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Pre-Service Teachers' Individual Innovativeness and Technology Standards: An Exploratory Study

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This study examines the relationship between pre-service teachers' innovativeness levels and technology standards and their prediction of each other regarding various variables. In this context, the study sample consisted of 345 pre-service teachers who were randomly selected voluntarily from among the pre-service teachers studying at the Faculty of Education of a university located in the Black Sea Region of Turkey. In the data collection process, the Demographic Information Form developed by the researchers, the "Individual Innovativeness Scale" developed by Kilicer and Odabasi (2010) and the "Technology Use Standards Scale" developed by Misirli (2013) were used. Descriptive analyses were conducted to determine the individual innovation levels and technology use standards of teacher candidates. Independent sample t-test, and one-way analysis of variance were used. In cases where statistical differences were found as a result of the analyses, the eta-squared (η2) effect size was calculated to determine the degree of difference. In addition, Bonferroni correction was made in one-way analysis of variance (ANOVA) to control type I errors. Pearson correlation and multiple regression analyses were applied. According to the research findings, technology standards and individual innovativeness levels of pre-service teachers show a significant difference in the direction of males according to gender and a significant difference in the direction of the CEIT department according to the department they study. While it was determined that pre-service teachers' technology standards were significantly correlated with individual innovativeness levels and sub-dimensions, it was concluded that individual innovativeness and its sub-dimensions predicted technology standards at a significant level.

Introduction

In today's rapidly changing and increasingly digitalized world, the boundaries between societies are gradually dissolving. This transformation presents one of the most significant challenges for societies: keeping pace with change. In this process, knowledge

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emerges as the most powerful tool for adaptation. To thrive in this dynamic global environment, individuals must be able to access, process, and apply knowledge, transfer it across different contexts, and create new insights by building on what they already know (Kilicer, 2011; OECD, 2021). The ability to bridge the old with the new is a critical factor in societal progress. According to the Turkish Language Association (TDK, 2024), innovation involves replacing outdated or ineffective practices with new, beneficial, or efficient ones. Van Braak (2001) describes innovativeness as a willingness to embrace change, while Rogers (2003) defines it as the perception of ideas, concepts, or objects as new. Hurt et al. (1977) add another perspective, describing it as the eagerness to engage with and explore new experiences.

Fostering innovative individuals who can adapt to change is crucial for enhancing a society's capacity for innovation and supporting national development. Individuals who actively integrate technological advancements into their lives play a vital role in societal progress. Research shows that higher levels of individual innovativeness are associated with greater skills and motivation to acquire and utilize new knowledge (Yuan & Woodman, 2010). Being open to innovation is expected to contribute to the renewal and evolution of universal knowledge on a societal level. Adopting innovation, embracing change, and integrating these changes into everyday life are essential for both personal and societal advancement (Kilicer, 2011; Mishra et al., 2020).

In the information age, individuals are increasingly expected to not only use new knowledge but also generate it while fulfilling their professional and personal responsibilities (Vila et al., 2014). Assessing how open individuals are to innovation is key to understanding their levels of innovativeness. Rogers (1962) categorized the adoption of innovation into five distinct groups: innovators, early adopters, early majority, late majority, and laggards. These categories illustrate the varying degrees of receptiveness to innovation, offering insights into the behaviours and attitudes of individuals within the framework of the individual innovativeness approach (Schilling, 2022).

Individual Innovativeness

Individual innovativeness can be defined as an individual's integration of innovation into his/her life before other individuals around him/her (Flynn & Goldsmith, 1993). In another definition, individual innovativeness is generating new ideas, adopting them, creating appropriate conditions for implementation, and employing multiple methods in the implementation process (Yuan & Woodman, 2010). When individual differences are considered, the level of innovativeness, the time of innovation adoption (early or late), willingness, risk-taking and innovation behaviour of each individual in the society vary (Rogers, 1993).

The concept of innovativeness focuses on the openness of individuals and institutions to change and their ability to adopt and implement innovations (TDK, 2024) and is considered to be of great importance in education. Innovation in schools and institutions is related to realizing differences and positive changes, and innovation plays a vital role in education. Research on innovativeness reveals that individuals differ in their attitudes and behaviours towards innovations (Bhatnagar et al., 2000; Van Braak, 2001)

Individuals' approach to innovations is based on their reactions to innovation. While some prefer to take risks and accept innovation, others may avoid and approach innovation with scepticism. These different approaches are defined as different dimensions of individual

innovativeness: resistance to change, opinion leadership, openness to experience and risk-taking (Rogers, 2003). It is stated that resistance to change is usually caused by habits, resistance to change or lack of tolerance, fear of the future and personal characteristics. Opinion leadership refers to the degree to which an individual influences the attitudes or behaviour of others. It represents a power of influence beyond formal position or status. Individuals open to experience have high levels of imagination and curiosity, are open to innovation and often have creative characteristics. Risk-taking refers to tolerance for uncertainty and symbolizes individual innovativeness. Some people have higher risk-taking tendencies than others, associated with innovativeness (Coriat & Weinstein, 2004). Individual innovativeness is adequate in teachers' adoption and integration of new educational methods, resources and technology (Wu et al., 2022). However, the priority of educational programmes should be to provide the education that students need according to their interests, abilities, goals and level to compete internationally (Chiu et al., 2023).

This framework examines the concepts associated with teachers' openness to change, techno-pedagogical education competencies, and classroom technology use. Teachers' openness to change is associated with an increase in their self-confidence, the development of critical thinking skills and an increase in their prestige. Teachers' attitudes towards change and their cognitive, affective and behavioural readiness are essential in realizing change (Bitkin, 2012; Kilicer, 2011). In this context, it is essential to examine the innovativeness characteristics of teachers.

Teacher and Innovativeness

When the spiral of knowledge and education is analyzed, innovation can be defined as a holistic output of the knowledge acquired through education (Kolb & Kolb, 2009). There are some skills expected in individuals who can present innovative ideas. These are creative and critical thinking, questioning, communication, collaborative working and technology utilization skills (Musluoglu, 2008; Salpater, 2003). Individuals can only acquire such high-level thinking skills through education. In other words, the adoption of innovativeness and the development of innovativeness skills in individuals pass through education (Ozturk & Summak, 2014). Teachers are most crucial in acquiring innovation skills at formal and informal education levels. In the process of producing and disseminating innovation practices in society, it is thought that the contribution of teachers with these skills and educational institutions that adopt the understanding of innovation is essential (Acikgoz & Sengul, 2008). Teachers are expected to keep up with the innovation process in a changing world (Grigoropoulos & Gialamas, 2018). In order to keep up with changing expectations, teachers can emphasize their professional development with various innovative experiences (Sun & Shi, 2018). This situation emphasizes the importance of teachers' innovative behaviours. The educational needs of the developing age expect teachers to gain renewed professional and individual responsibilities (MoNE, 2018). Higher education institutions are the most critical place where teachers acquire knowledge within the framework of an organized and holistic programme before starting their professional lives. Therefore, faculties of education, which are institutions that train teachers, have to follow all the change processes and innovation studies going on in the world in order to train teachers who are contemporary, adopt innovation, think critically and think creatively (Apaydin & Guven, 2022). The most important reason for this is that pre-service teachers' ability to gain the skills of accessing suitable information sources and acquiring, processing, using, and integrating information at a higher education level can be reflected in their professional lives.

The more pre-service teachers are open to acquiring new knowledge and using it in their lives, the more innovative teachers they will be. In this direction, pre-service teachers' lifelong learning can also manifest as a possible process outcome. Lifelong learning process can be built on information literacy skills. It is possible for changing information to be processed and transferred to the next generations by teachers with high literacy and technology usage skills (Dedebali, 2020). The fact that the sources of information are increasingly presented through technological infrastructures requires pre-service teachers to have a good level of technology literacy and information literacy skills. When the standards determined by ISTE and the standards that teachers should have been examined, they are gathered into learner, leader, citizen, collaborator, designer, facilitator and analyst (ISTE, 2020). As can be seen from the category nomenclature, it is essential for teachers to learn knowledge first and be pioneers in transferring knowledge. At the same time, teachers are expected to use knowledge with the awareness of a citizen with responsibilities towards society, work in cooperation with different stakeholders in the knowledge production and transfer process, design the education and training process within the framework of innovations, facilitate the use of innovations and analyze their usefulness throughout the process (Aslan & Kesik, 2018).

The acquisition of these skills in teachers' professional life processes can only be achieved through professional development and in-service training activities. This situation may be a limitation for teachers who want to adopt innovation but need more time due to their responsibilities in both professional and private life. For this reason, acquiring the gains above from higher education institutions during the candidacy process of teachers can form the basis for innovation and technology usage skills to be gained radically.

Technology Use Standards

Technology literacy includes understanding, using and managing technology (ITEA, 1996). In this context, technologically literate individuals gain the ability to understand how technology is defined, how its nature is created, how it affects society and how it is affected by society. In this context, technological literacy is defined as having the skills of obtaining information from the right source, using the right technology and producing solutions to problems in the use of tools and equipment necessary to positively affect one's own life, society and the environment (Hansen, 2003).

As the importance of technological literacy has increased, the frequency of studies examining these skills has also increased. In this context, different countries and institutions have developed technology literacy standards. Teachers' technology use skills are thought to have an essential role in determining technology standards (Misirli, 2015).

Technology integration must be successful, and trained personnel, access to software and hardware resources, appropriate teaching and assessment approaches, technical support, vision, necessary policies, and set standards are needed. As a result, technology standards and individual innovation play an essential role in today's education system.

Purpose of the Study

The aim of this study is to examine the individual innovativeness behaviours of pre-service teachers in terms of technology usage standards and various variables. In this context, answers to the following questions were sought.

(1) What are the levels of pre-service teachers' technology standards?
(2) What is the distribution of pre-service teachers' technology standards according to their gender and the departments they study?
(3) Do pre-service teachers' technology standards show a significant difference according to the departments they study?
(4) What are the individual innovativeness levels of pre-service teachers?
(5) What is the distribution of pre-service teachers' individual innovativeness levels according to their gender and the departments they study?
(6) Is there a relationship between individual innovativeness and technology standards of pre-service teachers?
(7) Do pre-service teachers' technology standard levels predict their individual innovativeness?

Method

Research Model

Correlational survey model was used in this research. This model can be used to determine the relationship between two or more variables and the level of the relationship (Creswell, 2003). This model was chosen in order to describe the technology standards and individual innovativeness levels of pre-service teachers and to reveal the relationship between them. In this direction, during the data collection process, the researchers did not intervene in the process in order to determine the current situation as it is. The process of conducting the research is explained in detail as follows.

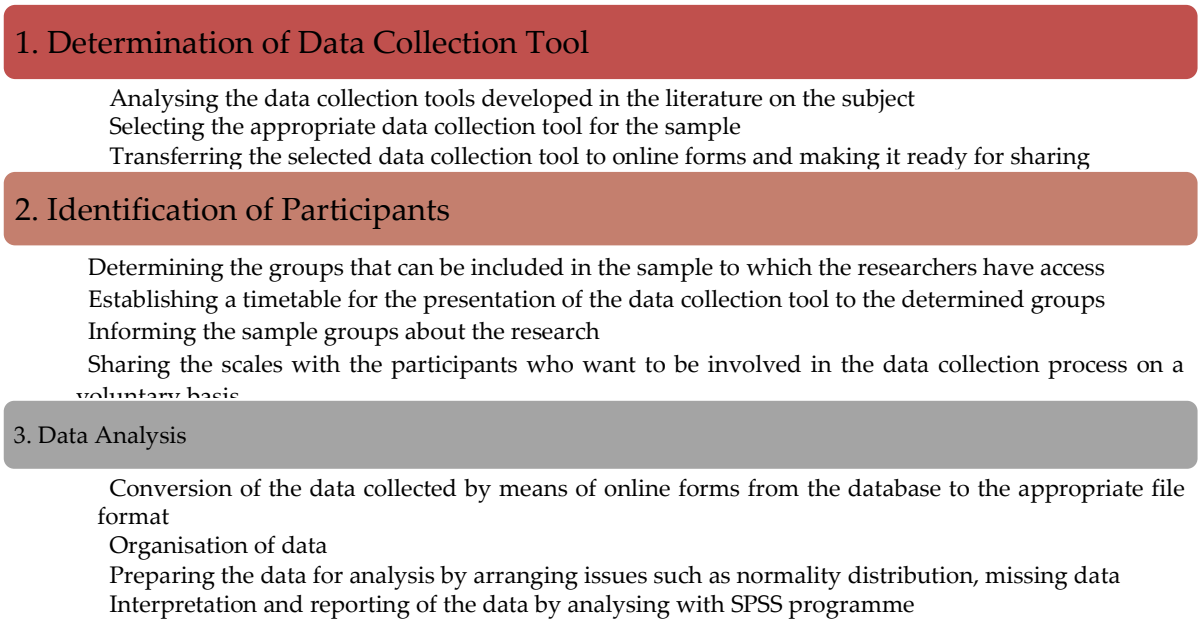

Figure 1. Research Stages

In the 1st stage, data collection tools were determined. In this context, scale development/adaptation studies published in the literature were analysed. Among these scales, the ones suitable for the sample level were selected. The selected data collection tool was transferred to online forms so that the data could be collected electronically. In the 2nd stage, it was determined to which sample group the data collection tool would be applied. The groups of pre-service teachers to which the researchers had access were selected by

evaluating the number of participants, the department they were studying and their ability to participate. The prospective participants were informed about the data collection process planned to be implemented within the scope of the courses taught by the researchers. The online link addresses of the data collection tools were shared by obtaining a declaration from those who voluntarily wanted to participate in the research among the candidates. Participants were allowed to fill in the forms for a total of 3 weeks. In the 3rd stage, the data obtained through online forms were recorded on computers from the relevant link address. File conversion and data editing processes were completed so that the saved files could be used in data analysis. Before the actual analysis, normality distributions of the data, removal of missing data, missing data loss situations were examined, and the data were made ready for analysis. The data pool ready for processing was analysed, interpreted and reported through the SPSS programme. The information obtained as a result of these stages is detailed under the following headings.

Data Collection Tools

The following scales were used to collect the data:

Demographic Information Form: It was prepared to obtain general information about the pre-service teachers included in the sample. The form includes questions about gender, grade level and department, where they get internet access, for what purpose they use the internet, and how often they use the internet.

Individual Innovativeness Scale: The Turkish translation of Kilicer and Odabasi's (2010) original Hurt et al. (1977) 5-point Likert-type scale with 20 items was used. The measure has four dimensions: "resistance to change," "opinion leadership," "openness to experience," and "risk-taking." The data exhibits a high level of internal consistency, as shown by an overall coefficient of .82 and a trustworthy test-retest reliability of .87. Those are classified according to their scores into several categories: those with scores over 80 are labeled as "Innovators," those with scores between 69 and 80 are classified as "Early Adopters," those with scores ranging from 57 to 68 are classed as "Early Adopters," those with scores between 46 and 56 are labeled as "Late Majority," and individuals with scores below 46 are classified as "Laggards." In addition, scores below 64 indicate a low level of innovativeness, whilst scores beyond 68 reflect a high level of innovativeness. It is mentioned by Kilicer & Odabasi (2010) as:

“The scale consists of 12 positive items (items 1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18, and 19) and 8 negative items (items 4, 6, 7, 10, 13, 15, 17, and 20). The innovativeness score is calculated by adding 42 points to the score obtained by subtracting the total score obtained from negative items from the total score obtained from positive items. With the help of the scale, a minimum score of 14 and a maximum score of 94 can be obtained. According to the scores calculated on the scale, individuals can be categorized in terms of innovativeness. Accordingly, individuals are interpreted as "innovators" if the calculated score is above 80 points, "pioneers" if between 69 and 80 points, "questioners" if between 57 and 68 points, "skeptics" if between 46 and 56 points, and "traditionalists" if below 46 points”.

Technology Standards Scale: The scale created by Misirli (2013) with 21 items in 5-point Likert type was used. The Cronbach Alpha reliability coefficient of the scale is 0.88. Mean score calculation is used in the scale. Accordingly, it is suggested that the mean TS scores should be interpreted as "very inadequate" in the range of 1-1.8, "inadequate" in the range of 1.81-2.60, "moderate" in the range of 2.61-3.40, "adequate" in the range of 3.41-4.20, and

"very adequate" in the range of 4.21-5.00 (Misirli, 2013).

Sample of the Study

A total of 345 pre-service teachers studying in different departments and grade levels at a state university education faculty located in the Black Sea region and selected randomly participated in the study. The distribution of pre-service teachers according to gender, grade level and the classes they study is presented in Table 1.

Table 1. Demographic Information on the Teacher Candidates

Variables	Groups	f	%
Gender	Female	241	69,8
	Male	104	30,1
Class Level	1. Class	152	43.4
	2. Class	38	10.8
	3. Class	42	12
	4. Class	104	29.7
	Repeat	6	1.71
Department	Turkish Language Education	51	14.7
	Primary Education	22	6.37
	Social Sciences Education	24	6.95
	CEIT (Computer Education and Instructional Technology Education)	72	20.8
	Pre-School Education	148	41.1
	Arts Education	28	8.11
Total		345	100

According to Table 1, 241 (69.8%) of the pre-service teachers participating in the study were female, 104 (30.1%) were male. When the class levels were analyzed, it was determined that 152 (43.4%) of them were in the first grade, 38 (10.8%) in the second grade, 42 (12%) in the third grade, and 106 (30.72%) in the fourth grade. 1 participant did not answer the grade-level question. When the departments of the pre-service teachers were examined, it was determined that 51 (14.7%) of the participants were studying at the department of Turkish Language Education, 22 (6.37%) were at primary education, 24 (6.95%) were at social sciences education, 72 (8.11%) were at computer education and instructional technology education, 148 (41.1%) were at Pre-School Education and 28 (8.11%) were at arts education.

Data Analysis

The data was collected through online forms prepared on the Internet. The online form database was used without digitizing the data. Before the analysis, the normal distribution of the data was examined. Accordingly, the data were accepted as normal since they were between the values of -1.5 and +1.5 with the .49 and .88 distribution score (Tabachnick & Fidell, 2013). Firstly, a descriptive analysis was used to determine pre-service teachers' individual innovativeness levels and technology usage standards. An independent sample t-test was used to assess the differentiation of pre-service teachers' individual innovativeness levels and technology standards according to gender, and a one-way analysis of variance was used to determine the differentiation according to department and grade level. In cases with a statistical difference due to the analyses, the degree of difference was determined by calculating the eta-square ($\eta 2$) effect size. In addition, a Bonferroni correction was made to control type I errors in a one-way analysis of variance (ANOVA). Pearson correlation and multiple regression analyses were applied to reveal the relationships between pre-service teachers' individual innovativeness levels and technology usage standards.

Results

Within the scope of the research, the findings related to the technology standards and individual innovativeness levels of pre-service teachers on various variables were revealed. In this context, the study was analysed within the framework of 5 research questions. The findings related to the research questions are analysed under the following headings.

Technology Standard Levels of Pre-Service Teachers

Within the framework of the 1st research question, the levels of pre-service teachers' technology standards were analysed. According to the analyses, the findings related to the technology standards of pre-service teachers and their mean and standard deviation values are presented in Table 2.

Table 2. Technology Standards Levels of Pre-Service Teachers

Variables	n	Mean/k	SD	Level
Technology Literacy	345	4.28	.74	Very Adequate
Creativity	345	3.52	1.02	Adequate
Digital Citizenship and Attendance	345	3.76	.77	Adequate
Innovativeness	345	3.97	.87	Adequate
Technology Standards	345	3.99	1.21	Adequate

As seen in Table 2, it can be determined that the mean values of pre-service teachers' technology usage standards and sub-dimensions can be seen. According to table, the highest mean score belongs to the Technology Literacy factor ($\bar{x}$=4.28); and the lowest average score belongs to the Creativity factor ($\bar{x}$=3.52). And the total average of technology Standards of pre-service teachers is $\bar{x}$=3.99. According to the data of this 5-point Likert scale, it can be said that the average scores of pre-service teachers' general technology standards are above the average scale score. According to the original scale, a mean score in the range of 3.41 - 4.20 means that the technology standard is at the "adequate" level (Misirli, 2013). Accordingly, the technology standards of the pre-service teachers participating in the study were determined at the "adequate" level.

Within the framework of the second research question, the distribution of pre-service teachers' technology standards according to gender and department of study was analysed. The findings are presented in Table 3 and Table 4.

Table 3. Technology Standards Levels According to the Gender

Variables	Gender	n	Mean	SD	f	t	p	Level
Technology Literacy	Female	241	4.26	.76	345	.85	.00	High
	Male	104	4.34	.70				
Creativity	Female	241	3.42	1.004	345	2.81	.00	Moderate
	Male	104	3.75	1.03				
Digital Citizenship and Attandance	Female	241	3.70	.74	345	2.34	.00	Moderate
	Male	104	3.91	.81				
Innovativeness	Female	241	3.89	.88	345	2.69	.00	High
	Male	104	4.17	.82				
Technology Standards	Female	241	3.94	.71	345	2.20	.00	Moderate
	Male	104	4.12	.65				

According to the data presented in Table 3, the technology usage standards of men ($\bar{x}$ = 4.12, classified as High) are higher than those of women ($\bar{x}$ = 3.94, classified as Moderate). When the distribution of the sub-dimensions is analysed, it is seen that both males ($\bar{x}$ = 4.34, classified as High) and females ($\bar{x}$ = 4.26, classified as High) have the highest mean score in the Technology Literacy sub-dimension. Conversely, the lowest mean score for both males ($\bar{x}$ = 3.75, classified as Moderate) and females ($\bar{x}$ = 3.42, classified as Moderate) belongs to the Creativity sub-dimension. These classifications emphasize that while overall technology usage standards are higher for men, both genders demonstrate strong competence in technology literacy, with creativity being relatively less developed for both groups. The distribution of pre-service teachers' technology standards according to their departments of study is presented in Table 4.

Table 4. Technology Standards Levels According to the Departments

Departments	n	Mean	SD	Level
1. Turkish Language Education	51	3.82	.70	Moderate
2. Primary Education	22	4.12	.85	High
3. Social Sciences Education	24	3.89	.62	Moderate
4. CEIT	72	4.35	.57	High
5. Pre-School Education	148	3.88	.67	Moderate
6. Arts Education	28	3.97	.74	Moderate

According to the data presented in Table 4, the highest average score of technology standards belongs to the students studying in the CEIT (Computer Education and Instructional Technology) department ($\bar{x}$ = 4.35, classified as High), while the lowest average score belongs to the students studying in the Turkish Language Education department ($\bar{x}$ = 3.82, classified as Moderate).

These classifications highlight that students in IT-intensive departments tend to have higher technology standards, likely due to their exposure to technology-oriented coursework, whereas students in non-technical departments, such as Turkish Language Education, exhibit comparatively lower levels. To determine whether there is a significant difference between pre-service teachers' technology standards and the department they study, One-way analysis of variance was used, and the results were obtained in Table 5.

Table 5. Difference of Technology Standards Levels According to Departments

Source of Variance	Sum of Squares	df	Mean Square	F	p	Effect size
Between groups	13.34	5	2.66			
Within groups	154.69	339	.45	5.84	.00	.05
Total	168.03	344				

Within the framework of the third research question, according to the table data in which it is analysed whether there is a significant difference according to the departments in which prospective teachers study technology standards. When the data presented in Table 5 were analysed, it was determined that the technology standards of pre-service teachers did not show a significant difference according to the department they studied (F=5.84; p>.05).

Individual Innovativeness Levels of Pre-Service Teachers

Within the framework of the fourth research question, individual innovativeness levels of pre-service teachers were analysed. According to the analyses, the findings related to the technology standards of pre-service teachers and the mean and standard deviation values are presented in Table 6.

Table 6. Individual Innovativeness Levels of Pre-service Teachers

Variables	n	Mean	Mean/k	SD	Level
Resistance to change	345	26.85	3.35	4.41	High
Opinion leadership	345	15.00	3.00	3.27	Moderate
Openness to experience	345	17.46	3.49	3.10	Moderate
Risk taking	345	8.62	4.31	1.22	Low
Individual Innovativeness	345	63,64	3,18		Moderate

According to the data presented in Table 6, when the individual innovativeness levels of pre-service teachers are analysed according to the scale evaluation criteria, it is seen that pre-service teachers fall into the category of "early adopters" based on the general scale score ($\bar{x}$ = 63.64, classified as Moderate) (Kilicer & Odabasi, 2010). Since the scoring of the technology standards scale is interpreted through the average score, the total score was divided by the number of items to calculate the average scores for the general and sub-dimensions of the individual innovativeness scale. According to the results obtained: The highest mean score belongs to the "Openness to Experience" factor ($\bar{x}$ = 3.49, classified as Moderate). The lowest mean score belongs to the "Opinion Leadership" factor ($\bar{x}$ = 3.00, classified as Moderate). These findings suggest that pre-service teachers demonstrate consistent levels of openness to new experiences while showing relatively lower leadership tendencies in adopting innovations. Both factors fall within the moderate level of innovativeness, aligning with the early adopter category. Within the framework of the fifth research question, the distribution of pre-service teachers' Individual Innovativeness Levels according to gender and department of study was analysed. The findings are presented in Table 7 and Table 8.

Table 7. Individual Innovativeness Levels According to the Gender

Variable	Gender	n	Mean	SD	df	t	p	Level
Resistance to change	Female Male	241 104	22.12 23.22	6.55 6.70	342	2.11	.08	Moderate
Opinion leadership	Female Male	241 104	14.69 15.72	3.21 3.34	342	2.69	.00	Moderate
Openness to experience	Female Male	241 104	17.45 17.43	3.05 3.21	342	.53	.00	Moderate
Risk Taking	Female Male	241 104	6.54 6.44	.91 1.04	342	.94	.00	Low
Individual Innovativeness	Female Male	241 104	60.83 62.83	9.53 9.87	342	1.76	.00	Moderate

When the data presented in Table 7 are analysed, it can be said that individual innovativeness levels of male pre-service teachers ($\bar{x}$ = 62.83, classified as Moderate) are significantly higher than those of female pre-service teachers ($\bar{x}$ = 60.83, classified as Moderate) (t = 2.95; p < .05). When individual innovativeness sub-factors were analysed: Opinion Leadership scores of male pre-service teachers were higher ($\bar{x}$ = 15.72, classified as Moderate), While Openness to Experience ($\bar{x}$ = 17.45, classified as Moderate) and Risk Taking ($\bar{x}$ = 6.54, classified as

Low) scores were higher for female pre-service teachers. However, it is observed that the Resistance to Change sub-factor levels of pre-service teachers' individual innovativeness show a statistically significant difference according to gender (t = 2.11; p > .05). This indicates that while males exhibit slightly higher leadership tendencies, females demonstrate more openness to new experiences and a moderate tendency toward risk-taking, aligning both genders within the moderate innovativeness level overall. The distribution of pre-service teachers' individual innovativeness levels according to the department they study was obtained in Table 8.

Table 8. Individual Innovativeness Levels According to the Departments

Departments	n	Mean	SD
1. Turkish Language Education	51	57.66	8.77
2. Primary Education	22	66.22	11.30
3. Social Sciences Education	24	58.91	9.51
4. CEIT	72	60.23	10.43
5. Pre-School Education	148	58.23	9.03
6. Arts Education	28	59.75	9.33

When the findings are examined, it can be seen that Information Technology ($\bar{x}$=73.12) is the branch with the highest average and Fine Arts ($\bar{x}$=68.83) is the branch with the lowest average. One-way analysis of variance was used to determine whether there was a significant difference between the individual innovativeness levels of teachers according to their branches. Table 9 was obtained as a result of the analysis.

Table 9. Individual Innovativeness Levels According to the Departments

Source of Variance	Sum of Squares	df	Mean Square	F	p
Between groups	1430,573	5	286,115		
Within groups	30693,989	339	90,543	3.160	.008
Total	32124,562	344			

Within the framework of the fifth research question, it was analysed whether the individual innovativeness levels of pre-service teachers showed a significant difference according to the departments they studied. When the relevant data presented in Table 9 were analysed, it was determined that there was a significant difference according to the department in which the pre-service teachers were studying (F=3.16; p<.005). Source of difference can be obtained from Table 10.

Table 10. Comparison Between Groups

Group A	Group B	Mean Difference (M)	p-value	Significance
Turkish Language Education	Primary Education	9.03	15.8639	Not Significant
Turkish Language Education	Social Sciences Education	0.82	7.4565	Not Significant
Turkish Language Education	CEIT (Computer Education and Instructional Technology)	1.05	5.9598	Not Significant
Turkish Language Education	Pre-School Education	2.0	6.3487	Not Significant

Turkish Language Education	Arts Education	1.43	7.7341	Not Significant
Primary Education	Social Sciences Education	-8.21	-0.2931	Significant
Primary Education	CEIT (Computer Education and Instructional Technology)	-7.97	-1.4425	Significant
Primary Education	Pre-School Education	-7.03	-0.9050	Significant
Primary Education	Arts Education	-7.6	0.0400	Significant
Social Sciences Education	CEIT (Computer Education and Instructional Technology)	0.23	6.5511	Not Significant
Social Sciences Education	Pre-School Education	1.18	7.0741	Not Significant
Social Sciences Education	Arts Education	0.61	8.0651	Not Significant
CEIT (Computer Education and Instructional Technology)	Pre-School Education	0.94	4.7942	Not Significant
CEIT (Computer Education and Instructional Technology)	Arts Education	0.38	6.3457	Not Significant
Pre-School Education	Arts Education	-0.57	4.9574	Not Significant

* Correlation is significant at the .05 level. ** Correlation is significant at the .01 level.

Table 10 shows the mean differences between the groups and the statistical significance of these differences. According to the results of the analysis, the largest mean difference was calculated as 9.03 between Turkish Language Education and Primary Education. However, this difference is not statistically significant (p = 15.8639). When the differences between other groups are analyzed: The difference between Turkish Language Education and Social Sciences Education was 0.82, p = 7.4565. The difference between Turkish Language Education and CEIT (Computer Education and Instructional Technology) is 1.05, p = 5.9598. The difference between Turkish Language Education and Pre-School Education is 2.00, p = 6.3487. The difference between Turkish Language Education and Arts Education is 1.43, p = 7.7341. Throughout the table, no significant difference was found between the groups as all p-values were above 0.05. This shows that the mean scores of the groups are statistically similar.

Findings Regarding the Relationship Between Individual Innovativeness and Technology Standards Levels

Within the framework of the sixth research question, it was examined whether there is a significant relationship between individual innovativeness and technology usage standards of pre-service teachers. Firstly, after the correlational analysis, the relationships between the variables were analysed by regression analysis. The data obtained are presented in Table 11 and Table 12.

Table 11. Relationship between Technology Standards Sub-Dimensions and Individual Innovativeness Levels

	Individual Innovativeness	**Resistance to Change**	**Opinion Leadership**	**Openness to Experience**	**Risk Taking**
Technology Standards	.45**	.40*	.34**	.32**	.44**

* Correlation is significant at the .05 level. ** Correlation is significant at the .01 level.

With the correlation analysis data presented in Table 11, the relationship between all sub-factors of technology standards and individual innovativeness levels of pre-service teachers was analysed. According to the data obtained, it was determined that there was a positive and moderate relationship between technology standards and individual innovativeness levels of pre-service teachers (r=.45; p<.01). In addition, it was determined that there was a positive and moderate relationship between the individual innovativeness levels of pre-service teachers and the sub-dimensions of Resistance to Change (r=.40; p<.01), Opinion Leadership (r=.34; p<.01), Openness to Experience (r=.32; p<.01) and Risk Taking (r=.44; p<.01).
Finally, Within the 7th research question, it was examined whether the technology standard levels of pre-service teachers predict their individual innovativeness. In this context, multiple regression analysis was performed to determine the extent to which pre-service teachers' individual innovativeness and its sub-dimensions predict technology standards levels. Related findings are presented in Table 12.

Table 12. Multiple Regression Analysis of Individual Innovativeness on Technology Standards

	B	**Std. Error**	**Beta**	**t**	**p**
CONSTANT	1.58	.214	-	7.39	.00
Resistance to Change	.173	.079	.156	2.18	.030
Opinion Leadership	.229	.068	.215	3.36	.001
Openness to Experience	-.020	.069	-.018	-.288	.773
Risk Taking	.288	.036	.393	8.03	.00

R= .55, R^2= .308, F= 37.77, p< .01

According to the data presented in Table 12 technology standards were found to be a significant predictor of individual innovativeness (R=.55; R2=.308; p<.01). In other words, it can be said that technology standards explain 22% of individual innovativeness level. When the ranking for the prediction of sub-dimensions is examined, according to the standardised regression coefficients (β), Resistance to Change (R2=.58, p<.01) explains the highest rate and Opinion Leadership (R2=.12, p<.01) explains the lowest rate. The lowest predictive power was on Openness to Experience and Attendance (R2=.07, p<.01) and Risk Taking (R2=.05, p<.01) factors.

When the p values related to the significance of regression coefficients were analysed, it was concluded that Resistance to Change dimension (p<.001) and Opinion Leadership dimension (p<.01) were significant predictors of individual innovativeness, but Openness to Experience (p>.05) and Risk Taking dimensions (p>.05) were not significant variables in predicting individual innovativeness.

Discussion & Conclusion

In this study, technology usage standards and individual innovativeness levels of pre-service teachers were examined in terms of various variables. The predictive status of individual innovativeness and its sub-dimensions on technology standards were determined. In the study, the individual innovativeness levels of pre-service teachers were consistent with the level of "early adopters". When the literature is examined, it is seen that there are studies with similar results (Akcanda, 2022; Baki, 2023; Celikoz & Kolemen, 2020; Gunduz, 2021). In this respect, although it is thought to have obtained results parallel to the studies in the literature, it was determined that there are also studies with an individual innovativeness level of "early adopters" (Aslan & Kesik, 2018; Cetin & Bulbul, 2017; Demir & Demir, 2023).

According to the findings examining the technology standards of pre-service teachers according to gender, it was determined that the average scores of males were slightly higher than females. When the changes in technology standards according to gender were examined, it was concluded that there was a significant difference between them. Although similar results are parallel to the results of the study conducted by Gunes (2019), and Pozas & Letzel (2023), it is seen that opposite results can also be obtained in the literature, as in the results of the studies conducted by Misirli (2015) and Ozciftci & Cakir (2015), and Hatlevtik & Hatlevik (2018).

When the technology standards of pre-service teachers are analysed according to the department of study, it is seen that the students with the highest average score belong to the Department of Computer and Instructional Technology Education. When the course contents of the department are analysed, it is usual that studying in a department where IT group courses are intensive affects this result. When the significance between the departments was analysed, it was determined that the difference was significant. Thanks to this finding, increasing the level of pre-service teachers' knowledge about information technologies will also increase their technology standards. According to the results of another study in which students from the Department of Computer and Instructional Technology Education were not included, it was revealed that the scores of students in the Department of Science Education regarding the use of technology were at a higher level than other departments (Departments of Elementary Education, Mathematics Education, Preschool Education, Psychological Counseling and Guidance, Social Sciences Education and Turkish Language Education) (Arseven, Orhan, & Arseven, 2019).

When the individual innovativeness levels of pre-service teachers were analysed, it was determined that they were at the level of "early adopters" according to the scale's total score. In the literature, it is seen that studies are reaching similar results (Yilmaz, 2018; Yilmaz & Beskaya, 2018). However, there are also various studies in the literature that teachers or pre-service teachers are highly innovative (Ozgur, 2013; Yilmaz et al., 2014).

According to the findings of the research question in which the individual innovativeness levels of pre-service teachers and gender distribution were examined, although it was determined that the general individual innovativeness levels of men were higher than women, it was determined that women's risk-taking and openness to experience levels were higher than men based on sub-dimensions. In addition, it was determined that there was a significant change in individual innovativeness levels according to gender. When the literature is examined, it is seen that although the findings are supported by some results (Shim & Kotsiopulos, 1994; Turhan, 2009), there are also studies (Korucu & Olpak, 2015; Rogers & Wallace, 2011) that reach the opposite conclusion (McQuiggan, 2006) or that there is no difference between groups. According to Sun and Jeyaraj (2013), innovators and early adopters see themselves as innovative or having sufficient experience, and they state that the decision to adopt an innovation at an early stage may result from the characteristics of the individual and the innovation.

According to the results of another research question in which the differentiation of pre-service teachers' innovativeness levels according to the department they are studying, it was determined that the highest level of individual innovativeness was found among the students of the Department of Computer Education and Instructional Technology (CEIT) and the difference between the groups was significant. When the literature is examined, it is seen that there are studies with similar results (Kert & Tekdal, 2012) studies that conclude that there is

no significant difference (Orun et al., 2015). In addition, according to the findings of the table in which the difference between the groups is analyzed, the differences observed between the groups are not based on a specific factor and these differences may be due to variations between the groups. In order to obtain more precise results, it is recommended to increase the sample size or to apply different analysis methods. In addition, the lack of significant differences may also indicate that there may be a homogeneous structure between the groups.

According to the findings of the last research question in which the relationship and prediction status between individual innovativeness level of pre-service teachers and technology use standards were examined, it was determined that individual innovativeness and its sub-dimensions Resistance to Change, Opinion Leadership, Openness to Experience and Risk Taking have a direct and significant relationship with technology standards. In addition, it was determined that individual innovativeness predicted technology standards at a significant level. In this case, the frequency of showing behaviours belonging to the general average or sub-dimensions will increase the standards of technology use. When the literature is examined, although there are studies examining the relationship between technology standards and individual innovativeness with many different variables, it is noteworthy that there need to be more studies to examine both. In this respect, the study offers a different perspective on the literature.

In line with these results, developing the innovativeness skills of students studying at all levels of educational environments will enable students to develop problem-solving skills, gain different perspectives, increase their creative thinking skills, use technology effectively, and develop innovative pedagogical practices. In this context, it uses various methods and provides continuous support by considering students' different learning styles and needs. In addition, it can be said that there is a need for more in-depth studies examining the effects of factors such as gender and department on technology usage standards and innovation levels. In other words, there is a need to conduct studies in different countries to explore comparable effect sizes and directions of these relationships in future studies.

Implications

In this section, implications are given in the light of the information obtained as a result of the research. In this context, implications can be categorised under five main headings.

(1) Enhancing Innovativeness Skills: The findings suggest that fostering innovativeness skills among pre-service teachers is crucial. Developing problem-solving abilities, promoting creative thinking, and encouraging innovative pedagogical practices can be achieved by incorporating activities and methods that stimulate innovation in educational environments.
(2) Exploring Gender Differences: The study highlights the importance of understanding gender differences in technology usage standards and innovativeness levels among pre-service teachers. Educators should delve deeper into the factors influencing these differences and tailor interventions accordingly to ensure equitable opportunities for all genders.
(3) Curriculum Development in IT-Intensive Departments: Given that students in departments with intensive IT coursework exhibited higher technology standards, there is a need to integrate comprehensive IT education into teacher preparation programs. Enhancing pre-service teachers' knowledge of information technologies can

positively impact their ability to integrate technology effectively into teaching practices.

(4) Further Research and Comparative Studies: The study underscores the necessity for more extensive research to explore the relationships between technology use standards, innovativeness levels, and various influencing factors. Comparative studies across different countries can offer valuable insights into the generalizability of findings and help identify universal trends or culturally specific nuances.

(5) Continuous Professional Development: Continuous professional development programs should be designed to equip educators with the skills and knowledge necessary to effectively integrate technology into teaching and promote innovation in educational settings. These programs should be tailored to address the specific needs and challenges identified in the study, ensuring their relevance and effectiveness.

In conclusion, the study emphasizes the importance of nurturing individual innovativeness skills and enhancing technology use standards among pre-service teachers. By addressing gender disparities, leveraging departmental strengths, and conducting further research, educators can effectively prepare pre-service teachers to meet the demands of modern education and contribute to innovative teaching practices.

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Author 1: Writing- Reviewing, Funding acquisition, Conceptualization, Writing-Original Draft Preparation, Methodology, Formal analysis, Software, Data curation.

Author 2: Writing-Reviewing, Editing; Discussion and conclusion, Implication, and future work.

Conflict of Interest

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Informed Consent

All participants provided informed consent before taking part in the study. Participation was voluntary, and all data were collected in compliance with ethical standards.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.