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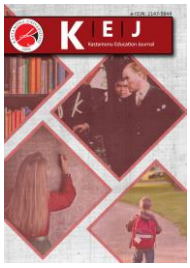

| Research Article / Araştırma Makalesi |

Investigation of Prospective Teachers' 21st Century Skills Competency Perceptions Based on Various Variables

Öğretmen Adaylarinin 21. Yüzyil Becerileri Yeterlik Algilarinin Çeşitli Değişkenlere Göre Incelenmesi[1]

Kübra Yenel[2], Gülenaz Selçuk[3]

Keywords
1.Prospective teacher
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Abstract

Purpose: The purpose of this study is to assess the self-perceived competency of prospective teachers regarding 21st century skills. The study seeks to understand how prospective teachers perceive themselves in terms of the skills they will need to teach and thrive in the rapidly evolving educational landscape that is shaped by globalization and technological advancements.
Design/Methodology/Approach: This study utilizes a quantitative method with a descriptive survey model to assess the competency perceptions of 341 prospective teachers' 21st century skills from a Turkish state university, using random sampling for representativeness. The "21st Century Skills Competency Perception Scale for Teacher Candidates" was employed to collect data, exhibiting high reliability (Cronbach Alpha of 0.98), and data analysis included descriptive statistics, T-tests, and ANOVA to explore differences in skills perception, with the scale's validity and reliability confirmed for the sample group.
Findings: The findings indicate that prospective teachers rate their competency in 21st century skills highly, with the greatest confidence in Information, Media, and Technology Skills and the least in Learning and Innovation Skills. Significant gender differences were found, with female candidates reporting higher competency perceptions than males. Age also influenced competency perceptions, with older groups (25-31 and 32+) rating their skills higher than the youngest group (18-24). Furthermore, pedagogic formation graduates rated their competencies higher than their peers from other faculties, indicating that educational advancement correlates with higher self-perceived 21st century skills.
Highlights: The research suggests that teacher education programs should focus on strategic development of learning and innovation skills and integration of technology into teaching, with findings indicating that perceptions of competency increase with age and are higher among females and graduates.

Öz

Çalışmanın amacı: Bu çalışmanın amacı öğretmen adaylarının 21. yüzyıl becerilerine ilişkin öz yeterlik algılarını değerlendirmektir. Çalışma, küreselleşme ve teknolojik gelişmelerin şekillendirdiği hızla gelişen eğitim ortamında öğretmen adaylarının öğretmek ve gelişmek için ihtiyaç duydukları beceriler açısından kendilerini nasıl algıladıklarını anlamayı amaçlamaktadır.

Materyal ve Yöntem: Bu çalışma, basit seçkisiz örnekleme yönetimi kullanarak, Türkiye'de bir devlet üniversitesinden 341 öğretmen adayının 21. yüzyıl becerileri yeterlik algılarını değerlendirmek için betimsel tarama modelli kullanan nicel bir araştırmadır. Veri toplamak için yüksek güvenilirlik sergileyen (Cronbach Alpha 0,98) "Öğretmen Adayları için 21. Yüzyıl Beceri Yeterlilik Algısı Ölçeği" kullanıldı ve öğretmen adaylarının yeterlik algısındaki farklılıkları ortaya koymak için betimleyici istatistikler, T testleri ve ANOVA yapıldı. Ölçeğin örneklem grubu için geçerliliği ve güvenirliği doğrulanmıştır.

Bulgular: Bulgular, öğretmen adaylarının 21. yüzyıl becerilerindeki yeterliliklerini yüksek düzeyde değerlendirdiklerini, en fazla güvenin Bilgi, Medya ve Teknoloji Becerileri boyutunda, en düşük ise Öğrenme ve Yenilik Becerileri boyutunda olduğunu göstermektedir. Kadın adayların erkeklere göre daha yüksek yeterlilik algısı bildirdiği önemli cinsiyet farklılıkları bulunmuştur. Yaş da yeterlilik algılarının belirleyiciler arasında yer almıştır; daha ileri yaştaki gruplar (25-31 ve 32+) becerilerini en genç gruptan (18-24) daha yüksek puanlamışlardır. Ayrıca, pedagojik formasyon mezunları kendi yeterliliklerini diğer fakültelerdeki akranlarından daha yüksek puanlamışlardır.

Önemli Vurgular: Araştırma, öğretmen eğitimi programlarının, öğrenme ve yenilik becerilerinin stratejik gelişimine ve teknolojinin öğretime entegrasyonuna odaklanması gerektiğini öne sürerken bulgular, yeterlilik algılarının yaşla birlikte arttığını ve kadınlar ve mezunlar arasında daha yüksek olduğunu göstermektedir.

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[2] **Corresponded Author,** Manisa Celal Bayar University, Faculty of Education, Department of Educational Sciences, Manisa, Türkiye; https://orcid.org/ 0000-0002-4237-9763

[3] Manisa Celal Bayar University, Faculty of Sports Sciences, Department of Physical Education and Sports, Manisa, Türkiye; https://orcid.org/0000-0002-3578-6010

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INTRODUCTION

With the rapid development of Information and Communication Technologies (ICT), the process of globalization in the 21st century forces the way of living, working and learning into a process of constant change. Levy and Murnane (2004) argue that due to the rapid development of ICT, a significant part of many jobs is no longer just about “information exchange” but also about “information perspective”. According to Anderson (2008), the society in which information functions is now referred to as the "information society". The dynamic changes demanded by the information society also create significant challenges for education systems. All these developments necessitate a greater focus on identifying and acquiring the competencies individuals need to actively and effectively participate in the information society (Ananiadou & Claro, 2009).

These competencies, called 21st century competencies or 21st century skills, are generally associated with high-level skills and behaviors that represent the ability to cope with multidimensional and complex problems and unpredictable situations (Westera, 2001). Dede (2010) refers to the "higher-level skills and learning tendencies" that individuals must develop in order to be successful in the information age, which emerged by blending the concepts of both knowledge and skill, as 21st century skills. Hixson et al. (2012) discuss 21st century skills under the headings of "critical thinking, collaboration, creativity and innovation, communication, self-direction, establishing global and local connections and using technology as a learning tool". Anagün et al. (2016) also stated that 21st century skills center on "accessing and using information, respecting different cultures and living together with different cultures". They emphasize that individuals with 21st century skills will lead a more qualified life, can easily overcome the problems they encounter, and can be successful by correctly evaluating the situations in their working and social lives.

The 21st century skills, which the individuals of the 21st century information society should possess, have been categorized in different ways by different institutions and organizations. The standards set by the International Society for Technology in Education (ISTE) provide a comprehensive road map for the effective use of technology in schools around the world, providing competencies for "learning, teaching and leading" in the digital age. ISTE Standards emphasize that using technology for learning enables all students to learn in an “effective, sustainable, and equitable” way. The standards have been adopted in all 50 US states and in many countries around the world. Additionally, the standards are compatible with UNESCO's Sustainable Development Goals.

ISTE lists student standards as "competent learner, digital citizen, information organizer, innovative designer, computational thinker, creative communicator and global collaborator" and educator standards as "learner, leader, citizen, collaborator, designer, facilitator and analyst" (ISTE, 2023). Assessment and Teaching of 21st Century Skills/ATC21S is a research and development project initiated by three major technology companies, Cisco, Intel and Microsoft, that seeks new ways to help students internalize and take their skills further in the 21st century (Griffin et al., 2012). The Organization for Economic Cooperation and Development/OECD launched the "Definition and Selection of Competencies (DeSeCo) Project" in late 1997 to provide a solid conceptual framework that will inform the definition of core competencies and strengthen international research. DeSeCo Project's conceptual framework for core competencies consists of three broad categories: “using tools interactively, interacting with heterogeneous groups, and acting independently” (OECD, 2005, p. 5). Asia Society Partnership for Global Learning aims at shaping shared futures for Asia and the world in the fields of politics, arts and culture, education, sustainability, business and technology. On the other hand, the Asia Society is a global education center that shares a common vision, encouraging participation, informing and educating new target audiences, and helping provide real solutions for the benefit of everyone (Asia Society, 2023). Another organization, The North Central Regional Educational Laboratory/NCREL (2021), is a nonprofit organization dedicated to helping schools and the students they serve reach their full potential. As experts in the educational applications of technology, NCREL's ultimate goal is to create safe and productive schools where all students can develop their skills and abilities (NCREL, 2021). While the European Union (EU) declared 1996 as the "Year of Lifelong Learning", 21st century skills and competencies have become more functional, especially in the field of education.

"The skills and competencies that individuals may need for lifelong learning" were determined by the European Parliament and the European Council in 2006 under the title "Key Competences for Lifelong Learning - A European Reference Framework". The Framework of Reference sets out eight core competencies: “communication in the mother tongue, communication in foreign languages, mathematical competence and key competences in science and technology, digital competence, learning to learn, social and civic competences, initiative and entrepreneurship, cultural awareness and expression” (European Union, 2006). Apart from these, the widely used reference in the literature is The Partnership for 21st Century Skills (P21). P21 is the result of a collaboration between educators and businesses to operationalize 21st century learning. The framework is used all over the world, especially in America (P21, 2019). The P21 framework includes “a set of skills, knowledge, and expertise that learners must acquire in order to be successful in both life and work” (P21, 2019; Voogt & Roblin, 2012). P21 (2009) categorizes 21st century skills as “a) learning and renewal skills, b) life and career skills and c) information, media and technology skills”.

Life and career skills are classified as "flexibility and adaptability", "initiative and self-management", "social and intercultural", "leadership and responsibility" skills. Information, media and technology skills consist of "information literacy", "media literacy" and "ICT (information, communication and technology) literacy" skills. Learning and renewal skills include "critical thinking and problem solving", "communication and cooperation", "creativity and renewal" skills. Apart from the three main categories in the P21 learning framework, there are also “core subjects and 21st century themes and interdisciplinary subjects”. While the core subjects are classified as "English, reading and language arts, world languages, art, mathematics, economics, science, geography,

history and civics", interdisciplinary subjects are classified as "global awareness, finance-economics-business and entrepreneurship literacy, civic literacy, health literacy, environmental literacy".

Although these classifications vary, it is seen that 21st century skills have a common denominator as "creativity, communication, collaboration, critical thinking, information and communication technologies literacy, social and cultural competencies" (Voogt & Roblin, 2012). When all classifications are taken into account these skills and competencies, called 21st century skills, are quite different from those needed in the 20th century (Dede, 2010). In order for these skills to become functional, it is an important necessity for all stakeholders in the learning-teaching process to be equipped with these skills. Wagner (2008) states that what potential employers want in young people today is "critical thinking, creativity and effective communication etc.". It is stated that there is a significant disconnect between the skills needed and the "passive learning environments and test-centered lesson plans focused on gaining rewards" offered by our schools. At the same time, Wagner (2008) emphasizes the importance of educating learners to meet the demands of the 21st century and cope with the problems brought by the age, and also draws attention to the need for competent teachers to teach skills suitable for the new century.

Chai et al. (2020) state that it is important for teachers to have a higher level of knowledge and skills than in the past in line with globalization, and that they need additional teaching scaffolds. In addition, equipping educators with 21st century skills will improve students' knowledge and skills, which are very important for their career prospects in the future. Ananiadou and Claro (2009) emphasize that schools aiming at developing the 21st century skills should respond to the social and economic needs of the society and that education also needs a significant reform. Silva (2009) states that all levels of education, starting from primary school, are important for learners to develop 21st century skills, and that providing students with skills such as decision-making, independent thinking, problem solving, critical thinking, especially from the primary school level, will create solid foundations. While Melvin (2011) emphasizes the importance of skills such as organizing environments, applying the reflective teaching model, arranging personal space and materials, being a model as a leader, cooperating with parents, doing practices between classes and creating a culture of citizenship for change in the 21st century, he points out that it is not clear to what extent they use these skills in education.

In Türkiye, within the scope of the Turkish Qualifications Framework (TQF), all education and training programs and all qualifications gained through other learning methods are designed as a single integrated structure. TQF also includes qualifications for which the Ministry of National Education (MoNE) is responsible, qualifications under the responsibility of the Vocational Qualifications Authority (2015), higher education qualifications offered under the coordination and supervision of the Council of Higher Education and the qualifications of other responsible institutions. In addition, there is an approach in TQF based on "creating an environment where learners can obtain any qualification through different ways". Within TQF, key competencies are included among the learning outcomes of most qualifications. Key competencies are stated as eight competencies: " a) communication in the mother tongue, b) communication in foreign languages, c) mathematical competence and basic competencies in science/technology, d) digital competence, e) learning to learn, f) social and civic competencies, g) taking initiative and entrepreneurship, h) cultural awareness and expression". Interrelated key competencies emphasize "critical thinking, creativity, initiative, problem solving, risk assessment, decision making and constructive management of emotions." In education policies of Türkiye, it is aimed to mostly provide key competencies (Turkish Competencies Framework, 2015).

Teacher candidates must possess a diverse set of 21st-century skills to effectively prepare students for the complexities of the modern world. Research highlights the critical importance of these skills, which include critical thinking, creativity, collaboration, and communication (Pellegrino & Hilton, 2012; Trilling & Fadel, 2009; Wagner, 2008). Ağaoğlu and Demir (2020) emphasize that integrating these skills into teacher education programs enhances candidates' readiness to implement innovative teaching strategies. Additionally, studies by Anagün et al. (2016) and Bedir (2019) suggest that teacher candidates who are well-versed in digital literacy and technological integration are better equipped to foster a dynamic and interactive learning environment. Future educators apply modern learning skills and teaching skills and examines the correlation between their proficiency in these two areas. This relationship is crucial for understanding how well teacher candidates are prepared to both learn and teach using contemporary educational practices and technologies (Orhan-Göksün & Kurt, 2017). Furthermore, Conklin (2012) and Dede (2010) argue that promoting problem-solving and adaptability within teacher training programs is essential for addressing diverse classroom challenges. According to OECD (2019) and P21 (2019), these competencies are pivotal for nurturing students who can thrive in a globalized economy. Consequently, teacher education must evolve to encompass these essential 21st-century skills, ensuring that future educators are prepared to meet the demands of contemporary education (Çınar, 2019; Erten, 2020; Gelen, 2017). Engin and Korucuk (2021) further highlight that understanding the various factors influencing 21st-century skills is crucial for developing effective teaching strategies tailored to diverse student needs. Additionally, the evaluation of the FATİH project indicates that integrating technology in education significantly enhances the development of these crucial skills among students (Eryılmaz & Uluyol, 2015). Miller (2009) also underscores the value of personal learning networks in fostering these skills, demonstrating how personalized, networked learning environments can enhance student engagement and competence. Yeni (2018) further notes that 21st-century skills education positively influences teachers' perceptions of their competence in educational technology and material development.

21st century skills are also very important for teacher candidates in terms of their ability to adapt to today's rapidly changing and developing world. At the same time, the greatest responsibility in providing school-age individuals with 21st century skills falls on teachers, and therefore the competencies of teacher candidates are expected to be increased (Tekerek et al., 2018). These skills will enable teacher candidates not only to convey knowledge to their students, but also to prepare their students for lifelong learning journeys. Some important 21st century skills for teacher candidates can be listed as follows (P21, 2015; UNESCO, 2016):

a) Communication skills: Teacher candidates must be able to communicate effectively with their students, parents and colleagues. For this, they must possess written, verbal and visual communication skills.

b) Use of technology: Teacher candidates should be able to effectively use technology, which is the indispensable tool of our age. In this way, they can teach their students more effectively and efficiently.

c) Critical thinking: Teacher candidates must also have this skill in order to provide their students with critical thinking skills. These skills improve students' "problem solving and decision making" skills.

d) Cooperation: Teacher candidates must also have this skill in order to provide their students with the skill of cooperation. Collaboration improves students' social and emotional skills.

e) Creativity: Teacher candidates need to be creative themselves in order to provide their students with creative thinking skills. Creativity makes students' learning process more fun and interesting.

Recognizing the pivotal role of these essential skills, this study seeks to investigate the level of competency perceptions of prospective teachers regarding 21st-century skills. Specifically, this research aims to answer the following questions:

1. What is the level of competency perceptions of prospective teachers regarding 21st century skills?
2. Do teacher candidates' 21st century skills competency perceptions differ significantly based on the following variables?
    a) Age
    b) Gender
    c) Educational Status

METHOD

Research Model

This research uses a quantitative method with descriptive survey model. This type of survey involves studying large groups to understand their opinions and attitudes about a particular event or phenomenon, aiming at describing these phonemena and events (Karakaya, 2012).

Population and Sample

The population of the research consists of graduate and undergraduate students. The sample of the research consists of 345 prospective teachers studying at Manisa Celal Bayar University in Türkiye in the 2022-2023 academic year. The sampling is determined using the simple random sampling method. Simple random sampling method is the method in which units are sampled, giving each sample selection an equal probability of being selected. This sampling method offers all units in the universe an equal and independent probability of being selected for the sample and is seen as the valid and best way to select a representative sample (Büyüköztürk et al., 2013). For this purpose, we have reached the prospective teachers at all related faculties of a state university and have taken the volunteer participants into the sample.

Data was collected online from the selected prospective teachers. The number of data analyzed in the research was 341. Demographic information about 341 teacher candidates was as follows:

a. *Gender*: Female prospective teachers constitute 86.8% of the total, while male teacher candidates constitute 13.2%. This distribution shows that the majority of the examined group consists of women.
b. *Age*: Prospective teachers aged 31 and over constitute 31.9% of the total, aged 25-30 constitute 20.2% of the total, and aged 18-24 constitute 47.8% of the total.
c. *Educational Status*: 44.2% of prospective teachers are in the graduate group receiving pedagogic formation education, 28.7% are undergraduate students who are continuing their formation education. On the other hand, 6.4% are undergraduate students of the faculty of education. 18.4% of the participants are undergraduate teacher candidates at the faculty of theology and 2% are undergraduate students at the faculty of sports sciences.

Data Collection Tool and Data Collection

In the study, the "21st Century Skills Competences Scale Directed at Teacher Candidates" developed by Anagün et al. (2017) was used to collect data. Necessary permissions for the scale were obtained from the authors. The scale has a three-dimensional

factor structure consisting of 42 items (a) Learning and Renewal Skills, b) Life and Career Skills, c) Information, Media and Technology Skills. To determine the reliability of the scale, the Cronbach's alpha internal consistency coefficient, the Spearman-Brown value, and the Guttman Split-Half value were examined. The reliability analyses indicated that the Cronbach's alpha value for the entire scale was 0.889, the Spearman-Brown value was 0.731, and the Guttman Split-Half value was also 0.731. When examining the Cronbach's alpha coefficients for each factor, the values were calculated as 0.845 for Factor 1, 0.826 for Factor 2, and 0.810 for Factor 3. The scale has a 5-point Likert rating, the minimum score obtained from the scale is 42 and the maximum score is 210. The reliability coefficient (Cronbach Alpha) of the scale obtained from this research is 0.98.

In order to collect data, necessary ethical permissions were first obtained from Manisa Celal Bayar University Ethics Committee. Afterwards, the data collection process was started with the survey form created via Google forms. Data collection from volunteer prospective teachers was carried out over a period of approximately one month.

Validity and Reliability

Since our sample characteristics did not differ significantly from the parameters of the original study, it was assumed that the original validity of the scale was maintained. Before conducting T-test and ANOVA analyzes to investigate differences between the mean score of groups, necessary preliminary analyzes were carried out, including normality and homogeneity of variance, and all assumptions regarding these tests were met. Since the results showed significant differences where expected, the assumption that the scale had discriminant validity was also met in the context of our study.

Analysis of Data

In the analysis of differences among demographic variables, several threshold values were used to ensure the robustness and significance of the results. Descriptive statistics were first calculated, including means and standard deviations, to summarize the data. Descriptive statistics were used to determine the perceptions of the prospective teachers participating in the research towards 21st century skills. Before moving on to descriptive statistics, four surveys with missing data were removed from the data set and analyzes were conducted on 341 forms. The other 341 forms didn't have any missing values. After calculating the extreme values and performing normality tests, the data obtained from the surveys determined to be normally distributed was analyzed. T-test and ANOVA tests were applied on the SPSS (Statistical Package for the Social Sciences) Program to reveal the difference between the scores received by prospective teachers from the 21st century skills scale compared to other variables. For hypothesis testing, a significance level (α) of 0.05 was used, meaning results with a p-value less than 0.05 were considered statistically significant. Post hoc tests were applied to the groups to identify specific differences between group means after the ANOVA test indicated significant differences among the groups.

FINDINGS

First, descriptive statistics (mean and standard deviation scores) were calculated both at the total scale score level and in the context of the three dimensions of the scale to determine teacher candidates' 21st century skills competency perceptions, and the findings are given in Table 1.

Table 1. Descriptive statistics on prospective teachers' perceptions of 21st century skills competency

	N	$\overline{X}$	*Sd*
Learning and Innovation Skills	341	4.13	.53
Life and Career Skills	341	4.32	.44
Information, Media and Technology Skills	341	4.39	.55
21st Century Skills	341	4.26	.42

On Table 1, it is seen that prospective teachers' 21st century skills competency perceptions have the highest mean ($\overline{X} = 4.39$) in the *Information, Media and Technology Skills* dimension, and the lowest mean ($\overline{X} = 4.13$) in the *Learning and Innovation Skills* dimension. In general, it is seen that teacher candidates' 21st century skills competency perceptions are at a high level ($\overline{X} = 4.26$).

T-test was conducted to determine whether prospective teachers' 21st century skills competency perceptions differed significantly based on gender, and the findings are given in Table 2.

Table 2. T-Test results on prospective teachers' 21st century skills competency perception levels by gender variable

	Gender	N	$\overline{X}$	*Sd*	*Sd*	*T*	*p*
Scale	Female	296	4.28	.42	339	1.94	.05*
	Male	45	4.15	.43			

*$p \leq .05$

Prospective teachers' 21st century skills competency perception levels show a significant difference based on the gender variable, t(339)= 1.94, p ≤ .05. It was found that female prospective teachers' 21st century skills competency perceptions ($\overline{X} = 4.28$) were higher than male teacher candidates ($\overline{X} = 4.15$).

Next, ANOVA test was conducted to determine whether teacher candidates' 21st century skills competency perceptions differed significantly based on age, and the findings are given in Table 3.

Table 3. One-Way Analysis of Variance (ANOVA) Results on the Level of Prospective Teachers' 21st Century Skills Competency Perceptions by Age Variable

	Age	N	$\overline{X}$	*Sd*	*F*	*P*	*Significant Difference*
Scale	18-24 (1)	163	4.11	.42	26.26	.00*	1-2
	25-31 (2)	69	4.32	.40			1-3
	32 + (3)	109	4.46	.35			

*p< .01

Prospective teachers' 21st century skills competency perception levels show a significant difference based on the age variable, F= 26.26, p> .01. Post hoc analysis indicated that teacher candidates aged 25-31 years reported significantly higher competency perceptions compared to those aged 18-24 years (p < .01). In addition, the 21st century skills competency perceptions of teacher candidates in the 32 and above age group are higher than the 21st century skills competency perceptions of teacher candidates in the 18-24 age group. As age increases, the perception of 21st century competency also increases.

ANOVA test was conducted to determine whether prospective teachers' 21st century skills competency perceptions differ significantly based on educational status, and the findings are given in Table 4.

Table 4. One-Way analysis of variance (ANOVA) results on the level of prospective teachers' 21st century skills competency perceptions by educational status variable

	Faculty	N	$\overline{X}$	*Sd*	*F*	*p*	*Significant Difference*
Scale	Pedagogic Formation/Graduate (1)	151	4.45	.35	12.55	.00*	1-2
	Pedagogic Formation/Undergraduate (2)	98	4.11	.40			1-3
	Faculty of Education/ Undergraduate (3)	22	4.16	.50			1-4
	Faculty of Theology/ Undergraduate (4)	63	4.15	.41			1-5
	Faculty of Sports Sciences/ Undergraduate (5)	7	3.93	.49			

*p< .01

Prospective teachers' 21st century skills competency perception levels show a significant difference based on the educational status variable, F= 12.55, p> .01. With the post hoc analysis, it was found that the 21st century competency perceptions of the pedagogic formation graduate group were higher than the 21st century competency perceptions of all other groups (pedagogic formation undergraduate, faculty of education undergraduate, faculty of theology undergraduate and faculty of sports sciences undergraduate).

DISCUSSION

As a result of the research, it was found that prospective teachers' 21st century skills competency perceptions were generally at a high level. It is seen that teacher candidates' 21st century skills competency perceptions are highest in the information, media and technology skills dimension, and lowest in the learning and innovation skills dimension. Technological knowledge and skills are undoubtedly one of the foundations of Information and Communication Technologies (ICT) integration, and research has shown that improving teachers' technological skills increases the likelihood of using ICT in the classroom (Hammond et al., 2011).

Some studies in the literature show that teachers who consider themselves sufficient in terms of field knowledge are more successful in choosing the appropriate technology for the subject they teach (Başaran, 2020). Accordingly, Murat (2018) found that prospective science teachers' perceptions of their proficiency in 21st-century skills are closely linked to their attitudes toward STEM education, further illustrating the interconnected nature of these competencies. Moreover, Yıldız and Palak (2016) present a transformative teaching model aimed at cultivating global competencies in the 21st-century classroom, highlighting the necessity for educators to adopt innovative and culturally responsive teaching practices. Therefore, it can be concluded that teacher education programs should equip teacher candidates not only with the use of technological tools but also with the skills to effectively integrate these tools into educational processes (Christensen & Knezek, 2017; Foulger et al., 2017). In particular, adopting strategic approaches to developing learning and innovation skills will be an important step in ensuring the integration of

these skills with other competencies and overcoming the difficulties that may be encountered in the journey of becoming a 21st century teacher.

When the 21st century competency perceptions of teacher candidates were examined on the gender variable, it was seen that female teacher candidates had a higher perception than male teacher candidates. It was determined that the age variable had a significant effect on the 21st century skills competency perception levels of teacher candidates. Similarly, Göksün (2017) found a significant difference in favor of women in terms of the gender variable in his research in the context of 21st century competencies. The findings show that women have higher perceptions of competency is consistent with studies highlighting gender differences in educational qualifications. For example, research shows that women generally rate themselves lower in mathematics proficiency than men, despite similar achievements, but rate themselves higher in literacy (Herbert & Stipek, 2005). In another study examining the levels of teacher candidates' 21st century learner and teacher skills and the relationship between these skills in terms of different variables, it was concluded that although there was no significant difference in terms of gender in the context of 21st century learner skills, there was a significant difference in favor of women in the context of teacher skills (Bakır, 2019). Another study suggests that teachers perceive the temperament and educational competency of boys more negatively than girls, indicating a potential gender bias in educational environments (Mullola et al., 2012). In a study conducted by Şahin et al., (2010) to determine the levels of teacher candidates in terms of lifelong learning basic competencies, researchers found that gender was not an effective factor in terms of teacher candidates' lifelong learning basic competencies. On the other hand, in Erten's (2020) research, no significant difference was found between gender and department variables and 21st century skills.

The finding in this study that teacher candidates' perceptions of competency increase as their age increases is consistent with research showing that age can affect teacher perceptions and competence. For example, Mullola et al. (2011) found that teacher age moderated the relationship between perceived student temperament and educational competency and academic achievement. Another study found a positive relationship between grade level and grade point average and the level of use of 21st century learner skills. It was concluded that as these increased, the usage levels of the skills among the participants also increased (Maltepe & Bayrakdar, 2021).

It has been observed that teacher candidates who are graduates have a higher perception than those who are not graduates. The significant differences found by graduation and faculty may be explained by differences in competencies across various educational backgrounds. For example, a study revealed that the field of study affects the perceived competencies in lifelong learning among prospective teachers (Şahin et al., 2010).

These results point to the importance of teacher candidates' 21st century skills competency perceptions. By learning these skills, teacher candidates can provide their students with the skills necessary in the modern world. In particular, the fact that female teacher candidates have a higher perception of these skills can provide a significant advantage for female teachers to provide students with these skills.

The development of 21st century skills in teaching highlights the need for teachers to have not only subject knowledge and core pedagogical competences, but also universal competences shaped by the political and social context. These include skills such as communication, collaboration, leadership, reflection and creativity (Belyaeva et al., 2022). However, the challenges that arise as well as the opportunities in modern teacher education systems appear as a challenge in the process of developing these skills. Especially, the global trends affecting teacher education such as globalization, information and communication technologies, climate change and sustainable development require a paradigm shift in teacher education to prepare teachers with competencies appropriate for the 21st century (Majumdar, 2011). Vats (2020) discusses the need for teachers to effectively support students in the 21st century, emphasizing the need for competencies to interact with students in a diverse and changing world.

There are many studies highlighting the importance of including 21st century skills in teacher education programs in Türkiye (Bakır, 2019). Discussing the applications of 21st century skills in the higher education curriculum, especially in teacher education, Baltacı Göktalay and Özeke (2015) investigate why teacher candidates should be equipped with 21st century skills and competencies to improve their own teaching skills and technology skills and examine the importance of teacher training institutions in the context of higher education qualifications in Türkiye. That study offers suggestions for implementing these competencies in their curricula. Similarly, González-Pérez and Ramírez-Montoya's (2022) study on Education 4.0 in the context of 21st century skills frameworks highlights the role of higher education in responding to the demands of Industry 4.0. That study points to the need for inclusive, equitable and quality education recommendations that are compatible with lifelong learning opportunities, which is vital in the context of the findings of this study on prospective teachers.

CONCLUSION AND RECOMMENDATIONS

Political and higher education environments play a critical role in shaping the competencies of prospective teachers in the 21st century. Collectively, studies in this field demonstrate the need for education systems and policies that will adapt to global trends, societal needs, and technological advances to effectively prepare teachers. This adaptation is necessary to ensure that teachers are equipped with the necessary skills and competencies to meet the challenges of a rapidly changing world and promote inclusive and equitable education.

As a result, including 21st century skills in education programs and ensuring that prospective teachers receive training on this subject is extremely important in terms of providing students with the skills necessary in the modern world. There is a great need

for studies that demonstrate subtle differences in educational competencies among pre-service teachers. As revealed in this study, these differences, influenced by gender, educational background, and age, highlight the complexity of preparing teachers for the diverse challenges of the 21st century. Since it is thought that teacher candidates who are more aware of their own learning and skills will be able to analyze the target audience more effectively in their teaching lives, it is a necessity to increase these skills above the current level.

All in all, to enhance the development of 21st-century skills among teacher candidates, it is essential to integrate learning and innovation skills into the curriculum through project-based and active learning strategies. Providing comprehensive ICT training and ensuring access to up-to-date technological resources are crucial for strengthening technological proficiency. Promoting gender equity through targeted support programs and awareness campaigns can address specific needs and benefits of diverse teaching teams. Implementing mentorship programs and tailored training based on age and experience can leverage the strengths of teacher candidates at different career stages. Developing robust assessment tools and feedback mechanisms will help measure and improve proficiency in these skills.

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We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

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