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Investigation of Emerging Technology Usage Characteristics as Predictors of Innovativeness

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Abstract

For today's societies trying to cope with the current globally increased competition, existence of individuals who can take risks, solve problems and adopt changes an innovation has gained more importance when compared to the past. This situation brings responsibility to educational institutions for increasing the number of innovative individuals and the qualifications of these individuals. Therefore, in the process of designing and developing any kind of in-class activities which will contribute to innovativeness, it is important to determine the technology usage characteristics that can be used to define individuals who have high levels of innovativeness. The purpose of the present study was to determine the variables related to technology which will be used to discriminate between individuals who have high and low levels of innovativeness. In the study, which was carried out using the causal-comparative design, a logistic regression model was formed by using technology-related variables, and which technology-related variables managed to predict high level of innovativeness was tested. In the logistic model, the technology budget (purchases, internet, and phone bills), technology ownership (smart phones, tablets, laptops, personal computers, internet, websites, blogs), technology renewal/update time (smart phones, computers), the number of utilized internet applications and internet usage habits were analyzed as predictors. The study was conducted with 244 university students from different class grades at a state university in Turkey. The results revealed that among the variables examined, only the variables of Internet usage habit, the number of Internet applications used, blog ownership and the money spent on technology use were significant predictors. In addition, the model in which these variables were used was found to classify high and low levels of innovativeness with accuracy of 71%. Implications are discussed.

Keywords: *Emerging technology; Innovativeness; Technology usage habits; Technology usage characteristic; Preservice teachers*

Introduction

The concept of innovation is currently considered to be the prior condition of making differences in every field and affair, creating values, leading the field and changing things. Innovation is an indispensable part of development, competition and thus profitability on personal, organizational and national scales. Therefore, innovation indexes are released almost in every field, and there are incentives and studies for high innovation. Briefly, vigorous efforts and endeavors are made in this respect. When the definition of the concept of innovation is considered, it is seen that various definitions have been provided in related literature from different perspectives: any object, idea, technology, or practice that is perceived to be new by an individual, group or society (Rogers, 1995); a process that transforms ideas into outputs

(Drucker, 1985); any object or idea which is perceived to be new by an individual or a particular group and which positively influences the individual or the group when put into practice (Goldsmith & Foxall, 2003); the implementation of a new or significantly improved product (good or service) or process; a new marketing method, or a new organizational method in business practices, work-place organization or external relations (OECD, 2005).

When all the definitions above are taken into account, the concept of innovation occasionally refers to new things, ideas or practices, sometimes refers to the creative process of the outputs, and sometimes refers to the changes in a person's cognitive process and behavioral responses caused by the outputs (Goldsmith & Foxall, 2003). Innovations can be considered to be new products and processes in general sense (OECD, 2005) and also viewed as product, process, service, marketing and organizational changes or renewals in products, services, production and delivery and business conduct methods, designing and marketing methods of organizations (Elci, 2006). Innovations are associated with technology and classified as continuous innovations, dynamically continuous innovations and discontinuous innovations (Robertson, 1967).

Another concept derived from the term innovation is innovativeness. Innovativeness, the noun form of the word innovative, is defined in most general sense as coming up with new ideas or original, creative thinking (http://www.oxforddictionaries.com/). Innovativeness is also defined as the degree to which an individual adopts new ideas relatively earlier than other members of the society (Rogers, 1995; Rogers & Shoemaker, 1971), as a basic dimension of personality relevant to the analysis of organizational change (Kirton, 1976), as willingness to change or to try new things (Hurt, Joseph & Cook, 1977) and as a person's tendency to try out new things (Agarwal & Prasad, 1998). As it is clear from the definitions, the concept of innovativeness has two common points. These are namely positive response to changes and relatively earlier adoption of new ideas than other members of a social system.

The concept of innovativeness, shaped by the view of behavioral responses to new things, is categorized in the "diffusion of innovation" model developed by Everett M. Rogers in 1962. In his model, in which the adoption process of new things in a social system is explained, Rogers (1995) suggests that those who adopt innovations sooner or later in the context of time differ in demographic features and psychological characteristics. He also classifies five adopter categories on the basis of innovativeness by using statistical techniques such as mean and standard deviation based on the curve of adopters. The first category is "innovators", which forms 2.5% of those who adopt innovations and those who adopt them the earliest. Innovators are venturers, entrepreneurs and pioneers who are willing to take risks (Rogers, 1963; Rogers, 1995), who have a higher social status, who have financial liquidity and who have active relationships within the social system (Beal & Bohlen, 1956). The category is then followed by "early adopters", "early majority", "late majority" and "laggards" in terms of adoption time of each person. The group constituting 16%, which consists of laggards or traditionalists, is characterized by the most remarkable features such as social isolation, conventionality (Rogers, 1995), conservative attitudes (Geoghegan, 1995) and communication/interaction with rather traditional people (Beal & Bohlen, 1956).

Although the categories of innovativeness are shaped on the basis of adoption of innovations, it is pointed out that innovativeness could be regarded as a personal trait when overwhelming characteristics in each category of innovativeness are taken into account (Goldsmith & Foxall, 2003). From that perspective, innovativeness is shaped by individuals' personal traits formed by their cognitive structures and behaviors that they constantly demonstrate. There are numerous scales developed by several researchers to measure innovativeness. For instance, Kirton (1976)

developed "Kirton adaption-innovation inventory (kai)", which allows foreseeing the levels of innovativeness before adopting innovations by considering innovativeness as a basic personality trait. Similarly, Hurt, Joseph and Cook (1977) developed the "personal innovativeness scale", which can predict the levels of innovativeness in general sense based on people's responses to given situations and which could be adapted to any innovations. As a result, whether it is considered from behavioral perspective or as a personal trait, innovators are those who have high socio-economic levels, who take great risks and who can adopt innovations and changes rapidly at short notice. On the other hand, traditionalists have low socio-economic backgrounds and take slight risks, and they can adopt innovations and changes very slowly, which thus takes a long time for them to adopt innovations.

It is obvious that the concepts of innovations, innovativeness and technology are interwoven in the current age of information, particularly with the developments in information and communication technologies. One of the main reasons for this situation is that production of innovations is mostly felt in the field of technology, and technology constantly introduces innovations in every aspect of life. In this regard, there are numerous studies focused on individual innovativeness as a variable across different disciplines including but not limited with the adoption of wireless internet services in mobile technologies (Lu, Yao, & Yu, 2005), the adoption of technological products at different levels (Van Rijnsoever & Donders, 2009), the adoption of wireless mobile data services (Lu, Liu, Yu, & Wang, 2008), the effect of technology on innovativeness (Huang, Li, & Chen, 2009) and the effect of personal innovativeness on the adoption of new technologies (Jackson, Yi , & Park, 2013).

In educational context, previous studies have also shown the relationship between technology and innovativeness. For instance, Jeong and Kim (2017) examined the acceptance of computer technology by kindergarten teachers through the technology acceptance model along with personal innovativeness. The results of the study revealed that personal innovativeness had an indirect influence on computer technology acceptance. Daud and Zakaria (2017) investigated the factors that influence academic researchers' in Malaysian research universities usage of collaborative technologies. The results of the study demonstrated that personal innovativeness was one of the significant predictors of individual usage of collaborative technologies. Ozcan, Gokcearslan, and Solmaz (2016) investigated pre-service teachers' individual innovativeness level and their attitudes toward e-learning. The results of the study illustrated that preservice-teachers' attitudes toward e-learning significantly differ with respect to their individual innovativeness profiles. The researchers concluded that the significant difference in pre-service teachers' individual innovativeness levels have numerous influences on their attitudes toward e-learning. Ngafeeson and Sun (2015) examined students' acceptance of e-textbooks by using the technology acceptance model as a general framework along with including technology innovativeness. In this study the researchers reported that they referred to technology innovativeness as an equivalent conception of individual innovativeness. The results of the study showed that students' technology innovativeness is associated with the acceptance of e-textbooks. The researchers concluded that students' openness to new information and communication technologies is likely to positively influence the adoption process. Abu-Al-Aish and Love (2013) investigated university students' intentions to accept m-learning through extending the unified theory of acceptance and use of technology with personal innovativeness. The results showed that along with other predictors personal innovativeness was also found to be one of the significant predictors of behavioural intention to use m-learning. Fagan, Kilmon, and Pandey (2012) examined personal innovativeness of the students as a variable to explain their intentions to use virtual reality simulation that enable them to learn the usage of medical emergency crash cart. The results of their study supported the hypothesis that personal

innovativeness was one of the significant predictors of intention to use the virtual reality crash cart simulation. The studies have shown that technology is closely related to innovativeness. Agarwal and Prasad (1998) and Rosen (2005) state that innovativeness influences the relationship between perceptions of technology and intentions towards new technology usage. Thus, innovativeness appears to be a significant factor in technology usage.

When the relationship between technology and innovativeness is considered in educational discourse, there is little doubt that it has a vast amount of importance whether the process is either learning-teaching or teacher training. For almost a quarter century, there have been many projects on the integration of information and communication technologies into education across the globe. If it is scrutinized carefully, one of the most important considerations of such projects is providing teachers with several affordances such as skilling up both in technological and instructional practices and keeping up with the pace of the technological and pedagogical developments (Pelgrum & Law, 2003; UNESCO, 2005; 2007). Previous studies focused on the relationships between how teachers' benefit from instructional innovations and their levels of innovativeness (see Cuhadar, Bulbul & Ilgaz, 2013; Gokcearslan, Karademir & Korucu, 2016; Marcinkiewicz, 1994; Marcinkiewicz & Grabowski, 1992). A considerable part of those studies reported that there are positive and significant results regarding the relationships between individual innovativeness of preservice teachers or in-service teachers and their competencies in adopting instructional innovations (Cuhadar, Bulbul & Ilgaz, 2013; Gokcearslan, Karademir & Korucu, 2016; Haelermans & Blank, 2012; Koroglu, 2014; Lai & Chen, 2011; Loogma, Kruusvall & Umarik, 2012; Orun, Orhan, Donmez & Kurt, 2015; Yilmaz & Bayraktar, 2014).

Research Problem

Considering the effects of innovativeness on technology usage, the focal point of the present study was to define technology usage profiles to predict those with a high level of innovativeness by examining the relationship between technology profiles and innovativeness. For this purpose, the study tried to investigate which of the following variables are predictors of those with a high level of innovativeness: technology budget (purchases, internet/phone bills), technology ownership (smartphones, tablets, laptops, personal computers, internet, websites, blogs), technology update time (smartphones, computers), the number of utilized internet technologies, mobile phone Internet access and Internet usage habits. In other words, the study aimed to obtain the regression equation to define those with a high level of innovativeness and the independent variables as predictors which are expected to contribute significantly to the equation. In this respect, the following research questions were directed in the study:

1. What are technology-related variables which will significantly predict high level of innovativeness in accordance with preservice teachers' technology usage habits?
2. To what extent can the regression model formed by using technology-related variables classify/predict highly innovative preservice teachers accurately?

Looking from such a glimpse, the results of the study will allow determining the predictors explaining preservice teachers' individual innovativeness and ways to design and develop instructional practices to improve their levels of innovativeness. In addition, instructors will have the opportunity to recognize preservice teachers' levels of innovativeness by observing their specific technology usage habits. In this way, in-class activities will be transformed into a more effective and engaging form.

Method

Research Model

In the study, technology usage profiles and level of innovativeness were discussed in a cause-effect relationship context. Causal-comparative studies allow not only investigating the causes of differences already existing between the groups examined but also examining the natural groups without any related manipulation (Fraenlek, Wallen & Hyun, 2011). Also, causal-comparative research is employed to study the relationship between a given independent variable and a dependent variable, pursuant to a case or an act. The effect of independent variables on the dependent variable is examined by comparing the individuals in two or more groups (Creswell, 2012; Salkind, 2010). In the study, the reason for selecting the causal-comparative model was to examine the differences between preservice teachers who already had low or high levels of innovativeness. Based on the reasons for the differences between the groups especially with respect to their technology usage profiles, the variables predicting high level of innovativeness significantly were tested.

Categories of innovativeness are found in the theory of "Diffusion of Innovation" put forward by Rogers (1995), who, in his theory, explained the personal and socio-economic characteristics of individuals with high level of innovativeness. According to this theory, individuals with high level of innovativeness are venturers and entrepreneurs who are willing to take risks leading to innovation (Rogers, 1963; Rogers, 1995) and who not only have a high level of income with a social status but also establish active relationships within the social system (Beal and Bohlen, 1956). In contrast, individuals with low level of innovativeness isolate themselves from the society, give priority to their traditions (Rogers, 1995), demonstrate conservative attitudes (Geoghegan, 1995) and establish communication with individuals who mostly give importance to traditions (Beal and Bohlen, 1956). Depending on the basic differences between these two groups, a research model was formed by determining the variables regarding technology use habits. The main variables included in the research model are shown in Figure 1.

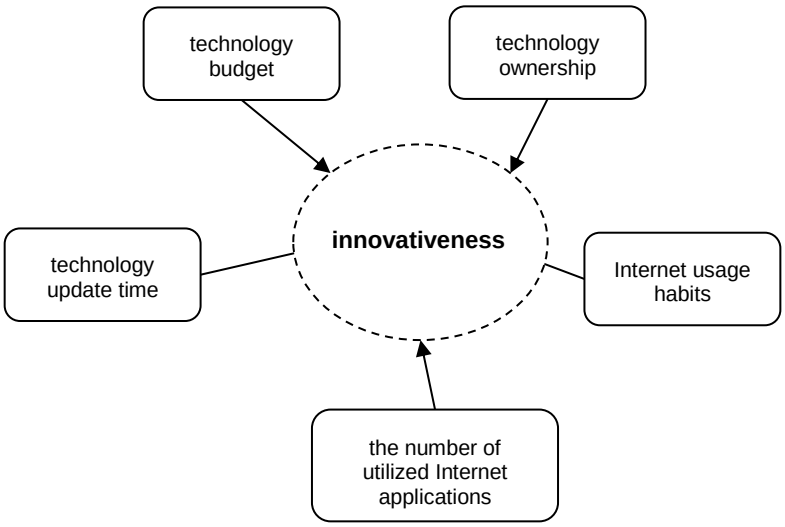

Figure 1. Research Model

Definitions and contents of the research model variables illustrated in Figure 1 are further elaborated in Table 1.

Table 1. Research Model Variables

Variable	Definition	Content
Technology budget	Monthly average amount of money spent on technology usage	Device purchases and monthly cost of use of information and communication technologies services
Technology ownership	Digital technology ownership and active usage	Ownership of such devices and tools as smartphone, tablet, laptop, personal computer, internet, mobile internet, web site and blog
Update time for technological devices	Average renewal/update time of technologies	Average renewal time of Mobile Phones and Computers (monthly)
The number of utilized Internet applications	The number of Internet applications utilized for technology usage	Social networking sites, online games, content development, cloud service, file sharing service, online shopping, virtual class, online news, forum, video sharing, online learning community, virtual world, e-banking, webmail and picture sharing total usage number of utilized Internet applications
Internet using habits	The way individuals define themselves regarding their ways of internet usage	*Follower* (I just follow somebody or something in Internet/social media), *Participant* (I not only follow but also write comments), *Sharer* (I follow, I write comments and I share something like text, image, video etc.), *Producer* (I follow, I write comments, I share and I produce content) and *Leader* (I follow, I write comments, I share, I produce content and become a role model for those I know)
Innovativeness	Personal willingness to try new things as a personality trait (Rogers, 1995)	High level of innovativeness and low level of innovativeness

Participants

At the beginning of the research process, there were 330 preservice teachers from different class grades in various departments of teaching at a Turkish state university. In the study, 20 participants were excluded from the research sample because they did not fully respond to the data collection tool or because they provided inconsistent responses; 30 were excluded as a result of being outliers (-3<z<+3) in terms of z scores; and lastly, 36 were excluded because they

were not included in the high or low innovativeness group. Eventually, the study was conducted with 244 participants. The participants' demographic features may be seen in Table 2.

Table 2. Demographic Features of the Participants

Demographic features	*f*	%	*M*	*SD*	Min	Max
Age			20.73	2.00	17	34
Gender*						
Female	155	63.50				
Male	88	36.10				
Class Grade*						
1st Class Grade (Freshman)	67	27.50				
2nd Class Grade (Sophomore)	116	47.50				
3rd Class Grade (Junior)	25	10.20				
4th Class Grade (Senior)	19	7.80				
Monthly technology budget ($)						
Device purchases			17.27	70.13	0	797.87
Monthly bill			10.44	8.73	0	58.97
Mobile phone Internet access						
Yes	161	66.00				
No	83	34.00				
Technology ownership						
Smartphone	151	61.90				
Tablet	30	12.30				
Laptop	148	60.70				
Personal computer	43	17.60				
Internet	132	54.10				
Web site	98	40.20				
Blog	118	48.40				
The number of utilized Internet applications			5.45	2.87	0	14
Internet using habits**						
Follower	60	24.60				
Participant	36	14.80				
Sharer	85	34.80				
Producer	49	20.10				
Leader	14	5.70				
Mobile phone renewal time*						
1-3 months	7	2.90				
3-6 months	3	1.20				
6-12 months	15	6.10				
12-24 months	57	23.40				
24 months and more	154	63.10				
Tablet renewal time*						
1-3 months	1	0.40				
3-6 months	1	0.40				
6-12 months	1	0.40				
12-24 months	12	4.90				
24 months and more	77	31.60				

Demographic features	*f*	%	*M*	*SD*	Min	Max
Computer renewal time*						
1-3 months	0	0				
3-6 months	2	0.80				
6-12 months	3	1.20				
12-24 months	10	4.10				
24 months and more	159	65.20				
The level of innovativeness						
Low	151	61.90	58.14	4.35	43.00	64.00
High	93	38.10	73.56	5.77	68.00	89.00

* Missing data
** Internet usage habit was determined by asking the participants to mark one of the five categories which best defined them and which were formed in accordance with the activities carried out via the Internet. These categories are presented and explained in detail in Table 1.

As it is clear in Table 2, the majority of the participants were female from the 2nd class grade (sophomore), and the average age was 20. When the dependent and independent variables are taken into account, it is seen that most of the participants were those who had a low level of innovativeness and who had smartphones and laptops and that most of the smartphone users also had mobile Internet access. They spent 17$ on technological device purchases in a month, paid 10$ for technology-related bills on average on monthly basis and renewed their mobile phones and computers over a period of two years or more. It is also clear that the participants defined their Internet usage habits as sharer (follow, write comments and post something like text, image, video etc. in Internet/social media) and that they actively used at least five of the given Internet applications (social networking sites, online games, shopping, e-mail etc.).

Instrumentation

The Turkish version of the individual innovativeness scale was employed to measure the level of innovativeness, which was the dependent variable of the study, and the technology usage questionnaire, developed by the authors, was used to measure the independent variables.

Turkish Version of Individual Innovativeness Scale

The scale, originally named innovativeness scale in English, was developed by H. Thomas Hurt, Katherine Joseph and Chester D. Cook in 1977. The scale was developed based on the innovativeness categories found in Rogers's (1995) theory of "Diffusion of Innovation." Innovativeness is made up of 20 five-point Likert-type items regarding characteristics of an innovative individual in accordance with the theory by taking innovativeness as a general personality trait. Eight of the scale items are negative, and 12 of them are positive. Each scale item was assigned scores ranging from 1 meaning "I Completely Agree" to 5 meaning "I Completely Disagree". The scale produced a score of 14 at lowest and a score of 94 at highest. The scores to be obtained via the scale as basis allowed measuring innovativeness levels of individuals (low-average-high levels of innovativeness) as well as categorizing them as laggards, late majority, early majority, early adopters and innovators in terms of innovativeness. Accordingly, the individuals who received a score over 68 from the scale were considered to have a high level of innovativeness, and those who received a score lower than 64 were

considered to have a low level of innovativeness. Within the scope of the validity study of the original version of the scale, construct validity and the upper-lower 27% group difference were examined. The results of the factor analysis revealed a two-dimension structure. The items with a factor load higher than .50 were included in the scale and considered to have one factor. In addition, a significant difference was found between the bottom-top %27 group differences for each item in the scale. Within the scope of the reliability study of the scale, internal consistency and split-half equivalence coefficient were examined. Accordingly, the internal consistency coefficient of the scale was calculated as .89, and the split-half equivalence coefficient was found to be .92 (Hurt, Joseph & Cook, 1977).

The scale was adapted into Turkish by Kilicer and Odabasi (2010). The related adaptation study was carried out with 343 university students. In this study, the scale items were translated into the target language. Following this, the equivalence of the two languages used in the original version and in the adapted draft was examined, and the validity and reliability of the adapted Turkish version were tested. As a result of the adaptation study, within the scope of the validity study of the Turkish version which was found conceptually and statistically equivalent to the original version in terms of their languages with the help of the single-translation method, construct validity of the adapted version was examined, and the related item analysis was conducted. In relation to the reliability of the adapted Turkish version, internal consistency and test-retest reliability coefficients were calculated. The results of the adaptation study revealed that the four-factor structure of the scale in the Turkish version explained 53% of the total variance and that the items in all the factors had factor load values ranging between 0.360 and 0.787. In addition, with respect to the innovative scores of the individuals for each item scale and for the whole scale, a significant difference was found between the individuals in the upper-lower 27% groups. For the Turkish version of the scale, the *Cronbach's Alpha* internal consistency coefficient was found to be .82, and the test-retest reliability coefficient was found to be .87.

In this study, the Cronbach's Alpha reliability coefficient of internal consistency of the scale items was calculated as .82, and the Spearman-Brown reliability coefficient of consistency of the two halves of the scale was calculated as .85.

Technology Usage Questionnaire

The questionnaire, which was developed by the authors, included a total of nine questions. The first three questions in the questionnaire were directed to obtain personal information about the participants (age, gender and class grade). The remaining six questions aimed to determine the participants' technology profiles, and each of these questions was related to the independent variables in the regression equation. The first one was an open-ended question directed to determine the monthly average amount of money spent on technology (purchase, internet/phone bill). This question was followed by four other nominal questions directed to determine the ownership of emerging technologies (smart phone, tablet, laptop, PC, internet, web site, blog), mobile phone Internet access (yes/no), technology update time (smart phone, computer) and the number of utilized Internet technologies (social network, game, content development, cloud application vb.). Lastly, there was one other ordinal question directed to determine the participants' Internet usage habits (follower, participant, sharer, producer, leader). While preparing the questionnaire form, first, the related literature was reviewed, and the draft version of the scale was formed by examining the technology-related characteristics which may have a relationship with innovativeness. In the end, the content validity and linguistic validity of the draft version were evaluated, and the scale was finalized.

Data Collection and Analysis

The research data were collected from preservice teachers in different class grades in various departments of the education faculty of a state university in Turkey. While collecting the data, the participants' departments or their class grades were not taken into account. In the process of data collection, first, enough copies of the paper-pencil form of data collection tool were obtained, and all the preservice teachers in the faculty were invited to participate in the data collection process. Following this, the research data were gathered from those who voluntarily accepted to take part in the study. The participants were informed about the content of the data gathering tools. Although they were told that there was no unethical or confidentiality concerns regarding individual rights, they had the right to give up taking part in the data collection process anytime they wanted. At the end of the data collection process, which lasted about four months, the research data were collected from a total of 330 preservice teachers.

In the data analysis process, first, the data obtained were examined, and the invalid data were excluded from the analysis. Then, the participants were divided into two groups according to the Turkish version of personal innovativeness scale scores as follows (Hurt, Joseph & Cook, 1977): Total scores higher than 68 referred to high level of innovativeness, and total scores lower than 64 referred to low level of Innovativeness. The data collected from 36 participants whose scores were in-between were excluded from the analysis in terms of personal innovativeness as innovativeness was taken as a two-categorical (high and low level of innovativeness) variable in the regression analysis.

Next, the normality of the participants' distribution was tested in terms of the dependent variable: the level of innovativeness. Accordingly, it was found that the distribution was normal because the number of the participants in both categories of innovativeness was greater than 30 and that skewness (0.544) and kurtosis (0.141) values of innovativeness were between the limit values of a normal distribution (±1) as accepted in related literature (Pallant, 2007). Then, descriptive statistics were used to examine technology usage habits of the participants in the high and low innovativeness groups, and *t*-test was employed to determine the difference in the scores of innovativeness in terms of technology usage habits. In addition, correlation was used to show the relationship between the variables. Finally, *logistic regression analysis* was performed to show technology usage characteristics that significantly predicted high level of innovativeness. Logistic regression is employed to predict an outcome such as group membership from a set of predictor variables that are continuous or categorical (Field, 2005; Tabachnick & Fidell, 2007). This analysis allows explaining the relationship between one dependent variable and several independent variables with regression equation and estimating the value of the given predictor variables in the regression model. In the study, *binary logistic regression analysis* was employed as the dependent variable (innovativeness) was made up of two categorical options (high and low level). In addition, *enter* was used as the method to design the regression model because all the covariates were considered to be a block in the regression model. Finally, such requirements of Logistic Regression Analysis as outliers (z scores greater than +3< or lower than -3) and multicollinearity of the independent variables and the minimum number of people in the categories of the independent variables (>20) were examined, and it was found that these requirements were met. The level of significance was taken as .05 in all the statistical calculations to interpret the results, and the statistically significant findings were presented with the effect sizes (eta squared).

Results

According to the research findings, as illustrated in Table 3, when the technology usage profiles of 151 preservice teachers with a low level of innovativeness are examined, it is obvious that most of them had smartphones and laptops and that almost half of them had Internet access, blogs and personal websites. It is also seen that very few of the participants had technological devices such as tablets and personal computers. The total number of the technological devices they had was two on average. Those who had mobile phone Internet access constituted the majority. When technology budget was considered, those with a low level of innovativeness monthly spent $20 on device purchases on average and paid $9 for their technology-related bills such as Internet and mobile phone bills on average. Also, those with a low level of innovativeness renewed/updated their technologies such as mobile phones and computers over a period of two years or longer. When the number of utilized Internet applications was considered, those with a low level of innovativeness used at least four Internet applications on average and mostly preferred the following applications: social networking sites, video sharing and news. The least preferred Internet applications were as follows: cloud computing, virtual classroom, and content development. Finally, those with a low level of innovativeness defined themselves in terms of their Internet usage habits as sharers (follow, write comments and post something like text, image, video etc. in Internet /social media).

Table 3. Technology Usage Profiles of the Preservice Teachers

	Low level of innovativeness (*N*=151)				High level of innovativeness (*N*=93)			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
Monthly technological device purchases ($)			20.36	80.57			12.24	35.87
Monthly technology-related bill ($)			8.95	6.58			12.86	11.00
Mobile phone Internet access (Yes)	97	64.20			64	68.80		
Smartphone ownership (Yes)	93	61.60			58	62.40		
Tablet ownership (Yes)	18	11.90			12	12.90		
Laptop ownership (Yes)	82	54.30			66	71.00		
Personal computer ownership (Yes)	19	12.60			24	25.80		
Internet ownership (Yes)	70	46.40			62	66.70		
Web site ownership (Yes)	64	42.40			34	36.60		
Blog ownership (Yes)	67	44.40			51	54.80		
The number of technological device			2.74	1.23			3.30	1.38
The number of utilized Internet applications			4.74	2.51			6.59	3.07
Mostly mobile phone renewal time (24 months and more)	100	66.20			54	58.10		
Mostly computer renewal time (24 months and more)	95	62.90			64	68.80		
Internet using habits								
Follower	43	28.50			17	18.30		
Participant	28	18.50			8	8.60		

	Low level of innovativeness (*N*=151)				High level of innovativeness (*N*=93)			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
Sharer	52	34.40			33	35.50		
Producer	24	15.90			25	26.90		
Leader	4	2.60			10	10.80		

When the technology usage profiles of 93 preservice teachers with a high level of innovativeness were examined, it was seen that most of them had laptops, Internet access and smartphones and that more than half of them had blogs. Only a few had technological devices such as tablets and personal computers, and the majority did not have personal websites. The total number of technological devices they had was three on average. Those who had mobile phone Internet access constituted the majority. When technology budget was considered, those with a high level of innovativeness monthly spent $12 on device purchases on average and paid $13 for their technology-related bills such as Internet and mobile phone bills on average. Also, those with a high level of innovativeness renewed/updated technologies such as mobile phones and computers over a period of two years or longer.

When the number of utilized Internet applications was considered, those with a high level of innovativeness used at least six Internet applications on average and mostly preferred the following applications: social networking sites, video sharing and e-mail. The least preferred Internet applications were as follows: virtual classroom, cloud computing, and content development. Finally, those with a high level of innovativeness defined themselves in terms of their Internet usage habits as sharers (follow, write comments and post something like text, image, video etc. in internet/social media).

When the participants' technology usage habits and the level of innovativeness were holistically considered, technology usage habits of those with a low level of innovativeness were similar to technology usage habits of those with a high level of innovativeness. The participants in both groups were almost the same in terms of technology ownership, renewal/update time, Internet usage habits and utilized internet applications.

However, there were other striking findings. To illustrate, the number of technologies that the participants with a high level of innovativeness had (t(242):3.327; p<.001; $\eta 2$:0.04), the number of utilized Internet applications (t(165,831):4.889; p<.001; $\eta 2$:0.10) and the money spent on technology-related bills (t(133,020):3.102; p<.05; $\eta 2$:0.05) were higher than those with a low level of innovativeness. Besides, in terms of their Internet usage habits, those with a high level of innovativeness (t(242):3.702; p<.001; $\eta 2$:0.05) were more active Internet users than those of the participants with a low level of innovativeness. Moreover, as the number of technological devices increased, the number of utilized Internet applications increased as well (r(244):0.493, p<.001). In addition, the latter brought higher technology-related bills (r(244):0.307, p<.001). Also, the number of utilized Internet applications (r(244):0.377, p<.001) and the number of technologies (r(244):0.305, p<.001) increased for those with higher skills in terms of internet usage habits.

The data of the regression model obtained as a result of the performed logistic regression analysis to show the predictors of high innovativeness in technology usage profiles in accordance with the research model are presented in Table 4.

Table 4. Overall Assessment of the Logistic Model

Tests	χ^2	*df*	*p*
Omnibus (Model χ^2)	44.518	14	.000*
Hosmer-Lemshow (Goodness-of-fit-test)	3.858	8	.870
R^2-type Indices	R^2		
Cox & Snell R^2	.167		
Nagelkerke R^2	.227		

*p<.001

As it is seen in Table 4, the logistic model is statistically significant (χ^2:44.518, p<.001), and the model had a high level of goodness-of-fit. In other words, the model-data-fit was sufficient (χ^2:3.858, p>.05). Besides, the predictive variables (technology budget, technology ownership, renewal/update time, the number of utilized Internet applications and Internet usage habits) were analyzed, and they explained 22.7% of the variance in the variable of high innovativeness of the model. Accordingly, the predictive variables in the tested logistic model in a holistic fashion defined people reliably as those with a high and low level of innovativeness. The classification obtained as a result of the tested logistic model is given in Table 5.

Table 5. Classification Table

Observed	Predicted		Percentage correct
	Low level of Innovativeness	High level of Innovativeness	
Low level of innovativeness	132	19	87.4%
High level of innovativeness	51	42	45.2%
Overall % correct			71.3%

As it is clear from Table 5, the tested logistic regression model categorized people with 71.3% accuracy as those with a high and low level of innovativeness in terms of technology usage profiles. Also, the sensitivity ratio of the model for classification was 45.2%, and the specificity ratio was 87.4%. The misclassification ratio of those with a low level of innovativeness was 27.9%, and the misclassification ratio of those with a high level of innovativeness was 31.1%.

Table 6. Predictors of the Logistic Model

Predictors	*B*	SE *B*	Wald's χ^2 (df=1)	*p*	e^B (odds ratio)
Amount of money spent on technological device purchase	-0.001	0.001	1.648	.199	0.999
Monthly cost of technological device usage	0.016	0.007	5.952	.015*	1.017
Smartphone ownership (1=yes, 0=no)	0.454	0.332	1.867	.172	1.574
Tablet ownership (1=yes, 0=no)	0.465	0.457	1.034	.309	1.592
Laptop ownership (1=yes, 0=no)	-0.411	0.362	1.291	.256	0.663
Computer ownership (1=yes, 0=no)	0.103	0.435	0.056	.812	1.109
Internet ownership (1=yes, 0=no)	-0.217	0.333	0.423	.515	0.805
Mobile Internet ownership (1=yes, 0=no)	0.343	0.345	0.990	.320	1.410
Web site ownership (1=yes, 0=no)	0.038	0.311	0.015	.903	1.039
Blog ownership (1=yes, 0=no)	-0.679	0.328	4.297	.038*	0.507
Mobile phone update time	0.076	0.171	0.199	.655	1.079

Predictors	β	SE β	Wald's χ^2 (df=1)	p	e^{β} (odds ratio)
Computer update time	-0.121	0.267	0.207	.649	0.886
The number of utilized Internet applications	0.151	0.067	5.047	.025*	1.162
Internet usage habit	0.318	0.136	5.448	.020*	1.375
Constant	-2.991	1.095	7.459	.006*	0.050

*p<.001, Note: The dependent variable in this analysis is innovativeness coded so that 0= low innovativeness and 1= high innovativeness

As it is clear from Table 6, only the following variables examined within the scope of the logistic regression model significantly contributed to the predictions of high innovativeness: monthly cost of technological device usage (*Wald's* χ^2*:* 5.952, p<.05), blog ownership (*Wald's* χ^2: 4.297, p<.05), the number of utilized Internet applications (Wald's χ^2: 5.047, p<.05) and Internet usage habits (*Wald's* χ^2*:* 5.448, p<.05). Moreover, when the odds ratio (e^{β}) value of these variables was considered, the relative order of importance in the predictions of high level of innovativeness was as follows: Internet usage habits (e^{β}: 1.375), the number of utilized Internet applications (e^{β}: 1.162), monthly cost of technological device usage (e^{β}: 1.017) and blog ownership (e^{β}: 0.507).

Discussion and Conclusion

The study provides significant information from different points of view in the interpretation of the relationship between preservice teachers' innovativeness, their technology perceptions and their technology usage. To begin with, the relationship between personal innovativeness and technology usage profiles was consistent with the related literature. It is asserted in literature that those with a high ranking in terms of innovativeness use technology more frequently and intensively than others (Cuhadar, Bulbul & Ilgaz, 2013; Koroglu, 2014; Orun, Orhan, Donmez & Kurt, 2013; Sahin & Thompson, 2006; Zayim, Yildirim & Saka, 2006). In the study, the number of technologies of those with a high level of innovativeness (laptops, smartphones, internet, blogs etc.) was greater than those with a low level of innovativeness in terms of technology usage profiles of the preservice teachers, and the difference in between was statistically significant. Similarly, the number of utilized Internet applications of those with a high level of innovativeness (social networking sites, video sharing, virtual classroom, content development and so on) was greater than those with a low level of innovativeness, and the difference in between was statistically significant. Accordingly, intensive Internet usage of those with a high level of innovativeness was more than the Internet usage of those with a low level of innovativeness. This result is parallel to the finding that individuals with a high level of innovativeness, when compared to others, do online shopping using the Internet intensively (Suki & Suki, 2006) and take advantage of e-trade (Rosen, 2004). Also, those with a low level of innovativeness monthly spent more money on technology than others, and the difference in between was statistically significant.

Interestingly, in terms of preservice teachers, those with a high and low level of innovativeness had similar technology usage habits according to the research results. The types of technological devices for both groups were the same. In other words, there was no different technology in the two groups. The only difference in-between was that the preservice teachers with a high level of innovativeness used those technologies more intensively and in various ways when compared to the others. This situation reflects the effect of innovativeness on ICT perceptions or on

technology usage similarly to the one mentioned in the related literature (Agarwal & Prasad, 1998; Jackson, Yi & Park, 2013; Lu, Liu, Yu & Wang, 2008; Lu, Yao & Yu, 2005; Van Rijnsoever & Donders, 2009; Thakur, Angriawan & Summey, 2016). However, another point to highlight here is that those with a high and low level of innovativeness had smartphones and tablets with almost the same percentage of ownership. This recall the fact that the perceived characteristics of innovations suggested by Rogers (1995) and social or cultural factors besides innovativeness are influential on technology usage or technological preferences. Based on this finding, it could be stated that those with a low level of innovativeness do not restrict themselves with respect to the use of up-to-date technologies and that they buy technology for its cultural or societal value rather than for their own personal needs.

Another remarkable result is the difference in the technology usage habits of the preservice teachers who were the members of the same generation in consideration with their innovative characteristics in the context of technology. The above mentioned portable technological devices (smartphones, laptops) that the participants owned reflect the characteristics of digital natives. Technology is an integrated part of life for those who are members of a generation which might be called as “digital natives” (Prensky, 2001). However, technology usage frequency and ways of technology usage vary within the same generation in terms of innovativeness. Although those with a high and low level of innovativeness describe their Internet usage habits as sharer (follow, write comments and post something like text, image, video etc. in Internet /social media), those with a high level of innovativeness use Internet blogs more intensively. Blogs are social platforms where people freely mention personal opinions, feelings and thoughts. Therefore, it could be suggested that meta-cognitive thinking skills of those with a high level of innovativeness are stronger than those of individuals with a low level of innovativeness when one considers that users of such platforms are information producers and publishers rather than being information gatherers. In addition, this situation is supported by research findings showing that those with a high level of innovativeness have a greater access to the Internet and a greater number of utilized Internet applications, which is 50% more than those with a low level of innovativeness. In a study by Huang, Li and Chen (2009), it was concluded that competency in information technologies (IT) alone did not significantly affect innovativeness although the level of Internet technology usage was found to be a significant indicator in terms of innovativeness in the present study. Intensive and versatile Internet usage by those with a high level of innovativeness has remarkably proven that they could effectively use those technologies to suggest solutions to real life affairs, which makes technology and the internet more precious for them. Higher monthly technology usage and technological purchase budget allocated by those in the group support that result.

When it comes to technology usage habits, the following items are the indicators of innovativeness of preservice teachers, which was the focal point of the present study: Internet usage habits, the number of utilized Internet applications, monthly cost of technological device usage and blog ownership. Hence, it could be suggested that the above mentioned four characteristics among the studied technology usage habits are distinctive in terms of innovativeness. In the logistic regression model, technology ownership such as smartphones, tablets, laptops, personal computers, Internet and web sites, technology renewal/update time and technology budget were not considered to be distinctive in terms of innovativeness. Accordingly, those who actively used the Internet in different ways, who displayed meta-cognitive thinking and reflection skills online and who allocated more budget to technology were found to have a high level of innovativeness. Additionally, in the logistic regression model, Internet usage styles and versatility were the most leading factors in predicting high level of innovativeness among the listed technological predictors of innovativeness. This shows that

innovativeness interacts with the 21st century skills such as creativity, critical thinking, problem solving and decision making. According to the framework of the 21st century learning, students need to have the essential skills, knowledge and experience to be able to achieve their aspirations both during their academic and social life. One of the skills for students who are prepared for increasingly complex life and work environments in the 21st century is learning and innovation. These skills might be exemplified as creative thinking, problem solving, effective reasoning, working and collaborating with others creatively, making judgements and decisions, implementing innovation and communicating clearly (Partnership for 21st Century Skills, 2010). Moreover, innovativeness is associated with digital wisdom, which is defined as wise use of technology to develop skills for finding solutions to real life problems (Prensky, 2009). Prensky (2009) suggests that a person with digital wisdom improves mental capacity, deep analysis, planning and prioritizing skills by using digital technologies rationally. The role of education in increasing innovative skills should never be ignored, whether they are associated with the 21st century skills or digital wisdom. It is asserted in related literature that organization-based drawbacks constitute the main obstacle in front of innovativeness (Kilicer & Odabasi, 2013). The first one of these drawbacks includes lack of activities planned by educational organizations and courses to support innovativeness and lack of examinations or assignments to encourage creativity. Also, Celik (2013) points out that there is a significant relationship between innovativeness and instructional skills. For this reason, education systems with an emphasis on innovativeness will indirectly contribute to technology usage in the following ways: online information production and publishing, opinion expression on social networking sites, and smart solutions to real life affairs on the basis of digital technologies. As a result, according to the logistic regression model, a great number of technologies, high technology budget and active Internet usage, particularly displaying meta-cognitive thinking and reflection skills on the Internet are the most significant indicators of individuals with a high level of innovativeness.

Limitations and Implications

In this study, technology usage characteristics that could be used to define those with a high level of innovativeness were examined within the framework of logistic regression model. One of the significant limitations of the model is that it was applied to preservice teachers from various departments of an education faculty because technology usage habits at faculties or departments of higher education institutions could vary (Mahmood, 2009). Another limitation of the study is the number of preservice teachers with a high level of innovativeness and the number of those with a low level of innovativeness in the model. The results might be better interpreted when the numbers in both groups are converged and when the groups include those who precisely reflect the characteristics of the group. Lastly, gathering participants' responses through an inventory could be regarded as another limitation in the present study.

In the light of the above-mentioned limitations, the model could be tested with a research sample including homogenous groups of participants with high and low levels of innovativeness. In addition, new models involving different variables such as level of income, number of technological products owned and number of applications installed on mobile technologies could be tested. Also, further qualitative research on technology usage habits in a broader perspective could be conducted. To sum up, studies could be conducted to show the effects of the relationship between technology and innovativeness on digital wisdom or the effects of socio-economic features on innovativeness.

The results of the present study revealed that the variables of technology usage budget, blog ownership, utilized Internet applications and Internet usage habits contributed significantly to the prediction of individuals with high levels of innovativeness. These variables obtained in the model can be used in the phase of making decisions regarding innovativeness. This situation will be beneficial especially for practitioners in terms of instructional design and technology teaching. Educational institutions could be involved in various training programs related to emerging technologies so that they can increase their students' levels of innovativeness. This could not only allow teaching students how to use the emerging technologies but also help increase their levels of innovativeness. In addition, making use of these variables, teachers can make rapid decisions regarding students' levels of innovativeness at the beginning of the instructional design process. Thanks to this, interesting and innovative in-class activities which will develop students in a multi-faceted manner could be designed. Moreover, students can make use of the variables in question while forming heterogenous groups by taking students' levels of innovativeness into consideration during project-based group works.

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