to innovations and creative (Kalafat, 2012). It is observed in the study that teacher candidates in the second grade are better than those in the first grade in the sub-dimension of openness to experience. It is estimated that the teacher candidates, who try to adapt themselves to university environment and prove themselves in the first grade, complete the process of orientation in the second grade and become open to new experiences. With respect to the total point of individual innovativeness, it is thought that the teacher candidates in the fourth grade have obtained occupational self-efficacy with their background knowledge in their field and in the field of pedagogy, which affects their level of

individual innovativeness. In their study, Klaeijsen, Vermeulen and Martens (2018) have found out a strong and positive relationship between teachers' occupational self-efficacy and their innovative attitudes. Finally, it has been observed in the study that the more time teacher candidates spend on the internet, the less their individual innovative levels are. It has also been realized that as the time spent on the internet decreases, teacher candidates get better results with respect to opinion-leading and openness to experience sub-dimensions. There are studies in the literature demonstrating that there is a positive relationship between technological self-efficacy and individual innovativeness. In their study, Çuhadar, Bülbül and Ilgaz (2013) have shown that there is a positive and medium-level relationship between individual innovativeness of teacher candidates and their techno-pedagogical educational competence. Örün, Orhan, Dönmez & Kurt (2015) have examined the relationship between individual innovativeness profiles of teacher candidates and their levels of technological attitudes, and they have detected a positive and significant relationship between the points of technological attitude levels and those of individual innovativeness. These studies nevertheless point to the difference between following technology and being aware of technological developments on the one hand, and spending time on the internet on the other. It has not been detected in the study on which internet sites teacher candidates spend their time, which is a limitation of this study. And there are studies in the literature demonstrating that those who spend time on the internet with the purpose of research have higher levels of individual innovativeness (Adıgüzel, Kaya, Balay & Göçen, 2014). The study proves that openness to experience lessens as the time spent on the internet increases, which shows the decrease in the desire and willingness among teacher candidates to search for the new and try it. Being open to experience is of great importance for professional knowledge and self-development and the time spent on the internet therefore has a great effect upon it (Kalafat, 2012). Another finding in the study is lessening of opinion-leading as the time spent on the internet increases. The rise of the time spent on the internet negatively influences opinion-leading, which includes the characteristics that

make individuals more privileged compared to other individuals in the group they belong to.

In conclusion, individual innovativeness levels among science teacher candidates are believed to affect their professional performance after graduation as well as the quality of the education they receive at university. Therefore, it is especially necessary to carry out studies focusing on improvement of individual innovativeness among science teacher candidates as their field of study is the one mostly associated with innovations. It is especially important to study the finding indicating that the increase in the time spent on the internet has a negative effect upon individual innovativeness. It is crucial to lead teacher candidates to the activities and projects that will enable them to have new experiences and make their communicative skills and abilities to work with a team stronger. It is also important that academics undertake a guiding role in this process.

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