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Teacher Candidates' Innovativeness and Attitudes Towards Artificial Intelligence: A Relational Study

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Abstract

This study aims to examine the relationship between teacher candidates' individual innovativeness levels and their attitudes towards artificial intelligence. In particular, it focuses on whether there is a significant relationship between these two variables and investigates whether teacher candidates' demographic characteristics lead to any differences. Within the scope of the research, the relationship between teacher candidates' individual innovativeness and their attitudes towards artificial intelligence was examined with respect to variables of gender, department, grade level, and research experience with artificial intelligence. A relational survey model was employed, and data were collected from 459 teacher candidates. The Individual Innovativeness Scale and the General Attitude Towards Artificial Intelligence Scale were used as data collection instruments. As a result of the analyses, no significant difference was found in the overall individual innovativeness profiles of teacher candidates based on gender. However, statistically significant relationships were observed for department, grade level, and research experience with artificial intelligence. Regarding attitudes towards artificial intelligence, significant differences emerged for gender, department, and grade level, whereas no statistically significant difference was found for the research experience with artificial intelligence. Finally, a correlation analysis revealed a very weak positive relationship that was not statistically significant between teacher candidates' individual innovativeness levels and their attitudes towards artificial intelligence.

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Introduction

With the rapid proliferation of technological advancements and the increasing role of artificial intelligence (AI) in various fields, including education, It is believed that teacher candidates' approaches to this technology may significantly impact educational processes and contribute to the integration of this technology into education. The growing use of AI in education is noteworthy, and it is deemed important to understand how individuals approach this technology and how these approaches are shaped by social and individual differences. The innovativeness levels of teacher candidates may be a determining factor in their attitudes towards AI, as innovativeness can play a crucial role in the adoption of new knowledge and skills and their integration into teaching environments.

Previous studies indicate that teachers' attitudes towards AI technologies vary, with some expressing concern over the pace of AI development (Azarfam & Jabbari, 2012). Research also suggests that such concerns and levels of trust may differ depending on individuals' innovativeness traits, as there is evidence linking innovativeness to perceptions of technostress (Çetin & Bülbül, 2017; Çetin & Aktaş, 2021). Therefore, revealing the relationship between the individual innovativeness levels of teacher candidates and their attitudes towards AI is crucial for both developing educational environments that meet the demands of the age and ensuring the adaptation of teachers, who will play an active role in these environments, to these technologies.

It is important to investigate how the innovativeness levels of teacher candidates might affect their tendency to adopt and adapt to AI, especially since AI has only recently established a significant place in modern life. The idea that this research could provide an answer is thought to be important for understanding the extent to which and in what contexts teacher candidates might use AI nce in their future professional practices. Understanding the effects of demographic characteristics collected from teacher candidates on their individual innovativeness levels could provide significant data for identifying differences in innovativeness among various demographic groups and how these differences might be reflected in the educational process. Similarly, it is thought that demographic factors could also influence teacher candidates' attitudes towards artificial intelligence. Determining the impact of these factors has the potential to contribute to institutions by informing how the instruction and teaching of artificial intelligence are reflected in curricula and how educational strategies tailored to different groups can be developed.

Innovativeness is defined as a fundamental characteristic for the development of individuals and institutions in the educational process (Kocasaraç and Harataş, 2018). The innovativeness of teachers can play a critical role from various perspectives, such as improving learning processes and supporting students' creativity in the field of education (Yenice and Yavaşoğlu, 2018). Furthermore, the use of artificial intelligence in education is also important for providing solutions that support teachers' individual learning experiences. In this context, examining the effects of individual innovativeness and attitudes towards artificial intelligence on teacher candidates can offer suggestions on how these candidates might contribute to educational environments in the future.

Teacher candidates' attitudes toward AI are not monolithic but are characterized by a complex duality. On one hand, there is considerable optimism regarding AI's potential to create personalized learning environments, reduce administrative workloads, and increase student engagement (Kesim et al., 2025; Tlili et al., 2024). On the other hand, this optimism is tempered by significant concerns. These include ethical issues such as data privacy and algorithmic bias, threats to academic integrity, and a profound *pedagogical uncertainty* regarding AI's impact on the teacher's role, the nature of knowledge, and the development of students' critical thinking skills (de Fine Licht, 2024; Hong, 2023; Williams, 2025). This tension suggests that pre-service teachers' approach to AI is less about simple technology adoption and more a process of negotiating their professional identity and values.

Within the technology adoption literature, individual innovativeness—an individual's openness to new ideas and technologies—has long been established as a key predictor of acceptance. Framed by Rogers' (2003) Diffusion of Innovations theory, individuals classified as "innovators" and "early adopters" are known to embrace new technologies more readily than their peers. Previous research in education has confirmed a positive correlation between teachers' innovativeness and their positive attitudes toward general educational technologies (Örün et al., 2015; Tondeur et al., 2017). This established pattern creates an expectation that teacher candidates with highly innovative profiles would similarly demonstrate a positive disposition toward AI.

Artificial intelligence technologies have the potential to transform teaching processes, and it is believed that teachers' adaptation to this transformation will increase educational efficiency. Therefore, it is anticipated that teacher candidates who adopt the use of artificial intelligence with an innovative approach will be able to use more flexible, student-centered, and effective teaching strategies in their future classroom practices. This situation suggests that teacher candidates with high levels of innovativeness may be more willing and successful in integrating AI-based tools and techniques into classroom dynamics.

As the idea and potential of using artificial intelligence in education have been realized, it is now possible to witness its use in real-life applications and complex tasks, beyond virtual environments. For educational purposes, ed-tech companies in the sector have developed 'Adaptive Learning Systems' applications and have applied to use these systems to assist with issues such as classroom management, second language learning, grading, and assessment (Guan, Mou, & Jiang, 2020). However, research in the literature shows that some teachers have expressed views that artificial intelligence technologies are developing too rapidly and that this development is not a positive sign (Azarfam and Jabbari, 2012).

Given this context, this study investigates the relationship between the individual innovativeness profiles of teacher candidates and their attitudes towards artificial intelligence. The research also examines the relationship of collected demographic characteristics with the individual innovativeness profiles and attitudes towards artificial intelligence of teacher candidates. To achieve this, the study seeks to answer the following specific questions:

1. Do the individual innovativeness levels of teacher candidates differ according to:
    - Gender,
    - Department,
    - Current grade level,
    - Research experience with artificial intelligence?
2. Do the attitudes of teacher candidates towards artificial intelligence differ according to:

- Gender,
- Department,
- Current grade level,
- Research experience with artificial intelligence?

3. Is there a relationship between the attitudes of teacher candidates towards artificial intelligence and their individual innovativeness levels?

Innovativeness

Innovativeness is broadly defined as the capacity of individuals to adapt to new technologies and changing circumstances (Korucu & Olpak, 2015). According to the Turkish Language Association (TDK, 2010), it refers to "the state of being innovative." In educational contexts, innovativeness is often associated with traits such as risk-taking, leadership, and creativity (Yenice & Yavaşoğlu, 2018).

According to Rogers' Diffusion of Innovations theory (2003) categorizes individuals into five groups based on their adoption behavior: innovators, early adopters, early majority, late majority, and laggards. These categories reflect varying levels of openness to change, willingness to take risks, and speed of adopting new ideas. When we consider the concept of innovativeness individually, we can see that it brings forth states of 'risk-taking, tolerance, willingness to gain new experiences, and acceptance .' In the literature, it is possible to encounter numerous studies that investigate and work on the concept of innovativeness in almost every field. There are also studies showing that an innovative society positively affects the performance, development, and service delivery duration of organizations (Jeong et al., 2018; Oldham and Cummings, 1996; Scott and Bruce, 1994; Yuan and Woodman, 2010).

Innovators, having a high tolerance for uncertainty, are more inclined to take risks associated with the uncertainties that innovations bring. In addition, innovators have characteristic traits such as moving quickly and acting boldly (Rogers, 1995). Innovative individuals can approach events with a holistic perspective, notice related situations, make inferences about events by thinking analytically, and achieve creative results (Çavuş, 2006). Early adopters, on the other hand, generally have a high level of education, are actively involved in social events, possess strong communication skills, and are considered a type of opinion leader in their community (Greenhalgh, 2004). Early adopters are distinguished by their proficient use of technology, appreciation for change, and a willingness to engage with innovations through risk-taking (Mumcu and Koçak, 2004).

The Early Majority, however, acts a bit more hesitantly when it comes to risk-taking. This hesitation pushes them to conduct detailed research about the situation they face. However, they take risks for the innovations they encounter only when the results of their research are satisfactory. The most prominent feature of skeptical individuals (Late Majority) is their skeptical and cautious attitude towards innovations. They wait for innovations to gain wide acceptance in society and therefore generally adopt them later than other members of society. Conformity with social norms is very important for these individuals, and they accept an innovation only when they observe this conformity. They do not enter the adoption process unless they are sure about the reliability of the innovation (Rogers, 2003).

The most prominent feature of the Late Majority is their skeptical and cautious attitude towards innovations. They wait for innovations to gain wide acceptance in society and therefore generally adopt them later than other members of society. Conformity with social norms is very important for these individuals, and they accept an innovation only when they observe this conformity. They do not enter the adoption process unless they are sure about the reliability of the innovation (Rogers, 2003).

Laggards tend to maintain the status quo and show resistance to change. They are reluctant to accept innovations and usually wait for these innovations to be widely adopted by the rest of society. These individuals tend to avoid the risks that innovations might bring to the existing social structure, and thus they exhibit a conservative attitude towards new ideas. Furthermore, laggards always approach new ideas and the people who present them with suspicion. For them to adopt an innovation, it must first be tried by others and have achieved successful results (Rogers, 2003).

The Importance of Innovativeness for Teachers

The institutions that are effective in the acceptance of innovations in societies and in shaping students' innovative perspectives are schools and teachers actively engaged in teaching activities (Gökbulut, 2021). Educational institutions need to have encourage the production of new knowledge and motivate students to learn (Bülbül and Göl, 2012). There are studies in the literature indicating that an attitude of innovativeness can be instilled in students and society through education, or that the development of innovative behaviors can be facilitated (Keskin, 2021). The existing literature indicates a positive correlation between the individual innovative dispositions of teachers and constructs such as their commitment to lifelong learning, technological proficiency, critical thinking abilities, and personal creativity (Yenice & Yavaşoğlu, 2018; Yenice & Tunç, 2019; Gündüz, 2020; Özgür, 2013).

In summary, the skill of innovativeness emerges as a competence that teachers should possess in multiple areas (creativity, critical thinking ability, technology use, commitment to learning). In addition to this, it is expected in accordance today that teachers be proficient in using technology, open to innovations and changes, able to adapt to them easily, and possess a structure that meets their professional competencies (Keskin, 2021). It is extremely important that teachers use the technologies they benefit from both in their daily lives and during their individual learning and teaching periods in line with their intended purposes to achieve maximum efficiency (Rogers, 2003).

Artificial Intelligence

Artificial intelligence is defined as the endeavor to comprehend the intricate cognitive architecture of the human mind with the goal of creating a comparable system (Ferik, 2003). Furthermore, it consists of computer programs and systems that can perform complex tasks, learn from data and interactions , and generate solutions to the problems they encounter. Today, the rapid advancement of technology and the ability to collect large amounts of information in short periods are laying the groundwork for the development and use of artificial intelligence applications. Artificial intelligence applications have increasingly integrated into almost every aspect of our lives and have come to the forefront in important areas such as energy, agriculture, economy, education, and health.

The History of Artificial Intelligence

Looking at the history of artificial intelligence, the 'Three Laws of Robotics', proposed in a story within the science fiction short story 'Runaround' in the mid-1940s, can be taken as a starting point. The first law is that a robot may not injure a human being or, through inaction, allow a human being to come to harm. The second law mandates that a robot must follow human commands unless they contradict the first law, while the third law requires a robot to preserve its own existence, provided this does not violate the first or second laws (Erdoğan, 2017). Another major step taken in more recent years was Alan Turing's role in the development of 'The Bombe' machine and his 1950 publication "Computing Machinery and Intelligence," along with the still-accepted 'Turing Test', which is a pioneering proposal in this field. The Dartmouth Conference in 1956, the ELIZA program, and the "General Problem Solver" can be considered as stepping stones in the rise of artificial intelligence. After these events, government support for AI projects increased, and projects began to gain acceptance (Haenlein and Kaplan, 2019). When examining the 1960s and 1970s, programs and systems were developed for use in chemistry and medical fields. In the following years, concepts such as machine learning and deep learning emerged, laying the foundations for the technologies that underlie many of today's projects.

It is possible to find studies in the literature that support the idea that artificial intelligence is one of the most constructive and powerful technologies of our current technological age. Based on this, it is considered necessary to uncover the attitudes of university students towards highly adaptable, high-potential artificial intelligence technologies—regardless of their professions or future plans—and to conduct studies aimed at positively developing these attitudes. Indeed, an education system that aims to perform beyond its era must provide good solutions to the needs of the time, be open to innovations, and continuously improve itself (Akkoyunlu et al., 2008). Furthermore, it is possible to see in the literature that artificial intelligence applications are used and have become widespread in many industries and society (Russell and Norvig, 2018). It is possible to see that the artificial intelligence technologies within the applications and methods we use today have become an important part of our daily lives and the internet.

Artificial Intelligence in Education

In the 21st century, one of the fields most impacted by and benefiting from AI technologies is education. AI applications in education are designed to support both students and teachers throughout the learning process, including in the design, analysis, and production of educational content (Tekin, 2023) Additionally, a special body of literature called Artificial Intelligence in Education (AIEd) has been established, which collects research on AI in education. Although artificial intelligence has many uses in education, in an article published by Chaudry and Kazim (2022), its purposes are grouped into 4 categories:

- Reducing teachers' workload without compromising the quality of learning outcomes.
- Creating of learner-centered course content and the personalization of course materials.

- The organization and development of assignments and teaching tasks to investigate not only what learners want to learn, but also how they learn and which pedagogies are more beneficial for them.
- For intelligent tutoring systems to provide students with an intelligent learning environment during the teaching process, offering personalized feedback, creating extra explanatory methods for selected topics, and enabling interaction with students.

As can be seen in the literature, artificial intelligence can be used in intelligent, personalized educational applications, provide interactive support through chatbots, and use algorithms to interpret students' body language to investigate whether the taught subject is sufficiently understood (Bisen, Nalcaci, Alagappan, and Yildirim, 2021). The literature shows that the existence of AI-driven systems that can adapt to the student when necessary and provide student-specific feedback (Luckin, Holmes, Griffiths, and Forcier, 2016). There are artificial intelligence applications that can assist teachers within educational institutions and also contribute to administrative decisions (Bisen, Nalcaci, Alagappan, and Yildirim, 2021).

Artificial intelligence applications that can be used in the educational process can help provide a transparent support process by tracking the success rate of subjects the student is learning and communicating deficiencies, which teachers may not always notice, to the student or their institution. At the same time, while AI-supported study environments can benefit the learner in terms of distance education and accessibility, AI-supported educational strategies can assist teachers in understanding students' learning analyses or tendencies by providing pedagogical information when needed (Aşık, et al., 2023). Conducting expensive-to-repeat experiments in AI-supported simulation environments can also provide economic support to institutions. Virtual reality or augmented reality-supported artificial intelligence applications can help students studying in departments such as design, architecture, chemistry, etc. Furthermore, the use of artificial intelligence in education can not only support educational systems but also create opportunities for innovative ideas and potential innovations (Roll and Wylie, 2016). It is worth noting that the categorization created by Baker and Smith (2019), which has established itself in the literature today—learner-centered AIEd, teacher-centered AIEd, and institutional systems-focused AIEd—is frequently used.

The Importance of Artificial Intelligence for Teachers

Recent literature highlights that artificial intelligence (AI) applications offer substantial benefits to teachers and educational institutions. According to Aşık et al. (2023), artificial intelligence can help teachers manage their time better, reduce their workloads, evaluate assignments effectively, and analyze student performance; it can also diversify teaching materials and produce different outputs. Furthermore, the literature indicates the existence of chatbots with natural language processing capabilities and contextual memory, which can provide instant natural feedback when needed in a student's education, and their use is stated to be beneficial (Kuhail et al., 2022). The ability of AI applications to provide feedback to students at their own pace and according to their needs can support efficient learning and enable teachers to spend more productive time with their students (Karaca, 2011). Based on the literature and practical implementations, it can be said that since AI shortens the material production process for teachers, diversifies the materials produced, provides feedback to students, and offers a personalized experience, teachers can devote more time to subjects such as materials and lesson design.

This shift fundamentally redefines the role of educators, moving from the traditional model of information transmission to one centered on mentorship and guidance, allowing teachers to more effectively help students discover and develop their individual potential. In this new paradigm, AI is not positioned as a replacement for teachers but as a powerful collaborator. The synergy between teacher and AI can significantly enhance teaching engagement, although this relationship is moderated by factors such as the teacher's technological self-efficacy and the level of perceived organizational support. The ultimate vision is a symbiotic partnership where AI handles routine tasks, freeing educators to focus on the uniquely human aspects of teaching, such as fostering emotional intelligence and building meaningful connections with students.

However, the effective integration of these technologies is contingent upon robust and continuous professional development. The effective integration of these technologies is contingent upon robust and continuous professional development. However, a systematic review by Tan et al. (2025) of research conducted between 2015 and 2024 revealed a significant imbalance, with the majority of studies (65%) focusing on AI applications for student learning, while far less attention (35%) has been paid to AI's role in enhancing teacher professional development. This gap highlights a critical need for structured training that equips educators with the necessary skills and knowledge to use AI effectively and ethically. To address this, researchers such as Al-Ali and Miles (2025) propose comprehensive support systems, like the TPTP (Teacher Training, Pedagogical Support, Testing Revamp, and Practice Networks) model. This approach includes not only initial teacher training but also ongoing pedagogical support, a re-evaluation of assessment methods, and the creation of practice networks where educators can share experiences and collaborate.

Ultimately, the successful adoption of AI in schools is heavily influenced by institutional factors, particularly school leadership and organizational culture. School leaders play a pivotal role in setting a clear vision, fostering a culture of innovation, and creating an environment conducive to learning and development with AI. A forward-thinking and collaborative school environment encourages interaction and shared responsibility among teachers, students, and parents, creating a resilient educational ecosystem capable of adapting to the evolving technological landscape. Research indicates that implementing AI can positively affect student outcomes and teacher effectiveness, but only when it reinforces a culture of continuous improvement and innovation within the educational institution.

Innovativeness and Artificial Intelligence

AI has existed for decades but has gained considerable popularity with recent rapid technological developments. Its growing influence and its role in driving societies toward innovation highlight the need for innovative mindsets and character traits. The importance of innovativeness, in particular, has been understood by various institutions in recent history, and it has begun to receive the necessary attention (Ferik, 2003). Upon reviewing the literature, it is thought that these two concepts are related to each other. The effort that innovative individuals will show to understand why and how the mechanisms of artificial intelligence applications and algorithms work is thought to contribute to technology and our country. This is because it is believed that innovative individuals will try to take advantage of all the opportunities offered by technological systems and will be able to integrate these opportunities with other technologies.

The present study is motivated by an interest in understanding whether teacher education programs in our country positively influence students' innovativeness, and in examining teacher candidates' attitudes toward AI alongside their individual innovativeness levels. It also seeks to determine whether these attributes change over the course of their studies. Furthermore, the study investigates the relationship between innovativeness and AI attitudes, and explores how these relationships vary according to predetermined demographic characteristics such as gender, age, department of study, and economic status, etc. The findings are expected to contribute to the existing literature and to inform educational institutions that aim to foster both technological competence and innovative thinking among future teachers.

Related Publications and Research

When the literature is reviewed, although there are many studies investigating artificial intelligence and individual innovativeness and the importance of these topics in education, educational institutions, and the community, no studies examining the correlation between artificial intelligence and individual innovativeness could be found. This gap in the literature serves as the primary motivation for the present study. The following review summarizes key findings from both AI-related and innovativeness-related research, highlighting how they inform the current investigation.

In a study by Avcı (2024), the relationship and effects of artificial intelligence technology on society, its potential social and economic consequences, and the degree of societal acceptance were investigated. The research also mentioned the importance of using AI technologies in fields such as education, health, security, and manufacturing, and drew attention to its widespread use. The study noted that alongside mentioning the successes of AI, it would be appropriate to consider the criticisms and concerns raised by society. Among the recommendations made in the research, strategies for the development of AI, such as AI research and development projects, education, and talent development, were mentioned, and suggestions were made to draw attention to increasing education and awareness.

Mart and Kaya (2024) stated that artificial intelligence technologies are an inevitable part of daily life and their importance is increasing day by day. In their research, they examined the relationship between the attitude levels of preschool teacher candidates towards artificial intelligence and their AI literacy. A random sampling method was used in their sample consisting of 235 volunteer preschool teacher candidates, and qualitative data were collected in addition to the quantitative data gathered with the scales they used. As a result of the analysis, it was concluded that teacher candidates rejected the use of this technology because they did not have sufficient knowledge about artificial intelligence. Furthermore, the importance of teachers having the necessary knowledge and skills to use technologies efficiently and effectively was highlighted. They also recommended organizing educational programs to reduce negative attitudes towards AI in society and investigating the attitudes of teacher candidates towards technology.

In their research, Yitmen et al. (2023) mentioned that AI models are changing teaching and learning in education, and they integrated artificial intelligence with a blended learning model. They discussed the contributions of chatbots to teachers and in managing the educational process. They mentioned that when they used chatbots as reminders for students about exam dates and assignment deadlines, the students were more motivated, but they emphasized that the relationship between chatbots and learners needs to be examined further. Their research also explained the time, energy, and resource savings that the ChatGPT language model provides for instructors and students. It was mentioned that it can offer learners well-designed and highly readable educational content at their own pace, and the potential of using AI in education to increase student engagement and allow students to redesign their own learning processes with an active and innovative perspective was discussed.

Research conducted by Chaudry and Kazim (2022) touched upon how technology and artificial intelligence have completely changed the world, and how the next major digital transformation will profoundly affect our lives, the way we communicate, our work lives, and our learning methods. While discussing its benefits in education, it was mentioned that it could help reduce teachers' workload, create personalized learning environments, improve assignments and responsibilities, and even assist with topics like personalization and feedback that intelligent tutoring systems can provide to students. It was stated that for AI to be effective in education, learners and teachers must be at the center of AI developments.

A study by Kengam (2020) examined how artificial intelligence is and can be used in education and mentioned that AIEd is a rising field in educational technologies. While noting that traditional methods are slowly being left behind, it was also mentioned that learners can share the same educational plan even in different languages, that people with hearing or vision loss can benefit, that assignments can be graded by artificial intelligence, and that task management in student groups can also be handled by these systems. Intelligent tutoring systems were addressed, and it was mentioned that different algorithms can be individually adapted for and benefit different students.

In a study by Sarı and Kartal (2018), it was stated that the use of technology in education and the self-improvement of teacher candidates in terms of technological innovations would provide convenience in many areas for their professional development. However, it was also noted that educational institutions and planned activities have a great responsibility to ensure teachers integrate with these technological developments and gain experience. The findings of their study indicated that within the sample group of social studies teacher candidates, a more positive disposition towards using technology in education was observed among those at more advanced grade levels. In relation to this, a suggestion was made that providing teacher candidates with more opportunities for activities and practice in teacher training institutions could make this quality permanent. It was also said that the attitudes of teacher candidates towards technology use could be developed more positively through activities such as projects and seminars designed appropriately for their individual innovativeness levels.

In a study conducted by Akça and Şakar (2017), the individual innovativeness scale was used, and the relationship between the individual innovativeness levels of teacher candidates, as well as pedagogical formation students and education faculty students, and variables such as department, age, grade level, and gender was examined. It was stated that pedagogical formation and education faculty students were in the interrogator (early majority) group, and recommendations were made such as the wider availability of technological developments in classrooms and schools and an increase in in-service training for teachers to be more effective in education and teaching programs. In the research conducted by Örün, Orhan, Dönmez, and Kurt (2015), the correlation between the individual innovativeness levels of teacher candidates and their technology attitude levels was examined. As a result of the analyses, it was concluded that there was a significant relationship between the technology attitude levels and innovativeness levels of teacher candidates. The research stated that it is necessary to train teachers and teacher candidates to use technology effectively, and it was conveyed that the attitudes of teachers and teacher candidates towards technologies, their adoption of technology, and their ability to use it efficiently are very important. At the same time, it was mentioned that individual innovativeness levels have an important place in the attitudes of teachers and teacher candidates towards technology, and that the innovativeness levels and technology attitude levels of teacher candidates should also be effective in the design process when designing their educational environments.

In a study conducted by Şahin (2016), the information technology acceptance levels of teacher candidates and the factors playing a role in this were investigated. In other studies mentioned in the research, it was found that teacher candidates considered themselves competent in using information technologies and had a high tendency to use them in their future professional work in classroom settings. At the same time, they stated that the high IT acceptance levels of teacher candidates indicated that their teacher training was prepared in a way that encourages the acceptance and use of information technologies. It was observed that the individual innovativeness category of the teacher candidates in their sample was the "interrogators" (early majority) category, with the largest slice at 48%. Based on this finding, it was stated that a large portion of teacher candidates are individuals who exhibit a more cautious, investigative, and questioning attitude towards the innovations they encounter. They also reported that they did not find a significant difference according to the gender factor in their research, and pointed out that the difference between genders has decreased because technological developments are used very frequently in daily life. A difference was detected according to grade level; third-year teacher candidates were reported to have higher IT acceptance levels than first-year teacher candidates. It was stated that the effect of courses such as "Instructional Technologies and Material Development" and similar courses that could improve attitudes towards technology for first-year students could be a factor.

In a study by Kılıçer (2011), the innovativeness levels of teacher candidates from the Department of Computer Education and Instructional Technology (CEIT) were examined. They stated that of the 360 teacher candidates in their chosen sample, 88.60% could be considered to have a good/above-average level of innovativeness, and 46.40% were in categories capable of disseminating innovations (innovators and early adopters). In their research, it was mentioned that the CEIT teacher candidates were most cautious about taking risks with innovations and chose to research and question them. They also stated that there was a significant difference in the innovativeness levels of the participating teacher candidates in terms of their internet and technology usage level and frequency, computer and internet use, social media membership status, and perceived innovativeness levels, and they concluded that the teacher candidates studying in the CEIT department were highly innovative. Accordingly, it was stated that the participating teacher candidates most often said that problems experienced at the institutional level were an obstacle to innovativeness.

Method

Research Model

This study employed a correlational survey model to investigate the relationship between teacher candidates' individual innovativeness levels and their attitudes toward AI. The correlational survey model is designed to determine whether a statistical relationship exists between two or more variables and to identify the direction and strength of that relationship (Karasar, 2011). It enables researchers to observe variables in their natural settings without implying any causal relationship between them (Fraenkel, Wallen, & Hyun, 2018). In addition to examining the relationship between individual innovativeness and AI attitudes, the study also explored whether these variables differed according to demographic factors such as gender, department, current grade level, and research experience with artificial intelligence. This design was deemed appropriate given the study's purpose of identifying associations among variables without experimental manipulation.

Research Group

The population of this research consists of approximately 2366 students studying at Ege University, Faculty of Education, during the 2023–2024 academic year. The student numbers were obtained from the "Ege University in Numbers" website owned by Ege University (2024, https://sayilarlaege.ege.edu.tr). Four separate strata were determined based on the grade levels of the teacher candidates, and the sample size was calculated using statistical power analysis based on a 5% significance level ($\alpha = 0.05$) and a 95% confidence level. In this context, using the G*Power 3 program (Faul, Erdfelder, Lang, & Buchner, 2007), an expected medium effect size ($d = 0.50$) and a target statistical power ($1 - \beta = 0.80$) were taken into account; thus, the required sample size was determined to be 331. This sample size was determined to be sufficient to ensure the validity of the analyses to be conducted in the research.

The stratified random sampling method was deemed appropriate for the selection process of the teacher candidates. Stratified sampling refers to sample selection in a population with homogeneous subgroups. This method can enable us to obtain more precise results by focusing on subgroups related to the variable we are examining; it also helps in obtaining more reliable results by reducing the probability of unequal distribution of factors such as age and gender that can occur in simple random sampling (Kılıç, 2013). However, it has disadvantages such as the difficulty of calculating the sampling error and a decrease in measurement precision when there are few individuals in some strata.

Before data collection, participants were informed about the purpose of the study, and all questions were addressed. Participation was voluntary. After eliminating erroneous data from 485 responses (131 male, 354 female), data from departments where a sufficient number of teacher candidates could not be reached (Special

Education Teaching and Art and Crafts Teaching) were not included in the data analysis. The final sample consisted of 459 teacher candidates.

Data Collection Tool

The Individual Innovativeness Scale

The Individual Innovativeness Scale, adapted into Turkish by Kılıçer and Odabaşı (2010), underwent a validity and reliability study with 343 university students. It was determined that the 20-item Turkish scale exhibited a four-factor structure, the factor structures were valid, the overall internal consistency coefficient was 0.89, and the test-retest reliability was 0.87. The innovativeness score of the participants is calculated based on the scores obtained from the scale, and they are divided into groups. If a participant's score is above 80, they are interpreted as an "Innovator"; between 69 and 80 as an "Early Adopter"; between 57 and 68 as an "Early Majority"; between 46 and 56 as a "Late Majority"; and below 46 as a "Laggard". It can be said that the adapted scale is suitable for use in Turkish academic studies related to innovativeness and its associated topics.

General Attitude Towards Artificial Intelligence Scale

The General Attitude Towards Artificial Intelligence Scale was developed by Schepman and Rodway (2020) and adapted into Turkish by Kaya et al. (2022). The scale consists of two sub-dimensions: negative attitude towards artificial intelligence and positive attitude towards artificial intelligence, and it contains 20 items. The items for negative attitude towards artificial intelligence are reverse-coded. It is rated on a 5-point Likert scale. In the study where the scale was adapted, it was found that the Cronbach's Alpha values were between .82 and .88; the reliability values were determined to be 0.77 for positive attitude and 0.83 for negative attitude.

Data Analysis

The demographic variables collected from participants included gender, department, current grade level, and research experience with AI. To comment on the general distribution of this information, frequency and percentage distributions from descriptive statistical techniques were calculated. The collected data will be analyzed quantitatively, and the presumed relationship between the individual innovativeness levels of teacher candidates and their attitudes towards artificial intelligence will be evaluated using correlation analysis. Predictive statistical methods will be used to examine the relationship between the variables using the collected and evaluated demographic information.

Results

In this section, the frequency and percentage values of the collected demographic information, as well as the data obtained from the test analyses related to the research problem and sub-problems, are presented in tables using statistical analysis tools. Additionally, the findings for each sub-problem of the research are explained under separate headings. Information regarding the gender, grade levels, departments, research experience with AI, and daily internet usage of the participating teacher candidates is provided. The frequency (f) and percentage (%) analyses of the collected data are presented to express the findings.

Table 1 presents the frequency and percentage values for the gender of the teacher candidates. Of the 459 participating teacher candidates, 72.1% (n=331) were female, and 27.9% (n=128) were male. The frequency and percentage values for the departments of the teacher candidates are also shown. Of the 459 participants, 15.7% (n=72) were from Computer Education and Instructional Technology, 12.9% (n=59) from Science Education, 12.4% (n=57) from Preschool Education, 18.7% (n=86) from Guidance and Psychological Counseling (PDR), 20.0% (n=92) from Classroom Teaching, 4.6% (n=21) from Social Studies Education, and 15.7% (n=72) from Turkish Language Education. The data indicate that a large portion of the teacher candidates were concentrated in the Classroom Teaching and PDR departments, while participation from the Social Studies Education department was lower compared to others.

Table 1. Demographic Characteristics of Teacher Candidates

Variable	**Category**	**f**	**%**
Gender	Female	331	72.1
	Male	128	27.9
	Total	459	100
Department	Computer Education & Instructional Technology	72	15.7
	Science Education	59	12.9
	Preschool Education	57	12.4
	Guidance and Psychological Counseling (PDR)	86	18.7
	Classroom Teaching	92	20.0
	Social Studies Education	21	4.6
	Turkish Language Education	72	15.7
	Total	459	100
Grade Level	1st Grade	99	21.6
	2nd Grade	95	20.7
	3rd Grade	150	32.7
	4th Grade	115	25.1
	Total	459	100
Read research about AI	No	259	56.4
	Yes	200	43.6
	Total	459	100.0

Regarding the grade levels of the teacher candidates, 21.6% (n=99) were in their 1st year, 20.7% (n=95) in their

2nd year, 32.7% (n=150) in their 3rd year, and 25.1% (n=115) in their 4th year. The data show that the largest group of teacher candidates was in the 3rd grade, and the smallest was in the 2nd grade. For the research experience with artificial intelligence, 56.4% (n=259) of the teacher candidates stated that they had not read any research about AI, while 43.6% (n=200) indicated that they had.

According to the descriptive analysis results in Table 2, the scores of the teacher candidates for resistance to change, opinion leadership, openness to experience, and risk-taking are above the mean.

Table 2. Descriptive Values of Teacher Candidates' Individual Innovativeness Sub-dimensions

Dimension	**M (Mean of items)**	**SD**
Resistance to Change	26.44 (3.305)	5.377
Opinion Leadership	18.35 (3.67)	3.693
Openness to Experience	19.78 (3.956)	3.118
Risk Taking	7.59 (3.795)	1.493

As shown in Table 3, in the Risk Taking dimension, the mean score for male teacher candidates ($M = 8.82$) was higher than that for female teacher candidates ($M = 7.44$) . The independent samples t-test indicated a statistically significant difference ($p < .05$) between genders. This finding indicates that the risk-taking levels of male teacher candidates were significantly higher than those of females. For all other sub-dimensions and the total innovativeness score, no statistically significant difference was found between male and female teacher candidates.

Table 3. Innovativeness Levels of Teacher Candidates by Gender

Dimension	**Gender**	**N**	**M**	**SD**	**t**	**df**	**p**
Resistance to Change	Male	128	26.42	5.99	-0.05	203.06	.96
	Female	331	26.45	5.13			
Opinion Leadership	Male	128	18.48	3.93	0.45	457	.66
	Female	331	18.31	3.60			
Openness to Experience	Male	128	20.14	3.37	1.52	457	.13
	Female	331	19.65	3.01			
Risk Taking	Male	128	8.82	1.56	3.68	457	.00
	Female	331	7.44	1.44			
Total Innovativeness	Male	128	73.04	10.09	1.19	202.32	.24
	Female	331	71.84	8.60			

The ANOVA results presented in Table 4 indicated a statistically significant difference among departments for the 'Resistance to Change' sub-dimension ($F(6, 452) = 3.51$, $p < .01$) and for the 'Total Innovativeness' score (F(6,

452) = 2.44, p < .05). To determine which departments the difference originated from in Resistance to Change and the overall scale, the Tukey post-hoc test was performed, and the results are given in Table 5.

Table 4. One-Way ANOVA Results for Teacher Candidates' Innovativeness by Department

Dimension		Sum of Squares	df	MS	F	p
Resistance to Change	Between Groups	589.310	6	98.218	3.51	.00
	Within Groups	12652.023	452	27.991		
Opinion Leadership	Between Groups	105.590	6	17.598	1.29	.26
	Within Groups	6141.233	452	13.587		
Openness to Experience	Between Groups	105.626	6	17.604	1.83	.09
	Within Groups	4348.021	452	9.620		
Risk Taking	Between Groups	22.282	6	3.714	1.68	.12
	Within Groups	998.533	452	2.209		
Total Innovativeness	Between Groups	1175.160	6	195.860	2.44	.02
	Within Groups	36306.896	452	80.325		

In the Table 5, Resistance to Change sub-dimension, a difference of 3.11 points was found between Science Education and Turkish Language Education, and this difference is statistically significant (p = 0.00).

Table 5. Tukey HSD Results for Individual Innovativeness Sub-dimensions by Department Variable

Dimension	(I) Department	(J) Department	(I-J)	Std. Error	p
Resistance to Change	Science Education	Turkish Lang. Edu.	-3.11	0.93	.00
	Classroom Teaching	Turkish Lang. Edu.	-2.57	0.83	.03
Total Innovativeness	Preschool Education	Turkish Lang. Edu.	-4.84	1.59	.04

Similarly, a difference of 2.57 points was found between Classroom Teaching and Turkish Language Education, and this difference is also significant (p = 0.03). In Total Innovativeness, a difference of 4.84 points was observed between Preschool Education and Turkish Language Education, which is statistically significant (p = 0.04). Based on these results, it can be said that the individual innovativeness sub-dimensions differ among departments.

Table 6 presents the results of the one-way ANOVA performed to examine whether teacher candidates' individual innovativeness and its sub-dimensions differ by grade level. A significant difference was found among grade levels in the Resistance to Change dimension (p = 0.03). However, no significant difference was found in the Opinion Leadership, Openness to Experience, or Risk Taking dimensions. In the analysis of Total Innovativeness, a significant difference was found among grade levels (p = 0.01). This result indicates that the total individual innovativeness scores differ by grade level.

Table 6. Results for Teacher Candidates' Individual Innovativeness and Sub-dimensions by Grade Level

Dimension		Sum of Squares	df	MS	F	p
Resistance to Change	Between Groups	252.69	3	84.23	2.95	.03
	Within Groups	12988.63	455	28.54		
Opinion Leadership	Between Groups	79.23	3	26.41	1.95	.12
	Within Groups	6167.59	455	13.55		
Openness to Experience	Between Groups	62.70	3	20.90	2.16	.09
	Within Groups	4390.94	455	9.65		
Risk Taking	Between Groups	11.18	3	3.72	1.68	.17
	Within Groups	1009.64	455	2.21		
Total Innovativeness	Between Groups	871.48	3	290.5	3.61	.01
	Within Groups	36610.57	455	80.46		

Table 7 shows that only the Resistance to Change scores of 1st-grade teacher candidates are significantly higher than those of other grade levels. However, no statistically significant difference was found among 2nd, 3rd, and 4th-grade teacher candidates or for the Total Innovativeness score.

Table 7. Tukey HSD Results for the Resistance to Change Sub-dimension by Grade Level

Dimension	(I) Grade	(J) Grade	Mean Difference (I-J)	Std. Error	p
Resistance to Change	1st Grade	2nd Grade	2.14	0.767	.03

The relationship between Teacher Candidates' Status of Researching Artificial Intelligence and their Individual Innovativeness Levels was investigated. For this purpose, an independent samples t-test was conducted. Table 8 shows the results of this test, examining the effect of the status of researching AI on the individual innovativeness levels of teacher candidates. The 'Resistance to Change' sub-dimension is not included in the table as no significant difference was found between the groups. A significant difference was observed between the groups in the Opinion Leadership, Openness to Experience, and Risk Taking sub-dimensions, as well as in the Total Innovativeness score, in favor of those who research AI. These findings reveal that the level of individual innovativeness significantly differs based on the status of researching AI across most dimensions.

Table 8. t-Test Results for Individual Innovativeness Levels by Status of Researching AI

Dimension		F	Sig.	t	df	p (2-tailed)
Opinion Leadership	Equal variances assumed	2.126	.14	-2.97	457	.00
Openness to Experience	Equal variances assumed	.646	.42	-4.70	457	.00
Risk Taking	Equal variances not assumed	15.185	.00	-5.07	455.58	.00
Total Innovativeness	Equal variances not assumed	.054	.82	-4.16	436.63	.00

Table 9 presents the descriptive statistics for teacher candidates' attitudes towards artificial intelligence. According to the analysis results, the Attitude Towards AI score was calculated as 3.27 (SD = 0.52). This value indicates that the general attitude of teacher candidates towards artificial intelligence is at a level between neutral and positive. The participating teacher candidates demonstrate a positive general tendency towards artificial intelligence.

Table 9. Descriptive Analysis Results for Teacher Candidates' Attitudes Towards AI

Dimension	**N**	**M**	**SD**
Attitude Towards AI	459	3.27	0.52

As descriptive analysis results are provided in Table 10, in terms of Attitude Towards AI scores, the mean for female teacher candidates was 3.27 with a standard deviation of 0.52, while for male teacher candidates, the mean was 3.43 with a standard deviation of 0.52. The independent t-test results showed a significant difference between gender groups in terms of general attitude scores (p = 0.00). Male teacher candidates scored higher than female teacher candidates.

Table 10. t-Test Results for Attitude Towards AI by Gender Variable

Dimension	**Gender**	**N**	**M**	**SD**	**t**	**df**	**p**
Attitude Towards AI	Female	331	3.27	0.52	3.01	457	.00
	Male	128	3.43	0.52			

In the analysis performed and showed on Table 11, p=0.00 was found for YZT. This result reveals that YZT scores show a statistically significant difference among the departments. It is observed that the attitude scores of teacher candidates show significant differences according to their departments. As a result of the Tamhane T2 test, significant differences were found in the total attitude dimension between Science Education and the PDR and Turkish Language Education departments. The test results are given below in Table 12.

Table 11. One-Way ANOVA Results for Attitudes Towards AI by Department

Dimension		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
Attitude Towards AI	Between Groups	5.42	6	0.90	3.38	.00
	Within Groups	120.76	452	0.27		

According to the Tamhane test results conducted to identify the source of the significance, there is a significant difference in total attitude scores between the Science Education and PDR departments (p = 0.01). It was determined that the attitude scores of Science Education students were higher than those of PDR students. Furthermore, a significant difference was also found in attitude scores between the Science Education and Turkish Language Education departments (p = 0.00). This result indicates that the attitude scores of Science Education students are higher than those of Turkish Language Education students.

Table 12. Tamhane T2 Test Results for Attitudes Towards AI by Department Variable

Dimension	(I) Department	(J) Department	Mean Difference (I-J)	Std. Error	p
Attitude Towards AI	Science Education	PDR	0.25948	0.073	.01
	Science Education	Turkish Lang. Edu.	0.30662	0.073	.00

In the analyses performed and showed in Table 13, p=0.03 was calculated for the attitude towards ai dimension. This indicates that attitude towards AI scores shows a significant difference according to grade level. A post-hoc test was conducted to determine the source of the difference, but since no statistically significant difference was found, it is not included as a table.

Table 13. One-Way ANOVA Results for Attitudes Towards AI by Grade Level Variable

Dimension		Sum of Squares	df	Mean Square	F	p
Attitude Towards AI	Between Groups	2.398	3	0.8	2.94	.03
	Within Groups	123.783	455	0.27		

The relationship between Teacher Candidates' Status of Researching Artificial Intelligence and their attitudes towards AI was investigated. The descriptive statistics for the investigated relationship are given in Table 14. As seen in the table, no statistically significant difference was found between the groups (p > 0.05).

Table 14. t-Test Results for Attitudes Towards AI by Status of Researching AI

Dimension		F	Sig.	t	df	p (2-tailed)
Attitude Towards AI	Equal variances assumed	0.178	0.674	-1.27	457	0.20

For the third sub-problem of the research, the relationship between the individual innovativeness scale and the artificial intelligence attitude scale was examined, and the collected data were analyzed. The descriptive statistics and correlation analysis results are given in Table 15 and Table 16, respectively.

In Table 15, the mean value for the teacher candidates' total individual innovativeness score is 72.17, with a standard deviation of 9.05. These values indicate that the individual innovativeness levels of the teacher candidates are generally high and that there is a certain distribution among individuals in terms of innovativeness levels.

Table 15. Descriptive Analysis Results of the Relationship Between Teacher Candidates' Attitudes Towards AI and Individual Innovativeness Levels

Dimension	M	SD
Total Individual Innovativeness Score	72.17	9.05
Artificial Intelligence Attitude Scale	3.27	0.52

For the artificial intelligence attitude scale, the mean value is 3.27, and the standard deviation is 0.52. This indicates that the teacher candidates' attitudes towards artificial intelligence are generally at a positive level and that these attitudes show low variability among individuals.

According to the correlation analysis results in Table 16, there is a very weak positive relationship between the teacher candidates' total individual innovativeness scores and their scores on the attitude towards artificial intelligence scale ($r = 0.04$), but this relationship is not statistically significant ($p = 0.43$; $p > 0.05$). This finding indicates that there is no significant relationship between the level of individual innovativeness and the attitude towards artificial intelligence. The analysis results suggest that these two variables are independent of each other or that the relationship between them is negligible.

Table 16. Correlation Analysis of the Relationship Between Teacher Candidates' Attitudes Towards AI and Individual Innovativeness Levels

		Total Innovativeness	**Attitude Towards AI**
Total Innovativeness	Pearson Correlation	1	.040
	Sig. (2-tailed)		.430
	N	459	459
Attitude Towards AI	Pearson Correlation	.040	1
	Sig. (2-tailed)	.430	
	N	459	459

Discussion and Conclusion

The finding that the majority of teacher candidates are "early adopters" aligns with the expectation that educators should be open to innovations to meet modern professional competencies (Keskin, 2021). The lack of a significant difference in overall innovativeness based on gender is consistent with several studies in the literature (Yenice & Yavaşoğlu, 2018; Çuhadar, Bülbül & Ilgaz, 2013; Şahin, 2016). However, the finding that male candidates score higher in "risk-taking" suggests a nuanced difference between genders that warrants further exploration.

The differences observed among departments—particularly the higher "resistance to change" among Turkish Language Education students—may stem from factors specific to their field's pedagogical traditions and curriculum. Conversely, the higher innovativeness scores in other departments could be linked to different educational philosophies. The finding that 1st-grade students exhibit higher resistance to change compared to upperclassmen is partially consistent with Şahin (2016), who found that innovativeness levels increase with grade level. This could be attributed to the adaptation process to university life and curriculum, which students overcome as they advance in their studies.

Regarding attitudes towards AI, the more positive stance among male teacher candidates aligns with findings from other studies (Sarıkaya & Kavan, 2024; İçöz & İçöz, 2024; Tan, Ceylan, & Öztürk, 2023). The more positive attitudes among Science Education students compared to those in PDR and Turkish Language Education may reflect the nature of their disciplines. While the literature indicates moderate to high attitudes among Turkish Language teacher candidates (Sarıkaya & Kavan, 2024; Banaz & Maden, 2024), the lack of comparative data for PDR candidates highlights a contribution of this study to the literature.

The primary finding—the lack of a statistically significant relationship between innovativeness and attitude towards AI—was contrary to initial expectations based on studies that found a positive correlation between innovativeness and general technology attitudes (Örün, Orhan, Dönmez, and Kurt, 2015; Banaz and Maden, 2024). The possible explanation for this discrepancy may be that AI is a relatively new and rapidly evolving technology. Unlike more established technologies, AI's role in education has not yet led to fundamental and permanent pedagogical shifts. Consequently, there may not have been sufficient time or opportunity for even highly innovative teacher candidates to fully form and align their attitudes with these emerging applications. This suggests that the relationship between innovativeness and attitude might be technology-specific and context-dependent.

This study examined the relationship between teacher candidates' individual innovativeness levels and their attitudes toward artificial intelligence (AI), considering demographic factors such as gender, department, grade level, and prior research experience with AI. The analysis of the innovativeness profiles revealed that the majority of teacher candidates in the sample fall into the "early adopter" and "innovator" categories, indicating a high level of inherent innovativeness overall. This finding aligns with the expectation that future educators should possess a disposition open to change to meet modern professional competencies. Significant differences in innovativeness were found based on department, grade level, and research experience with AI, while gender was only a significant factor in the "risk-taking" sub-dimension. Regarding attitudes towards AI, the study found that teacher candidates generally hold a "neutral to positive" view, with significant differences observed based on gender, department, and grade level.

The central and most noteworthy finding of this study is the lack of a statistically significant relationship between the individual innovativeness levels of teacher candidates and their attitudes towards AI. The correlation analysis revealed only a very weak, statistically insignificant positive relationship, suggesting that, at present, these two constructs operate independently among teacher candidates. This outcome is particularly striking as it contrasts with previous research that has established a positive correlation between innovativeness and attitudes toward more established technologies (Örün et al., 2015). A plausible explanation for this discrepancy is the relative novelty of generative AI in educational contexts. Unlike technologies that have been integrated over time, AI's role in pedagogy is still emerging and has not yet prompted fundamental, widespread pedagogical shifts. Consequently, even highly innovative teacher candidates may not have had sufficient meaningful, hands-on experience with AI in authentic teaching scenarios to form attitudes that are strongly aligned with their innovative dispositions. Their current attitudes may be shaped more by general societal discourse and media portrayals rather than deep pedagogical engagement.

These findings have profound implications for teacher education institutions. The high prevalence of "innovator" and "early adopter" profiles suggests that teacher candidates represent a fertile ground for the adoption of new educational technologies. However, their neutral-to-positive, yet uncorrelated, attitudes toward AI indicate that this innovative potential is not being fully activated in the context of AI. This highlights a critical gap between possessing an innovative character and developing an informed, positive stance on a specific, transformative technology. A systematic review of recent literature confirms an imbalance in research, with far more focus on AI applications for student learning than on AI's role in teacher professional development, underscoring this gap in practice (Tan et al., 2025). Therefore, teacher training programs must move beyond assuming that innovativeness will automatically translate into positive AI adoption.

To bridge this gap, institutions should implement structured and continuous professional development focused on AI (Bozkurt, 2024). This training should not only cover the technical aspects of AI tools but also emphasize pedagogical integration, ethical considerations, and practical applications in lesson planning and assessment. Fostering a supportive organizational culture where experimentation is encouraged is also crucial, as perceived institutional support significantly moderates the relationship between teacher-AI collaboration and teaching engagement (Kesim et al., 2025; Li et al., 2025). By providing these conditions, teacher education programs can help candidates connect their innate innovativeness to the concrete pedagogical affordances of AI. Ultimately, this study suggests that as AI continues to reshape the educational landscape, fostering a positive and informed attitude through targeted training and supportive institutional environments is as critical as the inherent innovativeness of future teachers. Empowering this new generation of educators is essential to ensuring that AI is leveraged not to replace the human element of teaching, but to enhance it, allowing teachers to evolve into the roles of mentors and learning architects in an increasingly complex world (Bozkurt, 2024; World Economic Forum, 2025).

Recommendations

Based on the study's findings and discussion, several recommendations are offered for future research and practice. It is suggested that future studies explore the specific factors within academic departments that influence innovativeness and AI attitudes. Qualitative methods, such as focus groups and in-depth interviews, could provide valuable insights into why certain departments, like Turkish Language Education, exhibit higher resistance to change, potentially uncovering influences from curriculum design, faculty attitudes, or established pedagogical traditions. Furthermore, the finding that grade level impacts attitudes towards AI, while statistically significant, requires clarification. Future research could employ larger or more diverse samples, including cross-institutional studies, to determine if this is a localized or widespread phenomenon and to investigate the specific curricular or experiential elements at different grade levels that might shape these attitudes.

The unexpected finding that having researched AI did not significantly relate to attitudes warrants further investigation. Future studies should move beyond a simple binary question and instead explore the nature, source, and quality of the information teacher candidates consume about AI. Differentiating between academic sources, mainstream media, and peer discussions could reveal how different information channels shape perceptions and attitudes. Given the lack of a significant relationship between innovativeness and AI attitudes, longitudinal studies are highly recommended. Tracking a cohort of teacher candidates from their initial training through their early professional years could reveal if and when this relationship emerges. It would allow researchers to test the hypothesis that the connection between innovativeness and AI attitude is context-dependent and may only become significant after gaining practical classroom experience with these technologies.

For teacher training institutions, the findings suggest a need for proactive measures. To address the higher resistance to change among first-year students and the disparities between departments, institutions could develop and integrate AI literacy workshops and practical application seminars early in their programs. Creating inter-departmental projects focused on educational technology could foster a more uniform and positive culture of innovation. Ultimately, fostering a supportive environment where experimentation with AI tools is encouraged could be crucial in bridging the gap between an individual's innovative potential and the development of a positive, informed attitude toward the integration of artificial intelligence in education.

References

Akça, F., & Şakar, Z. (2017). Öğretmen adaylarının bireysel yenilikçilik düzeylerinin incelenmesi. *Pegem Atıf İndeksi*, 451-462.

Akkoyunlu, B., Altun, A., & Yılmaz Soylu, M. (2008). *Öğretim tasarımı*. Maya Akademi.

Al-Ali, S., & Miles, R. (2025). Upskilling teachers to use generative artificial intelligence: The TPTP approach for sustainable teacher support and development. *Australasian Journal of Educational Technology, 41*(1), 88–106.

Aşık, F., Yıldız, A., Kılınç, S., Aytekin, N., Adalı, R., & Kurnaz, K. (2023). Yapay zekanın eğitime etkileri. *International Journal of Social and Humanities Sciences Research (JSHSR)*, *10*(98), 2100-2107.

Avcı, E. (2024). Yapay zekanın toplumsal karşılığı ve karşıtlığı üzerine bir derleme. *Yalova Sosyal Bilimler Dergisi*, *14*(2), 239-259.

Azarfam, A., & Jabbari, Y. (2012). Dealing with teachers' technophobia in classroom. *Advances in Asian Social Science*, *2*(2), 452-455.

Baker, T., & Smith, L. (2019, February 22). *Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges*. Nesta Foundation. https://media.nesta.org.uk/documents/Future_of_Al_and_education_v5_WEB.pdf

Banaz, E., & Maden, S. (2024). Türkçe öğretmen adaylarının yapay zeka tutumlarının farklı değişkenler açısından incelenmesi. *Trakya Eğitim Dergisi*, *14*(2), 1173-1180.

Bisen, I., Nalcaci, F., Alagappan, S., & Yildirim, Y. (2021). State of education and artificial intelligence after the pandemic. *London Journal of Social Sciences*, *1*(1), 88-98.

Bozkurt, A. (2024). Yapay Genel Zekâ (YGZ) çağında öğretmenlerin rolleri ve mesleki gelişimleri üzerine bir değerlendirme [An evaluation on the roles and professional development of teachers in the age of Artificial General Intelligence (AGI)]. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi, 10*(1), 123-141.

Bülbül, T., & Göl, E. (2012). İlköğretim okulu yöneticilerinin yenilik yönetimi yeterliklerine ilişkin öğretmen algıları. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *8*(2), 97-109.

Çavuş, M. (2006). *İşletmelerde personel güçlendirme uygulamalarının örgütsel yaratıcılık ve yenilikçiliğe etkileri üzerine imalat sanayinde bir uygulama* [Unpublished doctoral dissertation]. Selçuk Üniversitesi.

Çetin, D., & Bülbül, T. (2017). Okul yöneticilerinin teknostres algıları ile bireysel yenilikçilik özellikleri arasındaki ilişkinin incelenmesi. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *17*(3), 1241-1264.

Çetin, Y., & Aktaş, M. (2021). Investigation of the relationship between teachers' technostress perceptions and individual innovativeness characteristics. Turkish Studies-Educational Sciences, 16(1), 329-346.

Chaudry, M., & Kazim, E. (2022). Artificial intelligence in education (AIED): A high-level academic and industry note 2021. *AI and Ethics*, *2*, 157-165.

Çuhadar, C., Bülbül, T., & Ilgaz, G. (2013). Öğretmen adaylarının bireysel yenilikçilik özellikleri ile teknopedagojik eğitim yeterlikleri arasındaki ilişkinin incelenmesi. *İlköğretim Online*, *12*(3), 797-807.

de Fine Licht, K. (2024). Artificial intelligence, ethics and education: A systematic literature review. Education and Information Technologies.

Erdoğan, M. (2017). Sıfırıncı yasa. *Muhasebe Bilim Dünyası Dergisi*, *19*(3), 746-759.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191. https://doi.org/10.3758/bf03193146

Ferik, I. F. (2003). *Yapay zeka kavramının etkileri üzerine bir araştırma* [Unpublished Doctoral Dissertation]. Proquest.

Fraenkel, J., Wallen, N., & Hyun, H. (2018). *How to design and evaluate research in education* (8th ed.). McGraw-Hill Education.

Gökbulut, B. (2021). Individual innovativeness levels of teachers. *Karaelmas Journal of Educational Sciences*, *9*, 204-214.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly*, *82*(4), 581-629.

Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, *4*(4), 134-147.

Gündüz, Ş. (2020). Öğretmenlerin bireysel yenilikçilik ile dijital yerlilik düzeyleri arasındaki ilişkinin incelenmesi. *Eğitim ve Bilim*, *45*(201), 1-17.

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, *61*(4), 5-14.

Hong, H. (2023). Pedagogical uncertainty in the age of AI: A systematic review of teachers' perceptions. Educational Technology Research and Development, 71(4), 1461-1484.

İçöz, S., & İçöz, E. (2024). Türkçe öğretmen adaylarının yapay zeka uygulamalarına yönelik farkındalık düzeylerinin incelenmesi. *Ulusal Eğitim Dergisi*, *4*(3), 987-1001.

Jeong, S., Choi, B., & Chung, T. (2018). *The foundation of business administration*. Harin Book Publishing.

Karaca, E. (2011). Öğretimde geribildirimin önemi, gerekliliği ve niteliğine ilişkin öğrenci algıları. *Education Sciences*, *6*(2), 1951-1960.

Karasar, N. (2011). *Bilimsel araştırma yöntemleri*. Nobel Yayınları.

Kaya, G., Mart, M., & Parlak, B. (2022). General attitude towards artificial intelligence scale: Turkish adaptation study. Trakya Journal of Education, 12(3), 1735-1748.

Kengam, J. (2020). *Artificial intelligence in education*. Science and Technology Department, Bournemouth University.

Kesim, M., Ahmad, S., & Özarslan, Y. (2025). *Reshaping school cultures: AI's influence on organizational dynamics and leadership behaviors*. ResearchGate.

Keskin, F. N. (2021). *Fen bilimleri öğretmenlerinin bireysel yenilikçilik düzeylerinin incelenmesi* [Master's thesis, Kastamonu Üniversitesi, Fen Bilimleri Enstitüsü].

Kılıç, S. (2013). Örnekleme yöntemleri. *Journal of Mood Disorders*, *3*(1), 44-46.

Kılıçer, K. (2011). *Bilgisayar ve öğretim teknolojileri eğitimi öğretmen adaylarının bireysel yenilikçilik düzeyleri* [Doctoral dissertation, Anadolu Üniversitesi].

Kılıçer, K., & Odabaşı, H. (2010). Bireysel yenilikçilik ölçeği: Türkçeye uyarlama, geçerlik ve güvenirlik çalışması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *38*, 150-164.

Kocasaraç, H., & Harataş, H. (2018). Yenilikçi öğretmen özellikleri: Bir ölçek geliştirme çalışması. *Uşak Üniversitesi Eğitim Araştırmaları Dergisi*, *4*(1), 34-57.

Korucu, A. T., & Olpak, Y. Z. (2015). *Bireysel yenilikçilik: Yayılım, teknoloji ve e-öğrenme*. Seçkin Yayıncılık.

Kuhail, M., Alturki, N., Alramlawi, S., & Alhejori, K. (2022). Interacting with educational chatbots: A systematic review. *Education and Information Technologies*, *28*, 973-1018.

Li, C., Wang, Y., & Wu, B. (2025). Will teacher-AI collaboration enhance teaching engagement? The mediating role of technological self-efficacy and the moderating role of perceived organizational support. *Behavioral Sciences, 15*(7), 866. https://doi.org/10.3390/bs15070866

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson.

Mart, M., & Kaya, G. (2024). Okul öncesi öğretmen adaylarının yapay zekaya yönelik tutumları ve yapay zeka okur yazarlığı arasındaki ilişkinin incelenmesi. *Edutech Research*, *2*(1), 91-109.

Mumcu, F., & Koçak, Y. (2004). Mesleki ve teknik okul öğretmenlerinin bilgisayar kullanımları ve engeller. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *26*(26), 91-99.

Oldham, G., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal*, *39*(3), 607-634.

Örün, Ö., Orhan, D., Dönmez, P., & Kurt, A. A. (2015). Öğretmen adaylarının bireysel yenilikçilik düzeyleri ve teknoloji tutum düzeyleri arasındaki ilişkinin incelenmesi. *Trakya Üniversitesi Eğitim Fakültesi Dergisi*, *5*(1), 65-76.

Özgür, H. (2013). Bilişim teknolojileri öğretmen adaylarının eleştirel düşünme eğilimleri ile bireysel yenilikçilik özellikleri arasındaki ilişkinin çeşitli değişkenler açısından incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *9*(2), 409-420.

Rogers, E. (1995). Diffusion of innovations: Modifications of a model for telecommunications. In *Die diffusion von innovationen in der telekommunikation* (pp. 25-38).

Rogers, E. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 582-599.

Russell, S., & Norvig, P. (2018). *Artificial intelligence: A modern approach* (Global ed.). Pearson Education Limited.

Şahin, F. (2016). *Öğretmen adaylarının bilişim teknolojileri kabul düzeyleri ile bireysel yenilikçilik düzeyleri arasındaki ilişkinin incelenmesi* [Master's thesis, Anadolu University].

Sarı, İ., & Kartal, F. (2018). Sosyal bilgiler öğretmen adaylarının teknoloji kullanımına yönelik tutumlarının bireysel yenilikçilik düzeyleri ve bazı değişkenler açısından incelenmesi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *19*(2), 1673-1689.

Sarıkaya, B., & Kavan, N. (2024). Türkçe öğretmeni adaylarının yapay zekaya yönelik tutumlarının incelenmesi. *Elektronik Eğitim Bilimleri Dergisi*, *13*(26), 191-203.

Schepman, A., & Rodway, P. (2020). Initial validation of the general attitudes towards artificial intelligence scale. *Computers in Human Behavior Reports*, *1*, 100014.

Scott, S., & Bruce, R. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, *37*(3), 580-607.

Tan, Ç., Ceylan, Y., & Öztürk, O. (2023). Öğretmenlerin yapay zekaya karşı tutumlarının incelenmesi. *Akademik Sosyal Araştırmalar Dergisi*, (67), 72-83.

Tan, X., Cheng, G., & Ling, M. H. (2025). Artificial intelligence in teaching and teacher professional development: A systematic review. *Computers and Education: Artificial Intelligence, 8*, Article 100355. https://doi.org/10.1016/j.caeai.2024.100355

Tekin, N. (2023). Eğitimde yapay zeka: Türkiye kaynaklı araştırmaların eğilimleri. *Necmettin Erbakan Üniversitesi Ereğli Eğitim Fakültesi Dergisi*, *5*(Özel), 387-411.

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2024). What if the devil is in the details? A contemporary review of ChatGPT in education. Smart Learning Environments, 11(1), 1-21.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. Educational Technology Research and Development, 65(3), 555-575.

Türk Dil Kurumu. (2010). *Türkçe sözlük*. http://www.tdk.gov.tr

Williams, P. (2025). AI and academic integrity: A review of the literature. Journal of Academic Ethics, 23(1), 1-15.

World Economic Forum. (2025, January 9). *How AI and human teachers can collaborate to transform education*. https://www.weforum.org/stories/2025/01/how-ai-and-human-teachers-can-collaborate-to-transform-education/

Yenice, N., & Tunç, G. (2019). Öğretmen adaylarının yaşam boyu öğrenme eğilimleri ile bireysel yenilikçilik düzeylerinin incelenmesi. *Kastamonu Eğitim Dergisi*, *27*(2), 753-765.

Yenice, N., & Yavaşoğlu, N. (2018). Fen bilgisi öğretmen adaylarının bireysel yenilikçilik düzeyleri ile bireysel yaratıcılıkları arasındaki ilişkinin incelenmesi. *Eğitimde Kuram ve Uygulama*, *14*(2), 107-128.

Yitmen, İ., Almusaed, A., Almssad, A., & Homod, R. Z. (2023). Enhancing student engagement: Harnessing "AIED"s power in hybrid education—A review analysis. *Education Sciences*, *13*(6), 632.

Yuan, F., & Woodman, R. (2010). Innovative behavior in the workplace: The role of performance and image outcome expectations. *Academy of Management Journal*, *53*(2), 323-342.