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Does innovativeness matter in technology adoption? Addressing pre-service teachers' intention to use ITs

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Abstract

This study aims to identify the factors influencing pre-service teachers' use of information technologies in educational settings and to validate a technology acceptance model that is extended by employing variables related to innovativeness. The data were collected from 1819 pre-service teachers studying in 12 different teacher education programs of a state university. For the analysis, PLS-SEM technique was employed. The results showed that the most influential construct on intention was the perceived usefulness, and the strongest relationship was found between social influence and perceived usefulness. In addition, the relationships between openness and the core technology acceptance constructs were found to be significant. These findings suggest that the openness to change trait is crucial for instructors and the opinions of people who are important to pre-service teachers and social pressure are the primary factors influencing their views in performance increase they can achieve by using technology. Accordingly, social norms, motivational-emotional factors and personality traits regarding innovativeness may have a vital role in technology adoption both theoretically and practically.

1. Introduction

The enrichment of learning and teaching activities with information technologies (IT) is among the important issues of the modern education. Especially in today's world trying to adapt to living with the pandemic. Education has experienced a sudden and extensive digital transformation due to the pandemic and various institutions around the world have had to change their training methods into ITs. In this context, effective use of IT has become more critical and the importance of educators' use of technology has become a much more vital issue. The fact that it is a prerequisite for educators to be competent in using IT in education in order to create successful learning processes makes ITs more vital for today's education (Garone et al., 2019; Şahin et al., 2022). Accordingly, the successful use of ITs in educational settings is closely associated with teacher education (Valtonen et al., 2015), and the emphasis is placed on the importance of pre-service teachers' ability to effective use of ITs in their future lessons (Wong et al., 2012).

The rapid growth of new ITs has brought the integration of educational technologies into a new era (Teo et al., 2019). However, technology alone cannot ensure the competent use of ITs. In order for the acceptance of technology to be well understood, it can be mentioned that there is a requirement to examine especially the factors that have the potential to influence intention. In line with this, determining the variables that

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influence the pre-service teachers' intentions to use ITs will make important contributions to the field and to training teachers who are competent in using technology. In this context, the technology acceptance model (TAM), which has a simple and clear structure, is regarded as one of the leading models (King & He, 2006; Şahin et al., 2021).

Innovativeness plays an important role in the adoption of innovations in both theoretical and practical contexts (Thakur et al., 2016). The studies demonstrate that innovativeness characteristics deeply affect technology acceptance and innovative individuals are more leading in the acceptance of new technologies (Yi et al., 2006). It is stated that innovativeness characteristics of students affect their perception of both ITs (e.g. e-learning) and interaction with materials in education (Bervell et al., 2019; Şahin, 2016). It can be said that it is important for pre-service teachers to be trained as more innovative individuals with the necessary technology efficacy in order to use IT in teaching and learning. Accordingly, it was deemed important to include variables related to innovativeness among the external constructs to be added to TAM. The fact that the constructs related to innovativeness have been relatively less studied within the scope of technology acceptance also makes the findings to be obtained about these constructs more valuable. It is predicted that examining the factors influencing IT acceptance of pre-service teachers, and the potential relationships within the proposed model will make significant contributions to the field. Accordingly, this study aims to reveal the variables that influence the IT acceptance of pre-service teachers, and to validate an extended TAM for teacher education.

2. Literature and Hypotheses

2.1 Technology acceptance model

Technology acceptance model (TAM) is one of the fundamental models in the field of education. TAM is expressed as a robust, reliable and effective model (Davis, 1989; Venkatesh et al., 2003). Moreover, thanks to its simple structure, it provides the opportunity to extend the model in many different ways without making it complicated (Bagozzi, 2007; Venkatesh et al., 2003). TAM has been a vital model in the context of technology acceptance over the past years (Lu et al., 2019), and in many studies, the model has been extended by adding various constructs. The constructs included in the study are perceived usefulness (PU), perceived ease of use and efficacy (PEUE), behavioral intention (BI). Behavioral intention (BI) is defined as the intention of an individual to use technology. Perceived usefulness is expressed as the belief of an individual about the increase in performance he/she will obtain using technology. Perceived ease of use is explained as the degree of an individual's perception of how little effort will be required to use a technology (Davis, 1989), and efficacy is defined as an individual's assessment of the skill he/she has in order to use a technology effectively (Yuen & Ma, 2008). In the context of education, there are various studies showing that PEUE, PU and BI are closely related (Baydaş, 2015; Şahin, 2016; Şahin et al., 2021; Ursavaş, 2014). Accordingly, the following hypotheses were proposed.

H1. PEUE has a significant influence on PU.

H2. PEUE has a significant influence on BI.

H3. PU has a significant influence on BI.

2.2 Facilitating Conditions

Facilitating conditions (FC) can be expressed as the factors in the environment that may affect an individual's task and the perceptions of individuals regarding facilitating factors (Venkatesh et al., 2003; Şahin et al., 2021). It is stated that FC are influential in the use of IT in teaching (Baydaş, 2015; Teo, 2009) and in terms of attitude (Lai et al., 2012). Accordingly, it is important to examine the effect of FC on pre-service teachers' ability to integrate IT into their lessons. The following hypotheses regarding facilitating conditions were proposed.

H4. FC has a significant influence on PEUE.

H5. FC has a significant influence on BI.

2.3 Social Influence

Social influence (SI) can be defined as an individual's perception of the opinions of those he or she deems important that the individual should use technology (Ajzen & Fishbein, 1980). It is observed that SI is related to the social factors that affect the technology acceptance (Chan et al., 2017; Teo, 2010; Wong, 2015), and in most of the previous studies, the relationships of SI with the technology acceptance constructs have been determined (Abdullah & Ward, 2016; Venkatesh et al., 2003). Accordingly, the following hypotheses were proposed.

H6. SI has a significant influence on PEUE.

H7. SI has a significant influence on PU.

H8. SI has a significant influence on BI.

2.4 Anxiety

Anxiety (ANX) can be defined as an individual's state of anxiety and uneasiness about using technology. The studies indicate that negative emotions can emerge when trying to fulfill a technology-related task (Sanchez-Prieto et al., 2017). Even though the use of IT in education has increased nowadays, educators are not completely comfortable and that one of the key obstacles to successful IT integration is anxiety (Baydaş, 2015; Şahin, 2016). In addition, influence of anxiety on various acceptance constructs have been determined in the literature (Baydaş & Göktaş, 2017; Şahin et al., 2021; Şahin & Şahin, 2021). In this direction, the following hypotheses were proposed.

H9. ANX has a significant influence on PEUE.

H10. ANX has a significant influence on PU.

H11. ANX has a significant influence on BI.

2.5 Personality Traits in the Context of Innovativeness

It is emphasized in technology acceptance studies that individuals' tendencies to accept new technologies may differ significantly (Nov & Ye, 2008). In previous studies, efforts have been made to examine the innovativeness characteristics that affect individuals' technology acceptance decisions (Yi et al., 2006). Innovativeness can be expressed as the degree to which individuals adopt innovations relatively quickly compared to other individuals in their social systems (Rogers & Shoemaker, 1971). In the literature, the concept of innovativeness is expressed as a permanent personality trait or tendency that determines how an individual perceives-reacts to an innovation (Yi et al., 2006), and it is stated that a high level of innovativeness will generate more positive reactions (Ali, 2019).

It is emphasized that innovativeness contributes to the understanding of beliefs about technology acceptance, helps individuals to identify new technology adoption processes, and affects their dissemination among individuals (Agarwal & Prasad, 1998; Nov & Ye, 2008). Accordingly, innovation traits may have a role in pre-service teachers' intention to use technology. In terms of innovativeness, resistance to change, openness, risk-taking, and opinion leadership constructs which have solid theoretical foundations in the literature, were added to the model (Hurt et al., 1977; Kılıçer & Odabaşı, 2010).

2.5.1 Resistance to Change

In various information system studies, findings have been obtained on understanding why individuals tend to exhibit different behaviors in different settings (Thatcher & Perrewé, 2002). Resistance to change (RC)

manifests itself as one of the individual differences that are important in the context of technology acceptance. RC, which is related to tendency to resist changes and is highlighted as one of the crucial behaviors in technology adoption, has been examined within the scope of information systems (Nov & Ye, 2008). It is stated that RC, which is a vital factor in the context of IT adoption, is a barrier that should be overcome (Bhattacherjee & Hikmet, 2007). Considering pre-service teachers' perception of the benefit that will be provided using technology, it can be inferred that their opinions about the increase in performance that can be obtained are related to resistance to change. Accordingly, the following hypothesis was proposed.

H12. RC has a significant influence on PU.

2.5.2 Openness

Openness (OPN) is associated with reason and intelligence. OPN is defined as individual's sensitivity to new things (such as ideas and experiences) (Korukonda, 2007). OPN has characteristics such as mental curiosity, open-mindedness, imagination and originality (Ali, 2019; Weele, 2013), and showing interest in information-seeking behaviors (Bozionelos et al., 2014). Individuals with this feature are more resistant to uncertainty and are willing to take risks by trying (Kirton & De Ciantis, 1986), and tend to change their ideas and beliefs as a result of new knowledge and experiences (Korukonda, 2007). OPN trait of teachers are regarded as a feature that influences their willingness to use ITs in education, facilitates the technology acceptance process, and influences educators' experimentation with innovations and their beliefs to take risks in education (Baylor & Ritchie, 2002). Accordingly, OPN of pre-service teachers may have an effect on core constructs of TAM. The following hypotheses were proposed regarding OPN.

H13. OPN has a significant influence on PEUE.

H14. OPN has a significant influence on PU.

H15. OPN has a significant influence on BI.

2.5.3 Risk-Taking

Considering the uncertainty about the situation and the seriousness of the consequences for the situation together is used to express the concept of risk (Bauer, 1960). The studies indicate that perceived risk can affect users' behavioral intention and performance expectation (Luo et al., 2010), effort expectation (Martins et al., 2014), and perceived usefulness (Im et al., 2008). In line with this, it can be interpreted that the risk and the reactions of individuals regarding the risk will affect their tendency to try innovations and technology acceptance. In parallel, it can also be stated as important to consider in terms of risk that some individuals are more willing and more inclined to take risks and try new technologies than other individuals based on their personality traits (Yi et al., 2006) and are more motivated in the face of uncertainties (Kılıçer & Odabaşı, 2010). It can be said that risk taking (RT) and the ability to cope with them are important in terms of both PEUE and PU for pre-service teachers to successfully integrate IT into their lessons. Accordingly, the following hypotheses were proposed.

H16. RT has a significant influence on PEUE.

H17. RT has a significant influence on PU.

2.5.4 Opinion Leadership

Opinion leadership (OPL) is examined as the characteristics that make an individual stand out from other individuals within the group in which he/she is involved and is addressed as one of the main characteristics of innovativeness (Kılıçer & Odabaşı, 2010). In the context of education, the impact of individuals with vision and leadership skills who can direct changes in the success of technology integration is especially emphasized (Baylor & Ritchie, 2002). In parallel, it can be stated that pre-service teachers who can exhibit

their ideas and technological leadership characteristics will tend to use technology. In line with this, the following hypothesis was proposed.

H18. OPL has a significant influence on BI.

The research model is presented in Figure 1.

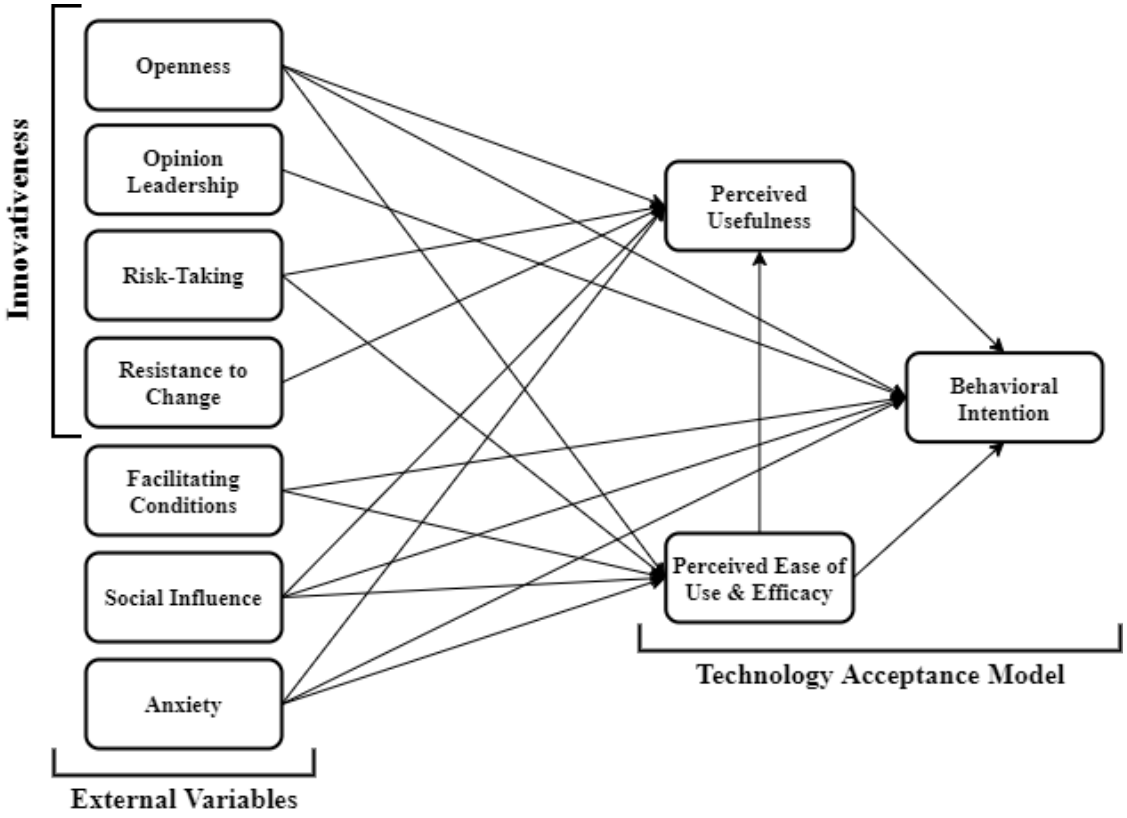

Fig 1. Research Model

3. Methodology

3.1. Research Design

Based on the quantitative research approach, this research was designed as a survey model; within the scope of the research hypotheses, causal relationship analysis (path modeling) was used. In the context of path modeling, the partial least squares structural equation modeling (PLS-SEM) technique was employed.

3.2. Data Collecting Tools

The 1st section of the measurement tool focuses on the personal information of pre-service teachers. In the second section, a 5-point Likert-type (1 = *strongly disagree*; 5 = *strongly agree*) scale consisting of 10 factors and 50 items was used. The items of the tool were adapted from Baydaş & Göktaş (2017) (perceived usefulness, perceived ease of use, facilitating conditions, social influence, anxiety, behavioral intention) and, Kılıçer & Odabaşı (2010) (resistance to change, openness, risk-taking, opinion leadership). The variables determined within the scope of the study consist of items that can effectively measure the variables selected according to the theoretical foundations within the context of the proposed model. For this purpose, the items were adapted from measurement tools using the same theoretical infrastructure as this study and validated with participants with similar characteristics in the field of education.

Validity and reliability tests were carried out in the original studies of the scales. The construct validity (exploratory and confirmatory factor analysis) and reliability of the original scales were tested. The results

of the analysis of the original studies revealed that the construct validity of both scales was established and that the instruments performed consistent measurements (Baydaş, 2015; Baydaş & Göktaş, 2016; Baydaş & Göktaş, 2017; Kılıçer, 2010; Kılıçer & Odabaşı, 2010). In addition to these, both validity (confirmatory factor analysis, convergent validity, discriminant validity) and reliability (item loadings, Cronbach's alpha, composite reliability) tests were carried out in the context of model assessment of the scales adapted within the scope of this study. The validity and reliability tests of the measurement tool, and the test results are presented in detail under sections 3.5 and 3.6.

3.3. Participant Group and Data Collection

Before the data collection process, the measurement tool was examined by the experts in the field of instructional technologies. In this way, it was ensured that the content validity was tested. After expert opinions, a pilot study was conducted with the participation of 12 pre-service teachers. With the pilot study, the clarity of the expressions in the measurement tool and the average completion time of the tool were determined. After examining the content validity with expert opinions and examining the intelligibility of the items with the pilot study, the main data collection process was started. In this process, the data of the research were collected face to face, and it was clearly stated that the participation in the data collection process was completely voluntary. The participant group of the study consists of pre-service teachers studying at a state university. The data were collected from 1819 pre-service teachers studying in 12 different programs. From among the collected data, the data of 70 participants were removed due to reasons such as outliers and repetitive answers. In this process, firstly, mahalanobis distances were calculated. In the next step, the thresholds specified in the literature were determined according to the number of variables of the study, and the data outside these critical points were excluded from the scope of the research. After the cleaning process, the data of 1749 participants formed the final version of the data. 1749 pre-service teachers correspond to 47.1% of total 3717 students studying in 12 programs. The profiles of the participant group (*department, course year, gender*) are summarized in Table 1.

Table 1.

Profile of the participants

Departments		***f***	***%***
Computer Education & Instructional Technologies		138	7.9
English Language Teaching		272	15.6
German Language Teaching		125	7.1
French Language Teaching		89	5.1
Primary School Education		185	10.6
Social Studies Education		117	6.7
Primary School Mathematics Teaching		145	8.3
Pre-school Education		122	7.0
Education of the Hearing Impaired		150	8.6
Education of the Mentally Disabled		142	8.1
Guidance and Psychological Counseling		139	7.9
Arts and Crafts Education		125	7.1
Course Year	**1**	408	23.3
	2	532	30.4
	3	458	26.2
	4	351	20.1
Gender	**Female**	1141	65.1
	Male	608	34.9

3.4. Data Analysis

Partial least squares structural equation modeling (PLS-SEM) employed for the analysis. In the literature, PLS is recommended if the model tested in structural equation modeling is complex (Hair et al., 2017). Furthermore, features of PLS such as its suitability in determining the presence of the relationships, and its applicability in exploratory models are emphasized (Hair et al., 2011). Based on this, PLS-SEM was preferred for analysis. During the analysis, convergent and discriminant validity tests of the measurement model were carried out and the relationships in the structural model were examined.

3.5. Validity and Reliability

The Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) values were examined to evaluate the convergent validity. The discriminant validity was examined according to Fornell-Larcker criterion and the heterotrait-monotrait **(**HTMT) ratio (Fornell and Larcker, 1981; Hair et al., 2017).

3.6. Findings and Discussions

The α, CRI, and AVE values were examined to evaluate the convergent validity. It was observed that values were above 0.7 for α and CR, and above 0.5 for AVE (Hair et al., 2017). In addition, loadings of the scale items were between 0.609 and 0.891. In line with this, convergent validity was established (Table 2). RC1, RC7 and ANX6 were removed at this stage due to reliability and validity issues.

Table 2.

Assessment of convergent validity

Constructs	Items	Factor Loadings	α	CR	AVE
Behavioral intention	BI1	.891	.716	.875	.778
	BI2	.873			
Perceived usefulness	PU1	.842	.894	.922	.702
	PU2	.876			
	PU3	.857			
	PU4	.826			
	PU5	.785			
Perceived ease of use & Efficacy	PEUE1	.861	.876	.910	.671
	PEUE2	.818			
	PEUE3	.717			
	PEUE4	.842			
	PEUE5	.848			
Social influence	SI1	.761	.836	.880	.551
	SI2	.754			
	SI3	.798			
	SI4	.758			
	SI5	.752			
	SI6	.619			
Facilitating conditions	FC1	.874	.895	.920	.662
	FC2	.883			
	FC3	.864			
	FC4	.865			
	FC5	.615			
	FC6	.744			
Opinion leadership	OPL1	.712	.741	.837	.563
	OPL2	.788			
	OPL3	.752			
	OPL4	.748			
Openness	OPN1	.805	.830	.877	.544
	OPN2	.811			
	OPN3	.609			
	OPN4	.685			
	OPN5	.770			

	OPN6	.727			
Risk taking	RT1	.862	.691	.866	.764
	RT2	.886			
	RC2	.728			
	RC3	.736			
Resistance to change	RC4	.711	.812	.864	.514
	RC5	.708			
	RC6	.683			
	RC8	.733			
	ANX1	.636			
	ANX2	.811			
Anxiety	ANX3	.839	.816	.871	.578
	ANX4	.784			
	ANX5	.712			

The discriminant validity was examined according to Fornell-Larcker and HTMT. It was determined that AVE values was higher than the correlation indices of the square root (Table 3) and all of HTMT values were ideal for $HTMT_{85}$ (Table 4) (Fornell and Larcker, 1981; Hair et al., 2017). Thus, discriminant validity was established.

Table 3.

Fornell-Larcker criterion (Discriminant validity)

Constructs	PEUE	PU	FC	SI	ANX	OPN	RC	OL	RT	BI
PEUE	**.819**									
PU	.351	**.838**								
FC	.353	.534	**.813**							
SI	.113	.532	.366	**.742**						
ANX	-.345	-.326	-.291	-.064	**.760**					
OPN	.363	.426	.454	.270	-.286	**.738**				
RC	-.142	-.205	-.200	.001	.432	-.309	**.717**			
OL	.361	.306	.320	.175	-.202	.671	-.191	**.750**		
RT	.237	.235	.265	.191	-.127	.523	-.109	.378	**.874**	
BI	.457	.639	.484	.385	-.341	.447	-.167	.349	.278	**.882**

Table 4.

HTMT ratio (Discriminant validity)

Constructs	PEUE	PU	FC	SI	ANX	OPN	RC	OL	RT	BI
PEUE										
PU	.393									
FC	.386	.596								
SI	.128	.612	.429							
ANX	.397	.376	.327	.099						
OPN	.420	.490	.518	.319	.338					
RC	.167	.237	.232	.044	.535	.369				
OL	.445	.375	.389	.220	.257	.845	.250			
RT	.303	.297	.332	.249	.168	.687	.166	.526		
BI	.575	.797	.595	.491	.432	.575	.215	.478	.395	

The proposed model explained 44.3% of PU, 22.7% of PEUE, and 50.4% of BI. The results showed that all, except for the three of the proposed hypotheses (H6, H17, H18), were supported.

According to the results, the strongest relationship between TAM constructs is PU->BI. In the case of FC, all hypotheses proposed were supported. In addition, it was observed that the strongest of the relationships

regarding FC was related to PU. In terms of SI, the results showed that there were significant relationships with PU and BI. It is determined that the relationship of SI with PU was much stronger than its relationship with BI.

The analysis results on ANX showed that there were significant negative relationships between ANX and all core TAM constructs. Among these relationships, it was determined that ANX->PEUE relationship was the strongest. It was observed that the relationship between RC and BI was significant, but its relationship with PU was not significant. In the context of OPN, the results demonstrated that it had positive relationships with PEUE, PU and BI. The results indicate that the strongest relationship is between OPN and PEUE. The hypotheses regarding RT were supported for PEUE and not supported for PU.

The results demonstrated that the relationship between RT and PEUE was significant, while the relationship between RT and PU was not. In the context of OPL, it was concluded that relationship between OPL and BI was not significant. In addition, results showed that the effect size of SI->PU was large, PU->BI was medium, and effect sizes of the other relationships was small. The results are presented in Table 5 and Figure 2.

Table 5.

Hypothesis testing

Path	Co-Eff.	t-Value	p-Value	f^2	VIF	Results
PU -> BI	.402	14.509***	.004	.168[b]	1.933	Supported
PEUE -> BI	.202	9.160***	.000	.061[c]	1.356	Supported
PEUE -> PU	.171	7.792***	.000	.042[c]	1.255	Supported
SI -> BI	.077	3.351***	.001	.008[c]	1.466	Supported
SI -> PEUE	-.036	1.487(ns)	.137	.001	1.182	Not Supported
SI -> PU	.455	19.962***	.055	.341[a]	1.092	Supported
FC -> BI	.095	3.711***	.000	.011[c]	1.602	Supported
FC -> PEUE	.199	7.053***	.000	.036[c]	1.429	Supported
OPL -> BI	.029	1.101(ns)	.271	.001	1.877	Not Supported
OPN-> BI	.098	3.342***	.001	.009[c]	2.164	Supported
OPN -> PEUE	.181	5.938***	.000	.025[c]	1.682	Supported
OPN -> PU	.186	5.664***	.000	.037[c]	1.707	Supported
RT -> PEUE	.067	2.531**	.011	.004[c]	1.383	Supported
RT -> PU	-.016	.690(ns)	.490	.000	1.392	Not Supported
RC -> PU	-.055	2.481**	.013	.004[c]	1.311	Supported
ANX -> BI	-.074	3.477***	.001	.009[c]	1.247	Supported
ANX -> PEUE	-.229	8.845***	.000	.060[c]	1.136	Supported
ANX -> PU	-.163	7.258***	.000	.035[c]	1.377	Supported

p: ns ≥ 0.05; ∗ < 0.05; ∗∗ < 0.01; ∗∗∗ < 0.001. a: Large effect size. b: Medium effect size. c: Small effect size.

All hypotheses proposed with regard to the relationships between PU, PEUE, and BI were supported. The fact that PEUE->PU and PEUE->BI relationships are significant supports the findings of the previous studies regarding PEUE->PU (Jeong & Kim, 2017; Sumak et al., 2017; Teo, 2009; Teo, 2010; Teo et al., 2012; Wong, 2015) and PEUE->BI (Lai & Chen, 2011; Sanchez-Prieto et al., 2017; Wong et al., 2013). It can be interpreted that pre-service teachers' perceptions of the effort for the effective use of ITs may affect their perceptions of the increase in performance achieved by using IT and the intention to use the IT in education. The significant PU->BI finding overlaps with many other studies and supports the view that pre-service teachers' thoughts about the increase in performance they will obtain while making decisions about the use of IT in education are important (e.g. Bourgonjon et al., 2013; Jeong & Kim, 2017; Lai & Chen, 2011; Teo et al., 2012).

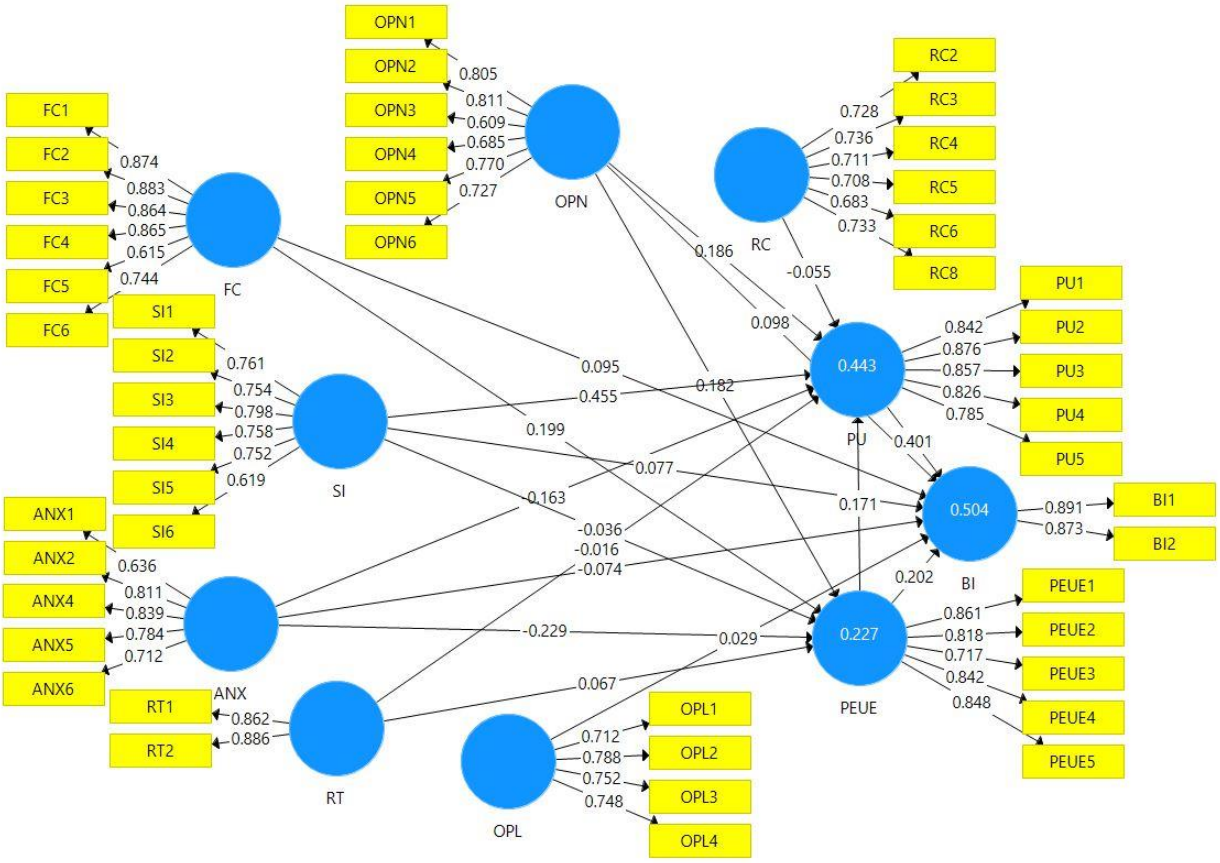

Fig 2. PLS-SEM results of the proposed model

The findings on social influence showed that SI->PU and SI->BI relationships were significant, whereas SI->PEUE relationship was not significant. It can be said that SI->PU finding, in general, supports the literature (Baydaş, 2015; Baydaş & Göktaş, 2017; Teo et al., 2008; Teo, 2011). These findings indicate that the opinions of people who are important to educators influence their views on the benefit they can obtain. However, the absence of this effect in terms of PEUE may be due to the high level of efficacy of pre-service teachers and their being benefit-oriented rather than ease of use. In terms of SI->BI, the study results emphasize that social influence affects the intention to use technology in educational processes. Although there are both overlapping (Baydaş, 2015; Sanchez-Prieto et al., 2019; Teo, 2012; Ursavaş, 2014) and contradicting results in previous studies (Teo, 2011; Wong et al., 2013), the results indicate that pre-service teachers may shape their tendencies to use IT in line with the thoughts of important individuals around them.

According to the results, hypotheses suggesting that FC is effective on PEUE and BI were supported. FC->PEUE relationship indicates that if pre-service teachers have sufficient technical support and training, they tend to think they will spend less effort to integrate IT into lessons. It is observed that previous studies have generally displayed similar results (Baydaş & Göktaş, 2017; Teo, 2010; Teo, 2012; Teo & van Schaik, 2012; Teo et al., 2018). Furthermore, it can be interpreted that the resources to be provided will make them feel more competent in terms of using IT effectively. On the other hand, it was revealed that the results obtained in terms of FC->BI both coincided with other studies (Baydaş & Göktaş, 2017; Teo, 2011; Ursavaş, 2014) and contradicted them (Teo, 2012; Wong et al., 2013). Accordingly, it can be said that the technical support, education and opportunities that pre-service teachers will have will affect their tendency to use IT in their lessons.

The results showed that ANX had negative effects on PEUE, PU, and BI. The findings in the context of PEUE are similar to previous studies (Baydaş, 2015; Baydaş & Göktaş, 2017). ANX->PEUE relationship

indicate that the anxiety and fear of pre-service teachers about using IT in their lessons are effective on their self-efficacy and their perceptions of the effort they will spend for technology use. The reports of ANX as one of the important reasons for negative perceptions of IT, low usage, low level of satisfaction, and reluctance to try new technologies supports the results of the study (Baydaş, 2015; Thatcher & Perrewe, 2002; Ursavaş, 2014).

ANX->PU result suggests that pre-service teachers' anxiety and fears about technology negatively affect their perceptions of the increase in performance by using ITs. Considering that individuals' beliefs in their skills for performing a certain task reduce their anxiety regarding the task in question (Bandura, 1977), it can be stated that if the anxiety of pre-service teacher's decrease, they will be more inclined to the thoughts that they can increase their performance using these technologies. Finally, ANX->BI showed that pre-service teachers' anxiety negatively affected their intention to employ ITs and results were in parallel with the literature (Baydaş, 2015; Baydaş & Göktaş, 2017). It can be interpreted that the findings on ANX strengthen the views that anxiety has a vital role in the context of reluctance to try new technologies and that individuals with high computer anxiety will be more disadvantaged compared to their peers (Saade & Kira, 2007). Moreover, it can be said that the findings indicating that one of the most important obstacles to successfully integrating IT is anxiety towards technology in educational settings provide supporting evidence (Rahimi & Yadollahi, 2010; Şahin, 2021).

According to the results, it was revealed that RC was effective on PU. The results indicate that pre-service teachers' resistance to changes is related to their opinions about the increases in performance they will obtain using IT in education. The result obtained in terms of RC are similar to the literature (Sanchez-Prieto et al., 2019). Moreover, the results support the views that resistance to change is one of the barriers for the technology integration in education and that resistance is an important factor in terms of the effective use of IT in educational settings (Bhattacherjee & Hikmet, 2007; Bingimlas, 2009; Mayya, 2007).

All of the hypotheses regarding OPN were supported. OPN->PU result suggests that pre-service teachers who are open to new technologies tend to think that they can achieve performance increase by using IT. It can be stated that this result supports the findings that individuals who are open to experiences are prone to information-seeking behaviors and that individuals who are open to new experiences will find innovations more useful (Bozionelos et al., 2014; Sevendsen et al., 2013). The significant OPN->PEUE relationship indicates that pre-service teachers think that if they are willing to try new technologies, they can use them with less effort. Accordingly, it can be stated that being open to experience is related to technological efficacy (Baylor & Ritchie, 2002). OPN->BI result indicates that pre-service teachers' being open to experiences and changes will affect their intention to use IT in their lessons. These results provide evidence that supports the views that openness to change is an important internal factor for educators in terms of technology use and that it is effective in predicting the success of technology use and technology integration in education (Baylor & Ritchie, 2002; Mayya, 2007).

The analysis results showed that RT->PEUE relationship was supported, while RT->PU relationship was not. In the context of RT->PEUE, findings suggest that pre-service teachers who are willing to take risks find it easier to use IT in education and regard themselves as more competent. The results support the findings, such as the fact that individuals with risk-taking characteristics have more advanced technological knowledge (Yi et al., 2006) and that educators' ability to take risks in education affects their beliefs about change (Baylor & Ritchie, 2002). Furthermore, it can be interpreted that the findings indicating that the risk situation is important in predicting the intention and that risk-taking is one of the important predictors of technology acceptance and leadership is among the important characteristics are in line with the study (Ali, 2019; Mayya, 2007). In terms of RT->PU, it is thought that pre-service teachers' beliefs about coping with uncertainties regarding new ITs and the risk levels of possible consequences outweigh the performance increases to be obtained using IT in education.

According to the results, it was observed that OPL was not related to the BI. It can be said that a contrary result was obtained in terms of OPL->BI. Baylor and Ritchie (2002) emphasize the impact of individuals with vision and leadership skills who can direct changes in the success of integrating technology into educational processes. However, the expectation that the opinion leadership was to include the intention to use technology could not be confirmed. As a possible explanation to this result, the inability of beliefs about opinion leadership within the participant group to reach the levels that can affect the tendency to use IT in education.

4. Conclusion and Suggestions

Helping to better understand pre-service teachers' intention to use ITs in education and to provide valuable information by extending TAM with less-studied innovativeness-related constructs can be expressed as the main contributions of this study. In addition, the fact that this study was conducted with pre-service teachers from 12 different departments, can provide valuable information on the use of technology in education, both theoretically and practically.

All of the core constructs of TAM had strong relationships with each other. It was determined that the most significant effect on BI comes from PU. This finding indicates that the most significant influence on pre-service teachers' intention to use IT is focused on the increase in performance they will obtain through the use of technology in education. Given the big role of the usefulness in providing motivation (Şahin et al., 2021), in the integration studies to be planned, prioritizing the benefits that technologies can provide to instructors and being aware of these benefits may play a critical role.

The strongest relationship in the model was found between SI and PU. Considering previous studies, it can be considered as a rare finding that this relationship represents the strongest relationship in the model. This result suggests that the social pressure and the opinions of people who are important to pre-service teachers are the primary factors influencing their views in performance increase they can achieve by using ITs. In terms of emerging body of literature, this result indicates that the influence of SI is critical for pre-service teachers. In line with this, it can be stated that new studies that investigate social norms in more detail and comprehensively are needed. Moreover, it can be interpreted that regarding SI as a factor that should be focused more in the integration processes may provide important contributions to the field.

It was found that the effects of FC on PEUE and BI were significant. FC->PEUE and FC->BI relationships indicate that if pre-service teachers have supports in using ITs, they will find the effort required for the effective use of ITs more appropriate and tend to use IT in their lessons. In this respect, it can be stated that instructors' having at least basic support opportunities plays a key role. In terms of ANX, it is observed that all of the hypothesis are supported. The findings reveal that pre-service teachers' anxiety about using IT in education affects both their thoughts about ease of use, their beliefs about the increase in performance they can achieve, and their intention to use IT in their lessons. The results suggest that emotional factors may also have a big role in technology acceptance. Based on this, it can be said that it is important that future technology acceptance studies address emotional variables (e.g. playfulness, fear, frustration) in a more detailed and comprehensive manner (Beaudry & Pinsonneault, 2010; Şahin et al., 2021; Şahin et al., 2022a; Şahin et al., 2022b). In terms of training activities to be carried out for the effective use of technologies, it is important to consider the emotional states of educators in program designs and integration processes.

The relationships of OPN with all of the core TAM constructs and RC->PU were significant. According to the findings, being open to innovations and willing to try new technologies positively influence the perceptions about benefits to be obtained from ITs, the level of effort required for effective use, self-efficacy beliefs, and their tendency to use, and resistance to change negatively influence their perceptions of the potential benefit they can obtain from ITs. Accordingly, the fact that openness to change supports positive perceptions and IT usage tendency for PEUE and PU reveals a need for a more detailed study of this variable in order to understand technology adoption, and to improve teaching activities by integrating technology

better. However, it is important to take into account the findings that the effect of constructs like OPN and RC may be weakened in situations that make the use of technology in education mandatory, such as a pandemic (Şahin et al., 2021; Şahin et al., 2022a). Based on this, it can be inferred that more comprehensive studies on OPN and RC are needed.

Apart from the suggestions for the focus of future studies, implications for practice are also critical. The fact that the relationships between social influence, perceived usefulness and intention were stronger than other relationships showed that the beliefs of pre-service teachers in the performance increase that the use of IT would be directly affected by the views of their immediate environment such as friends and peers. In other words, it is seen that the fact that the close environment of the pre-service teacher sees the relevant ITs as beneficial has an effect on their own perception of it and ensures a higher tendency to use technology. In this direction, it is critical that the technologies that will be used in educational processes are perceived by both pre-service teachers, teachers and instructors in a way that increases student success and professional performance. In order for the technologies to be included in the integration processes to have a design that will provide these perceptions and to increase the success of technology use in education, both policy makers, technology designers and instructional technologists should take these relationships into account.

On the other hand, the effects of facilitating conditions on technology in terms of ease of use, perception of efficacy and intention to use showed that usage conditions have a critical role in pre-service teachers' IT usage tendencies. Accordingly, factors such as software and hardware, infrastructure opportunities and technical support that pre-service teachers have are vital for the effective use of instructional technologies. From this point of view, for technology to be successful in educational environments, the critical role of education financing needs to be taken into account by policy makers and administrators. Another of the major conclusion of the study is the results related to the innovativeness factors. The results particularly shed light on the impact of openness and resistance to change on IT use. In this direction, before the implementation of the applications related to the use of technology in education, examining the personality traits related to innovativeness through field studies and determining the innovativeness categories of pre-service teachers' will provide valuable information about the adoption processes of ITs and will increase the success of the educational environments and activities where technologies are employed.

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