Investigation of the 21st Century Skills Levels of Teacher Candidates in Terms of Various Variables[1]
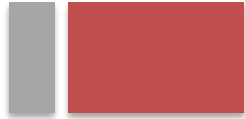
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Abstract
The general purpose of this research is to examine the 21st century skills of teacher candidates in terms of different variables and to reveal their opinions about 21st century skills and teaching. For this purpose, explanatory sequential design was preferred in the research, firstly to obtain a general perspective on the 21st century skills of teacher candidates with quantitative data, and then to use qualitative data to explain these findings in more depth in line with the opinions of teacher candidates. In the research, quantitative data were obtained using the "Multidimensional 21st Century Skills Scale" and qualitative data were obtained with the "Semi-Structured Interview Form" created by the researcher. The study population of the research consists of 993 teacher candidates studying at Ankara University Faculty of Educational Sciences, and the sample consists of 379 teacher candidates selected from this population. In the qualitative phase of the research, the study group consists of a total of 12 participants, including 2 teacher candidates from each department within the faculty. When the data obtained in the research are evaluated; Teacher candidates' multidimensional 21st century skills are at a medium level; It was concluded that the lowest level was in the critical thinking and problem solving sub-dimension, and the highest level was in the career awareness sub-dimension. When examined in terms of demographic factors, it was determined that the 21st century skills levels of teacher candidates did not differ according to the variables of gender, mother's education level and father's education level. There is a significant difference according to department and GPA variables; Participants in classroom teaching, preschool teaching, and Computer and Instructional Technologies Teaching departments have higher levels of multidimensional 21st century skills compared to participants in psychological counseling and guidance and special education teaching departments; In terms of GPA, it was determined that participants with a high GPA had more of these skills than those with a medium GPA. In the qualitative part of the research, the participants' opinions were included through direct quotations and these opinions were analyzed by comparing them with the existing literature. Considering the interview data, teacher candidates' definitions of 21st century skills and their views on teaching these skills reveal that their level of knowledge regarding these skills is high. Digital literacy, communication, problem solving, collaboration, critical thinking and creativity are among the basic skills highlighted by teacher candidates. In addition, prospective teachers state that students' acquisition of 21st century skills will positively contribute to their personal development, contribution to society and preparation for their careers. In line with the research results, various suggestions are presented for prospective teachers, relevant institutions and organizations, and future research in the context of 21st century skills.

Key Words: 21st century skills, teacher candidates

P21 Framework for 21st Century Skills

The Partnership for 21st Century Learning (P21), a U.S.-based initiative, developed a comprehensive framework to ensure that students are equipped as competent individuals who meet the demands of the modern era. This framework, shaped through the contributions of

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educators, academics, and representatives from the business world, defines the essential skills students need to thrive in an information-driven society (P21, 2019a).

Internationally recognized, this structure aims to make learning processes active, meaningful, and sustainable, while also empowering individuals in both professional life and civic engagement (Cansoy, 2018).

The P21 framework is organized into three main categories:
1. Learning and Innovation Skills
2. Information, Media, and Technology Skills
3. Life and Career Skills

The framework also includes critical support systems—such as assessment, curriculum, professional development, and learning environments—which play a vital role in the effective instruction of these skills (P21, 2019b).

Learning and Innovation Skills

This category includes skills such as creativity and innovation, critical thinking and problem solving, communication, and collaboration. In a complex and ever-changing world, students need these competencies to generate creative ideas, develop innovative solutions, and analyze diverse perspectives (P21, 2019a; Trilling & Fadel, 2009).
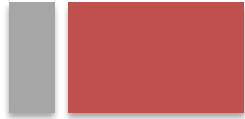
Creativity and innovation refer to individuals' abilities to generate original ideas, perceive failures as part of the learning process, and remain open to change (Öğretir Özçelik, 2019). Critical thinking enhances individuals' capacity to direct both personal and social life through analyzing information, reasoning, and drawing logical conclusions (Paul & Elder, 2006). Problem solving involves the process of drawing upon past experiences to generate effective solutions to present challenges (Karakuş, 2001).

Communication and collaboration skills require individuals to express their thoughts and emotions both verbally and non-verbally, and to work efficiently with others toward shared goals (Hotaman, 2020; P21, 2019a). Teachers, in particular, are expected to model and support these skills within the classroom setting (Yeşildağ Hasançebi, 2021).

Information, media, and technology skills

In today's digital age, individuals' ability to access, evaluate, and ethically use information is of critical importance. This category encompasses information literacy, media literacy, and information and communication technology (ICT) literacy (UNESCO, 2006; P21, 2019a).

Information literacy involves knowing how to access information, analyzing it effectively, and integrating it into real-life problem-solving processes (Warmkessel & McCade, 1997). Media literacy refers to the competence to critically analyze media content, understand various perspectives, and use media tools consciously (RTÜK, 2024). ICT literacy represents the efficient and ethical use of technological tools. In the processes of accessing, analyzing, sharing, and creating information, digital literacy has become a fundamental necessity (ISTE, 2002; P21, 2019a).

In fostering these skills, teachers are expected to enhance their own digital competencies and enrich learning environments through the effective integration of technology (Aydoğmuş & Karadağ, 2020).

Life and career skills

This category enables individuals to succeed both in professional and personal life by developing skills such as flexibility, self-management, productivity, and leadership (PPRC, 2010; P21, 2019a).

Flexibility and adaptability refer to individuals' ability to adjust to changing conditions and communicate effectively in multicultural environments (Trilling & Fadel, 2009). Entrepreneurship and self-management involve setting goals, taking responsibility, and maintaining ownership of one's own learning processes (Sarıtaş & Duran, 2017). Social and cross-cultural skills represent the capacity to establish respectful relationships with individuals from diverse identities (UNESCO, 2006).

Productivity and accountability encompass acting with time management and a sense of responsibility to achieve goals (Gedikoğlu, 2012). Leadership and responsibility include the ability to guide others effectively within a group, demonstrate ethical behavior, and contribute to collective objectives (Fiedler & Garcia, 2005).

21st Century Skills in the Context of the Teaching Profession

Today, teaching is no longer solely about transmitting knowledge; it also encompasses the responsibility of guiding students and managing learning processes. The competencies expected of teachers have evolved in response to technological advancements and globalization (Çalık & Sezgin, 2005). Teachers are now expected to facilitate learning, be open to innovative practices, promote problem solving and critical thinking, and prepare students as individuals equipped with digital literacy skills (Öğretir Çelik, 2009).

In this context, teachers are required to engage in continuous professional development and to design pedagogical strategies aimed at equipping their students with 21st century skills. Qualified teachers contribute not only to individual academic success but also to the development of schools, communities, and the nation at large (Yılmaz, 2011).

As a result of technological developments and globalization, the knowledge, skills, and competencies expected of individuals have significantly changed. Today's learners are expected to demonstrate multifaceted competencies such as problem solving, creativity, critical thinking, and information and technology literacy (Trilling & Fadel, 2009; Griffin, McGaw & Care, 2012). These skills play a crucial role not only in academic achievement but also in individuals' social and professional success. Frameworks developed by national and international organizations (P21, ATC21S, OECD, EU, ISTE) aim to cultivate individuals who are aligned with the knowledge-based structure of 21st-century society (OECD, 2015; ISTE, 2016; P21, 2019a). In Turkey, the Ministry of National Education (MoNE) has also issued various strategic documents and programs to integrate these skills into the national education system (MoNE, 2015, 2017b).

Accordingly, teachers are expected not only to possess these skills but also to demonstrate the pedagogical competence to transfer them to their students (Aydın & Tunagür, 2021). Preservice teachers are the key actors in this process. However, the literature includes very few studies that examine both the skill levels of preservice teachers and their perceptions regarding the instruction of these skills using a mixed-methods approach.

Purpose of the Study

The aim of this study is to examine the level of 21st century skills possessed by preservice teachers in relation to various variables and to analyze their views regarding the instruction of these skills. The research seeks to address the following questions:
1. What are the levels of preservice teachers' skills in information and technology literacy, critical thinking and problem solving, entrepreneurship and innovation, social responsibility and leadership, and career awareness?
2. Do these levels differ based on variables such as gender, department, academic achievement, and parental education level?
3. What are preservice teachers' perspectives on the instruction of 21st century skills?
4. How can the quantitative findings be better understood through the support of qualitative data?
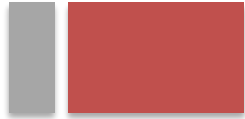
Method

The purpose of this study is to examine the levels of 21st century skills among preservice teachers in relation to various variables. To achieve this aim, a mixed methods approach was employed, specifically utilizing an explanatory sequential design. In the first phase, quantitative data were collected, followed by qualitative data in the second phase to provide deeper insight into the quantitative findings.

Research Design

The quantitative dimension of the study is based on the general survey model, which aims to describe the current situation (Karasar, 2012). For the qualitative dimension, a phenomenological design was adopted, aiming to understand specific phenomena based on individuals' lived experiences (Yıldırım & Şimşek, 2021). The use of a mixed-methods design was preferred to ensure data diversity and enhance the validity of the findings.

Population and Sample / Study Group

The population of the quantitative phase of the study consists of 993 preservice teachers enrolled in the 3rd and 4th years at the Faculty of Educational Sciences, Ankara University, during the 2023–2024 academic year. Using a stratified sampling method, a total of 379 preservice teachers were selected to represent the proportional distribution of programs within the population. Among the participants, 69.1% were female and 30.9% were male. Variables such as academic achievement, department, and parental education level were also taken into consideration. The study group for the qualitative phase was composed of 12 preservice teachers, with two students selected from each teacher education program. Participants were chosen through maximum variation sampling to ensure diversity in terms of gender, academic standing, and grade level.

Data Collection Instruments

Data were collected using three instruments:

The Multidimensional 21st Century Skills Scale (M21CSS): Developed by Çevik and Şentürk (2019), this 41-item, 5-point Likert-type scale consists of five subdimensions: information and technology literacy, critical thinking, entrepreneurship, social responsibility, and career awareness. The overall Cronbach's alpha reliability coefficient was reported as .87, with subdimensions ranging between .43 and .86.

Semi-Structured Interview Form: This form was developed to collect qualitative data. It was constructed in alignment with the scale's subdimensions and refined based on expert feedback.

Personal Information Form: This form was used to gather demographic information about participants, including gender, academic department, grade point average, and parental education level.

Data Collection

Ethical approval and institutional permissions were obtained prior to the data collection process. Quantitative data were collected through face-to-face administration in classroom settings, while qualitative data were gathered via audio-recorded interviews conducted either in person or online.

Data Analysis

Quantitative data were analyzed using SPSS 22.0. In addition to descriptive statistics such as frequency, percentage, mean, and standard deviation, inferential analyses including t-tests and ANOVA were conducted. Assumptions of normal distribution were tested, and where appropriate, group differences were further examined using the LSD post-hoc test.

Qualitative data were analyzed using content and descriptive analysis techniques. MAXQDA Pro 2020 software was employed for data management and coding. The coding process was carried out through an inductive approach, and the analysis was supported with direct quotations from participant interviews.

Validity and Reliability

In the quantitative analyses, the overall reliability of the scale was found to be high ($\alpha = .87$); however, low reliability was observed in the social responsibility subdimension ($\alpha = .43$).

In the qualitative analyses, validity and reliability were ensured based on Lincoln and Guba's (1985) four criteria:
- Credibility: Established through expert review and participant confirmation.
- Transferability: Ensured by providing detailed descriptions of participant characteristics and sample structure.
- Dependability: Achieved through a systematic coding process and supervision by a research advisor.
- Confirmability: Maintained by archiving interview audio recordings, codes, and analytical procedures.

Results

This section of the study presents the findings and interpretations derived from the analysis of quantitative and qualitative data collected from preservice teachers studying at the Faculty of Educational Sciences, Ankara University. The findings and interpretations are organized under headings corresponding to the sub-objectives of the research.

Quantitative Findings

In this section, the analysis results of the Multidimensional 21st Century Skills Scale (M21CSS) regarding the preservice teachers' levels of 21st century skills are presented by addressing each subdimension individually.

Findings on Preservice Teachers' Levels of 21st Century Skills

In the quantitative phase of the study, descriptive statistics of subdimensions and the total scale scores were used to examine how preservice teachers from the Faculty of Educational Sciences at Ankara University perceived their levels of 21st century skills in the areas of information and technology literacy, critical thinking and problem solving, entrepreneurship and innovation, social responsibility and leadership, and career awareness.

Table 1 presents the skewness and kurtosis values for the overall 21st century skills scale and its subdimensions within the preservice teacher dataset.

Table 1

Means, Standard Deviations, Skewness, and Kurtosis Values of the Multidimensional 21st Century Skills Scale (M21CSS)

Scale	Subdimensions	N	$\bar{X}$	Ss	Skewness	Kurtosis
Multidimensional 21st Century Skills Scale	Information and Technology Literacy	379	3,937	0,486	,006	-,137
	Critical Thinking and Problem Solving	379	1,955	0,631	,366	-,234
	Entrepreneurship and Innovation	379	3,233	0,660	,205	-,138
	Social Responsibility and Leadership	379	3,270	0,695	,037	-,318
	Career Awareness	379	4,307	0,549	-,654	-,008
	Total	379	3,340	0,361	,042	-,218

As shown in Table 1, the skewness values range from –.654 to .366, and the kurtosis values range from –.318 to –.008. Based on the acceptable skewness and kurtosis range of –1 to +1 as recommended by Hair, Black, Babin, Anderson, and Tatham (2013), the distribution is considered normal. Additionally, according to the overall mean score of the M21CSS (3.340), preservice teachers are positioned at the "neutral" level, indicating that they possess 21st century skills to a moderate extent.

Table 2 presents the descriptive statistics of the distributions for the overall 21st century skills scale and its subdimensions within the preservice teacher dataset.
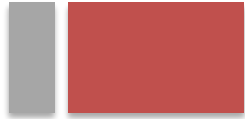
Table 2

Descriptive Statistics of Participants' Tendency Levels in Multidimensional 21st Century Skills

Subdimensions	*N*	*X̄*	*Ss*	*Level of Agreement*
Information and Technology Literacy	379	3,937	0,486	Agree
Critical Thinking and Problem Solving	379	1,955	0,631	Disagree
Entrepreneurship and Innovation	379	3,233	0,660	Neutral
Social Responsibility and Leadership	379	3,270	0,695	Neutral
Career Awareness	379	4,307	0,549	Strongly Agree
Multidimensional 21st Century Skills Scale	379	3,340	0,361	Neutral

As shown in Table 2, participants in the study group generally expressed a neutral stance (x̄ = 3.340; SD = 0.361) regarding their multidimensional 21st century skills. This suggests that participants tend to evaluate their perceptions of these skills as undecided overall. Among the subdimensions, the highest mean score was observed in career awareness (x̄ = 4.307; SD = 0.549), whereas the lowest mean score was in critical thinking and problem solving (x̄ = 1.955; SD = 0.631). Additionally, preservice teachers considered themselves competent in "Information and Technology Literacy" skills.

The following section presents whether the preservice teachers' views on their 21st century skill levels differ significantly by gender, academic department, grade point average, and parental education level.
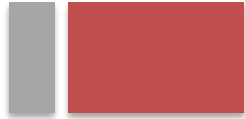
Findings Related to the Gender Variable

An Independent Samples t-test was conducted to examine the scores of preservice teachers on the 21st century skills scale and its subdimensions based on gender. The results of the analysis are presented in Table 3.

Table 3

Examination of Participants' Multidimensional 21st Century Skill Levels by Gender

Subdimensions	Gruplar	*N*	*X̄*	*Ss*	T- test *T*	*df*	*p*
Information and Technology Literacy	Female	262	3,907	0,486	-1,783	377	,075
	Male	117	4,004	0,481			
Critical Thinking and Problem Solving	Female	262	1,974	0,655	,895	377	,371
	Male	117	1,911	0,575			
Entrepreneurship and Innovation	Female	262	3,206	0,652	-1,164	377	,245
	Male	117	3,292	0,676			
Social Responsibility and Leadership	Female	262	3,251	0,691	-,816	377	,415
	Male	117	3,314	0,705			
Career Awareness	Female	262	4,352	0,527	2,377	377	,018*
	Male	117	4,208	0,586			
Multidimensional 21st Century Skills Scale	Female	262	3,338	0,355	-,186	377	,853
	Male	117	3,346	0,375			

As shown in Table 3, a statistically significant difference was found in the career awareness subdimension based on gender (t(377) = 2.377, p < .05). Female participants reported higher levels of career awareness ($\bar{x}$ = 4.352; SD = 0.527) compared to male participants ($\bar{x}$ = 4.208; SD = 0.586). However, no statistically significant differences were observed between genders in the subdimensions of information and technology literacy (t(377) = –1.783, p > .05), critical thinking and problem solving (t(377) = 0.895, p > .05), entrepreneurship and innovation (t(377) = –1.164, p > .05), social responsibility and leadership (t(377) = –.816, p > .05), or in the overall multidimensional 21st century skills scores (t(377) = –.186, p > .05).

Findings Related to the Department Variable

Table 4 presents the results of a one-way analysis of variance (ANOVA) conducted to determine whether there are statistically significant differences in the total scores and subdimension scores of the 21st Century Skills Scale among preservice teachers based on their academic departments.
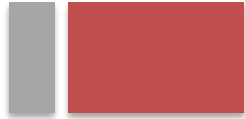
Table 4

Examination of Participants' Multidimensional 21st Century Skill Levels by Academic Department

Subdimensions	Groups	N	$\bar{X}$	Ss	Source of Variance	Sum of Squares	Sd.	Mean Square	F	p	LSD
Information and Technology Literacy	Elementary Teaching (1)	103	4,033	0,495	Between Groups	4,318	5	,864	3,789	,002**	
	GPC (2)	70	3,788	0,434	Within Groups	85,017	373	,228			1-2
	Early Childhood Education (3)	62	3,891	0,463	Total	89,335	378				1-5 2-4 2-5
	Social Studies (4)	50	3,964	0,414							6-2 6-3
	Special Education (5)	52	3,842	0,506							6-5
	CEIT (6)	42	4,104	0,548							
Critical Thinking and Problem Solving	Elementary Teaching (1)	103	1,948	0,621	Between Groups	,567	5	,113	,282	,923	
	GPC (2)	70	1,981	0,579	Within Groups	150,281	373	,403			
	Early Childhood Education (3)	62	2,024	0,674	Total	150,849	378				
	Social Studies (4)	50	1,920	0,610							
	Special Education (5)	52	1,903	0,606							
	CEIT (6)	42	1,932	0,750							

Scale	Group	N	Mean	SD	Source	SS	df	MS	F	p	Differences
Entrepreneurship and Innovation	Elementary Teaching (1)	103	3,300	0,656	Between Groups	6,544	5	1,309	3,084	,010**	
	GPC (2)	70	3,052	0,556	Within Groups	158,317	373	,424			1-2
	Early Childhood Education (3)	62	3,296	0,660	Total	164,861	378				2-3 2-6 4-6 5-6
	Social Studies (4)	50	3,192	0,709							
	Special Education (5)	52	3,105	0,632							
	CEIT (6)	42	3,483	0,720							
Social Responsibility and Leadership	Elementary Teaching (1)	103	3,291	0,789	Between Groups	2,422	5	,484	1,002	,416	
	GPC (2)	70	3,171	0,598	Within Groups	180,357	373	,484			
	Early Childhood Education (3)	62	3,419	0,698	Total	182,779	378				
	Social Studies (4)	50	3,285	0,668							
	Special Education (5)	52	3,201	0,669							
	CEIT (6)	42	3,232	0,656							
Career Awareness	Elementary Teaching (1)	103	4,335	0,522	Between Groups	2,966	5	,593	1,987	,080	
	GPC (2)	70	4,323	0,478	Within Groups	111,343	373	,299			
	Early Childhood Education (3)	62	4,301	0,618	Total	114,309	378				
	Social Studies (4)	50	4,373	0,510							
	Special Education (5)	52	4,099	0,630							
	CEIT (6)	42	4,404	0,525							
Multidimensional 21st Century Skills Scale	Elementary Teaching (1)	103	3,381	0,394	Between Groups	1,698	5	,340	2,654	,023*	
	GPC (2)	70	3,263	0,266	Within Groups	47,717	373	,128			1-2 1-5 2-3
	Early Childhood Education (3)	62	3,386	0,321	Total	49,414	378				2-6 3-5 5-6
	Social Studies (4)	50	3,346	0,374							

Special Education (5)	52	3,230	0,347
CEIT (6)	42	3,431	0,430

*p<0,05,** p<0,01, Tek Yönlü Varyans Analizi (ANOVA)

As shown in Table 4, participants' scores in the subdimensions of critical thinking and problem solving, social responsibility and leadership, and career awareness did not show a statistically significant difference based on their academic departments (p > .05). However, a statistically significant difference was found in the information and technology literacy subdimension scores according to participants' departments (F(5, 373) = 3.789; p < .05). According to the results of the LSD test conducted to identify the source of the difference, participants from the elementary school teaching department scored significantly higher in information and technology literacy compared to those from the guidance and psychological counseling and special education departments. Similarly, participants from the social studies teaching department scored higher than those from the guidance and psychological counseling department; participants from the special education department scored higher than those from the guidance and psychological counseling department; and participants from the computer education and instructional technology department scored higher than those from the guidance and psychological counseling, early childhood education, and special education departments.

In the entrepreneurship and innovation subdimension, participants' scores also differed significantly by academic department (F(5, 373) = 3.084; p < .05). According to the LSD test results, participants from the elementary school teaching, early childhood education, and computer education and instructional technology departments scored significantly higher than those from the guidance and psychological counseling department. Moreover, participants from the computer education and instructional technology department had higher entrepreneurship and innovation scores than those from the social studies teaching and special education departments.

Finally, a statistically significant difference was found in the overall multidimensional 21st century skills scale scores based on academic department (F(5, 373) = 2.654; p < .05). LSD test results indicated that participants from the elementary school teaching department scored higher than those from the guidance and psychological counseling and special education departments; participants from the early childhood education department scored higher than those from the guidance and psychological counseling and special education departments; and participants from the computer education and instructional technology department scored higher than those from the guidance and psychological counseling and special education departments in terms of overall multidimensional 21st century skills.

Findings Related to the Grade Point Average (GPA) Variable

Accordingly, Table 5 presents the results of the Kruskal-Wallis H test conducted to determine whether there are statistically significant differences in the subdimensions of the 21st Century Skills Scale based on the grade point average (GPA) variable among preservice teachers.
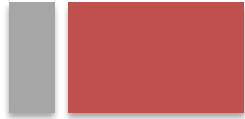
Table 5

Kruskal-Wallis H Test Results on Differences in Multidimensional 21st Century Skill Levels According to Participants' Grade Point Average (GPA)

Scale and Dimensions	Groups	N	$\bar{x}_{sira}$	x^2	sd	p	Difference
Information and Technology Literacy	Low	21	148.50				**Low-High**
	Medium	167	170.92	15.29	2	**.000**	**Medium-**
	High	191	211.24				**High**
Critical Thinking and Problem Solving	Low	21	236.17				
	Medium	167	184.75	4.15	2	**.126**	-
	High	191	189.51				
Entrepreneurship and Innovation	Low	21	161.14				**Low-High**
	Medium	167	173.24	10.44	2	**.005**	**Medium-**
	High	191	207.82				**High**
Social Responsibility and Leadership	Low	21	159.17				
	Medium	167	183.34	3.68	2	**.159**	-
	High	191	199.22				
Career Awareness	Low	21	150.88				
	Medium	167	183.14	5.08	2	**.079**	-
	High	191	200.30				
Multidimensional 21st Century Skills Scale	Low	21	166.19				**Medium-High**
	Medium	167	172.20	10.66	2	**.005**	
	High	191	208.18				

As shown in Table 5, no statistically significant differences were found in the subdimensions of critical thinking and problem solving, social responsibility and leadership, and career awareness based on participants' grade point average (GPA) (p > .05). However, significant differences were observed in the subdimensions of information and technology literacy, entrepreneurship and innovation, and in the overall scores of the Multidimensional 21st Century Skills Scale (p < .05). To determine the direction of these significant differences, Mann-Whitney U tests were conducted. The findings related to these differences are presented below.

Regarding information and technology literacy, significant differences were found between participants with low and high GPAs, as well as between those with medium and high GPAs, in favor of participants with higher GPAs. Similarly, in the entrepreneurship and innovation subdimension, significant differences were observed between participants with low and high GPAs, and between those with medium and high GPAs, again in favor of those with higher GPAs. For the overall Multidimensional 21st Century Skills Scale scores, a significant difference was found between participants with medium and high GPAs, with higher scores favoring those with higher academic performance.

Findings Related to the Mother's Education Level Variable

Table 6 presents the results of a one-way analysis of variance (ANOVA) conducted to determine whether there are statistically significant differences in the total and subdimension scores of the 21st Century Skills Scale among preservice teachers based on their mothers' education levels.
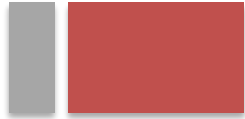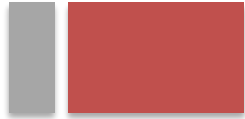
Table 6

Examination of Participants' Multidimensional 21st Century Skill Levels by Mother's Education Level

Subdimensions	Groups	N	X̄	Ss	Source of Variance	Sum of Squares	Sd.	Mean Square	F	p
Information and Technology Literacy	Primary School (1)	179	3,899	0,493	Between Groups	,521	3	,174	,733	,533
	Middle School (2)	54	3,959	0,503	Within Groups	88,815	375	,237		
	High School (3)	92	3,968	0,428	Total	89,335	378			
	Undergraduate (4)	54	3,990	0,539						
Critical Thinking and Problem Solving	Primary School (1)	179	1,929	0,651	Between Groups	,254	3	,085	,211	,889
	Middle School (2)	54	1,969	0,696	Within Groups	150,595	375	,402		
	High School (3)	92	1,972	0,589	Total	150,849	378			
	Undergraduate (4)	54	1,996	0,576						
Entrepreneurship and Innovation	Primary School (1)	179	3,194	0,648	Between Groups	,773	3	,258	,589	,622
	Middle School (2)	54	3,259	0,627	Within Groups	164,088	375	,438		
	High School (3)	92	3,239	0,692	Total	164,861	378			
	Undergraduate (4)	54	3,325	0,681						
Social Responsibility and Leadership	Primary School (1)	179	3,247	0,690	Between Groups	,396	3	,132	,271	,846
	Middle School (2)	54	3,282	0,702	Within Groups	182,383	375	,486		
	High School (3)	92	3,323	0,669	Total	182,779	378			
	Undergraduate (4)	54	3,245	0,760						
Career Awareness	Primary School (1)	179	4,272	0,536	Between Groups	,667	3	,222	,734	,532
	Middle School (2)	54	4,280	0,565	Within Groups	113,642	375	,303		
	High School (3)	92	4,360	0,507	Total	114,309	378			
	Undergraduate (4)	54	4,361	0,645						
Multidimensional 21st Century Skills Scale	Primary School (1)	179	3,308	0,362	Between Groups	,385	3	,128	,980	,402
	Middle School (2)	54	3,350	0,352	Within Groups	49,030	375	,131		
	High School (3)	92	3,272	0,341	Total	49,414	378			
	Undergraduate (4)	54	3,383	0,399						

As shown in Table 6, participants' levels of information and technology literacy, critical thinking and problem solving, entrepreneurship and innovation, social responsibility and leadership, career awareness, and overall multidimensional 21st century skills did not show

statistically significant differences based on the mother's education level variable (p > .05).

Findings Related to the Father's Education Level Variable

Table 7 presents the results of a one-way analysis of variance (ANOVA) conducted to determine whether there are statistically significant differences in the total and subdimension scores of the 21st Century Skills Scale among preservice teachers based on their fathers' education levels.

Table 7

Examination of Participants' Multidimensional 21st Century Skill Levels by Father's Education Level

Subdimensions	Groups	N	X̄	Ss	Source of Variance	Sum of Squares	Sd.	Mean Square	F	p
Information and Technology Literacy	Primary School (1)	117	3,911	0,496	Between Groups	,219	3	,073	,308	,820
	Middle School (2)	68	3,934	0,461	Within Groups	89,116	375	,238		
	High School (3)	112	3,972	0,469	Total	89,335	378			
	Undergraduate (4)	82	3,930	0,518						
Critical Thinking and Problem Solving	Primary School (1)	117	1,968	0,618	Between Groups	3,096	3	1,032	2,619	,051
	Middle School (2)	68	1,779	0,614	Within Groups	147,752	375	,394		
	High School (3)	112	1,968	0,650	Total	150,849	378			
	Undergraduate (4)	82	2,063	0,619						
Entrepreneurship and Innovation	Primary School (1)	117	3,188	0,612	Between Groups	,805	3	,268	,614	,607
	Middle School (2)	68	3,213	0,719	Within Groups	164,056	375	,434		
	High School (3)	112	3,301	0,628	Total	164,861	378			
	Undergraduate (4)	82	3,220	0,720						
Social Responsibility and Leadership	Primary School (1)	117	3,228	0,745	Between Groups	,824	3	,275	,566	,638
	Middle School (2)	68	3,364	0,648	Within Groups	181,955	375	,485		
	High School (3)	112	3,270	0,687	Total	182,779	378			
	Undergraduate (4)	82	3,253	0,674						
Career Awareness	Primary School (1)	117	4,294	0,548	Between Groups	,029	3	,010	,032	,992
	Middle School (2)	68	4,311	0,539	Within Groups	114,280	375	,305		
	High School (3)	112	4,314	0,574	Total	114,309	378			
	Undergraduate (4)	82	4,315	0,536						
Multidimensional 21st Century Skills Scale	Primary School (1)	117	3,318	0,362	Between Groups	,175	3	,058	,445	,721
	Middle School (2)	68	3,320	0,348	Within Groups	49,239	375	,131		

High School (3)	112	3,365	0,350	Total	49,414	378
Undergraduate (4)	82	3,356	0,388			

As shown in Table 7, participants' levels of information and technology literacy, critical thinking and problem solving, entrepreneurship and innovation, social responsibility and leadership, career awareness, and overall multidimensional 21st century skills did not show statistically significant differences based on the father's education level variable (p > .05).

Qualitative Findings

In the qualitative phase of the study, preservice teachers' views on 21st century skills and their instruction were collected through a semi-structured interview form developed by the researcher and are presented below.

Findings on Preservice Teachers' Perceptions of 21st Century Skills and Their Development

Preservice teachers were asked the following questions: "How would you define 21st century skills?", "Why do you think 21st century skills are important?", "What resources do you use to focus on 21st century skills in your own professional development?", and "Can you explain why your students should acquire 21st century skills?". Based on the responses to these questions, the findings were visualized using the hierarchical code-subcode model presented in Figure 1.

Figure 1

Hierarchical Code–Subcode Model of Preservice Teachers' Perceptions of 21st Century Skills and Their Development
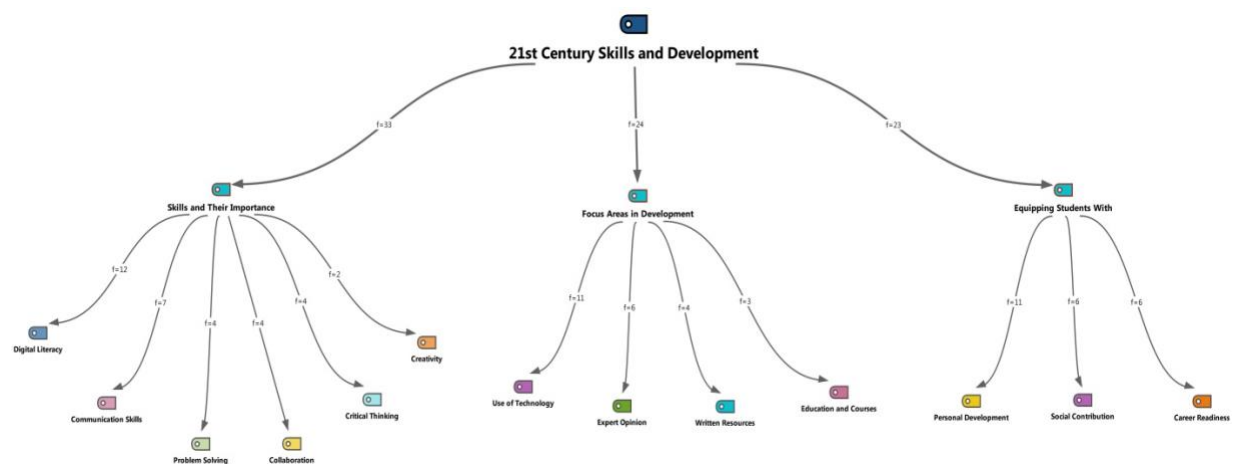

The research findings indicate that preservice teachers conceptualized 21st century skills and their developmental processes under three main themes: Skills and Their Importance, Focus Areas in Development, and Equipping Students With These Skills. The subcodes and frequency values associated with these themes were structured according to the model presented in Figure 1.

Findings on Preservice Teachers' Information Technology Literacy Skills

Preservice teachers were asked the following questions: "How do you identify reliable sources and evaluate the accuracy of information when accessing knowledge?" and "How do you aim to guide your students in researching and evaluating information?" Based on the responses, the emerging themes were organized into a hierarchical code–subcode model, as presented in Figure 2.

Figure 2

Hierarchical Code–Subcode Model of Preservice Teachers' Information Technology Literacy
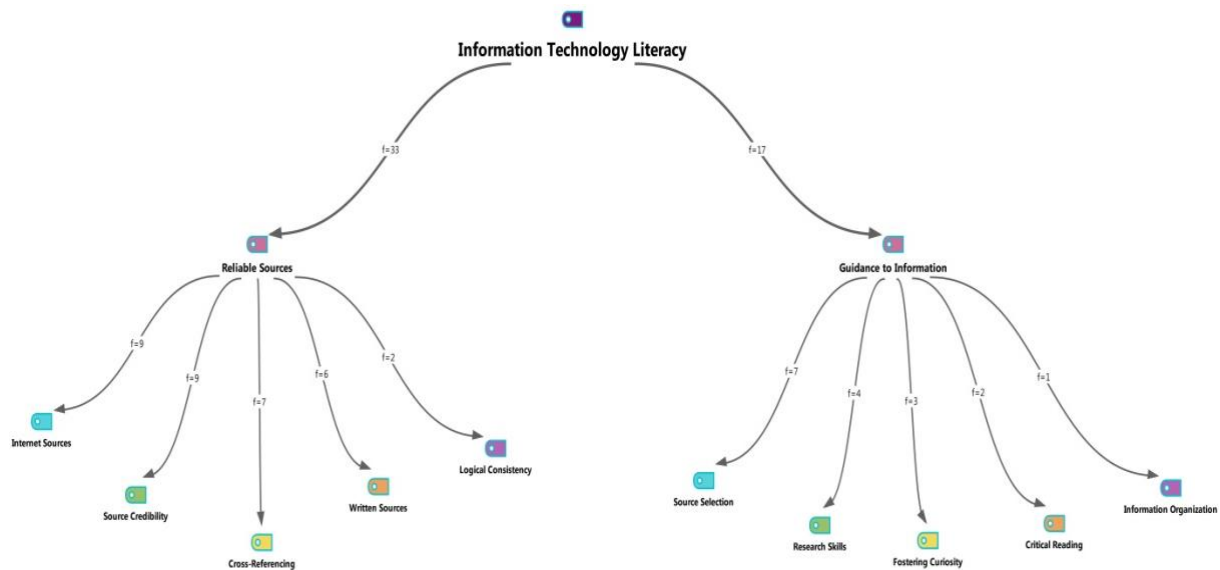
As shown in Figure 2, preservice teachers' views on information technology literacy were categorized under two main themes: Reliable Sources (f = 33) and Guidance to Information (f = 17).

Findings on Preservice Teachers' Critical Thinking and Problem Solving Skills

Preservice teachers were asked the following questions: "What criteria do you prioritize when making a decision about your life or evaluating an idea, and why are these criteria important?", "What types of strategies do you think can be used to develop students' critical thinking skills?", and "Which problem-solving methods do you believe can be taught to students to address learning-related issues in the classroom?" Based on the responses, the findings were structured into a hierarchical code–subcode model, as presented in Figure 3.

Figure 3

Hierarchical Code–Subcode Model of Preservice Teachers' Critical Thinking and Problem Solving Skills
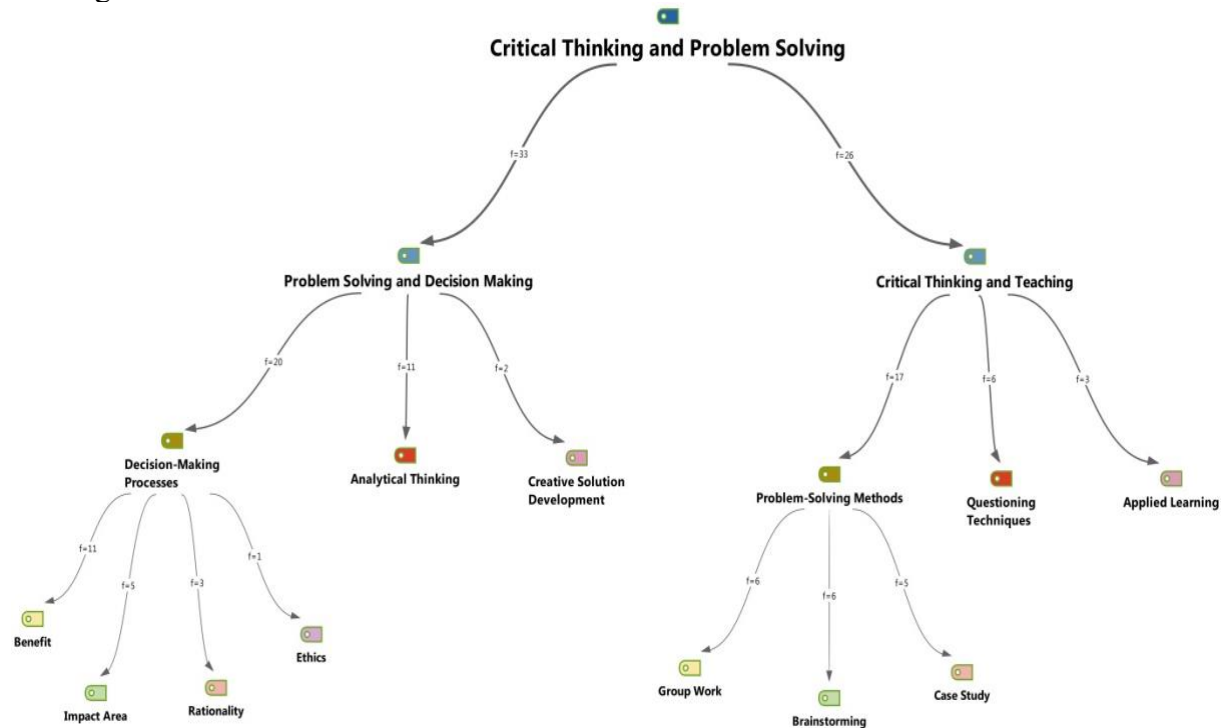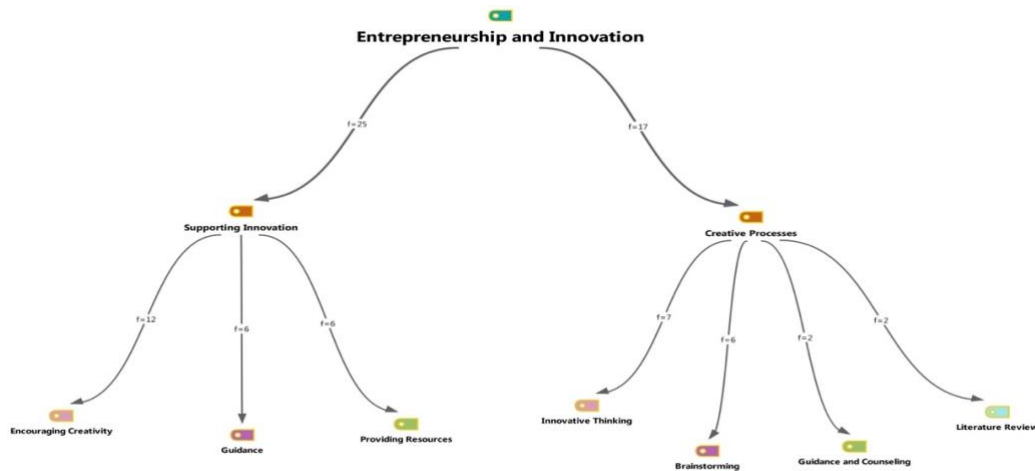

As shown in Figure 3, preservice teachers' views on critical thinking and problem solving skills were grouped under two main themes: Problem Solving and Decision Making (f = 33) and Critical Thinking and Instruction (f = 26).

Findings on Preservice Teachers' Entrepreneurship and Innovation Skills

Preservice teachers were asked the following questions: "What process do you follow when developing a new idea or project? What methods and techniques do you use?", "What do you do to foster students' creativity and innovation skills?", and "How do you guide students in implementing their new ideas?" Based on the responses, the findings were structured into a hierarchical code–subcode model, as presented in Figure 4.

Figure 4

Hierarchical Code–Subcode Model of Preservice Teachers' Entrepreneurship and Innovation Skills
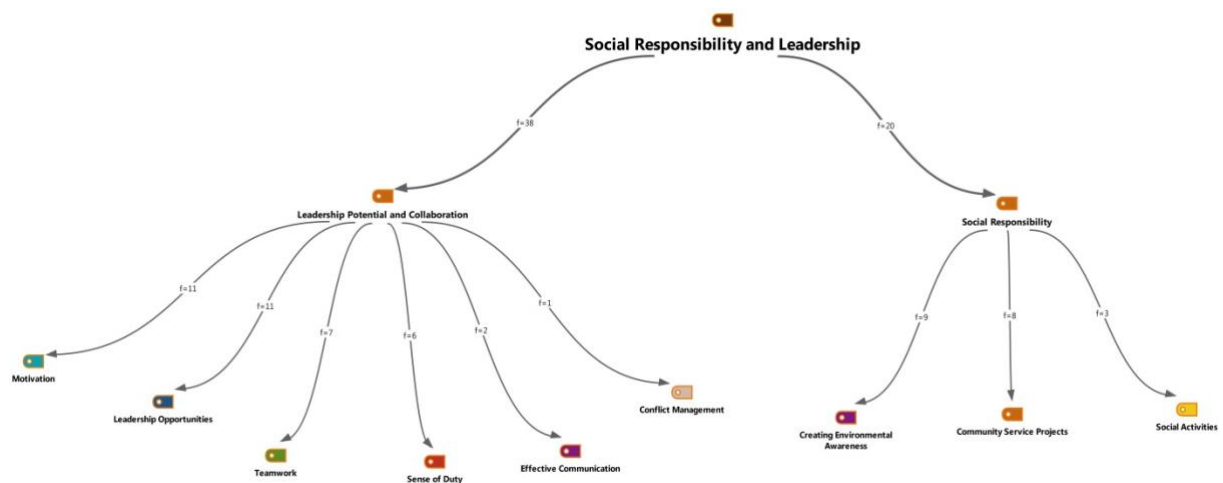

As shown in Figure 4, preservice teachers' views on entrepreneurship and innovation skills were categorized under two main themes: Supporting Innovation (f = 25) and Creative Processes (f = 17).

Findings on Preservice Teachers' Social Responsibility and Leadership Skills

Preservice teachers were asked the following questions: "What strategies do you use to motivate others and promote collaboration when working with a group of students?", "What kinds of activities do you organize to instill a sense of social responsibility in students?", and "What can you do to support students' leadership potential in the classroom or at school?" Based on the responses, the findings were structured into a hierarchical code–subcode model, as presented in Figure 5.

Figure 5

Hierarchical Code–Subcode Model of Preservice Teachers' Social Responsibility and Leadership Skills
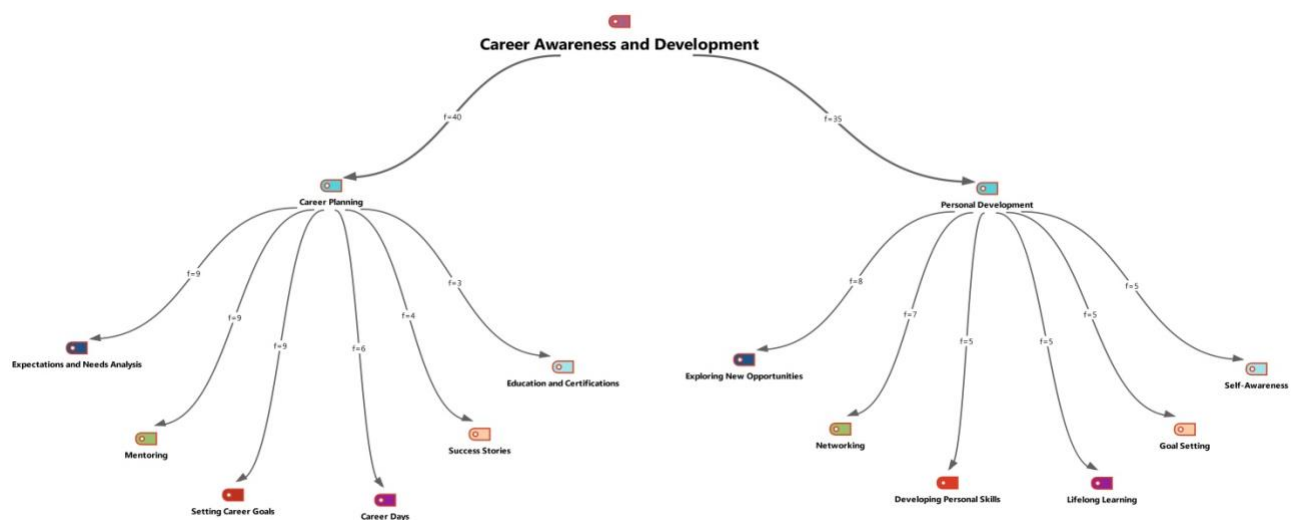
As shown in Figure 5, preservice teachers' views on social responsibility and leadership skills were grouped under two main themes: Leadership Potential and Collaboration (f = 38) and Social Responsibility (f = 20).

Findings on Preservice Teachers' Career Awareness and Development Skills

Preservice teachers were asked the following questions: "How do you research and evaluate opportunities for career advancement?", "How do you help students set their career goals?", and "How do you support students in their professional development and inform them about career opportunities?" Based on the responses, the findings were structured into a hierarchical code–subcode model, as presented in Figure 6.

Figure 6

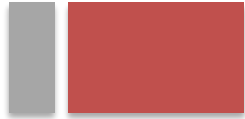Hierarchical Code–Subcode Model of Preservice Teachers' Career Awareness and Development Skills

As shown in Figure 6, preservice teachers' views on career awareness and development skills were grouped under two main themes: Career Planning (f = 40) and Personal Development (f = 35).

Discussion and Conclusion

The primary aim of this study was to examine preservice teachers' levels of 21st century skills across various variables and to reveal their perspectives on the instructional processes associated with these skills. The quantitative and qualitative findings obtained offer a holistic reflection of preservice teachers' general competence levels regarding multidimensional skill sets, as well as their perceptions, attitudes, and instructional approaches concerning these skills.

The quantitative results indicate that preservice teachers generally possess a moderate level of 21st century skills. Among the subdimensions, the lowest mean score was observed in "critical thinking and problem solving," while the highest was found in "career awareness." This

suggests that while preservice teachers have a heightened awareness of career planning, they still require further development in higher-order thinking skills. These findings are consistent with those of previous studies such as Bedir (2019) and Valli, Perkkilä, and Valli (2014). Moreover, no significant differences were found based on gender or parental education level, whereas statistically significant differences emerged in relation to academic department and grade point average. Participants from elementary school teaching, early childhood education, and computer education and instructional technology programs demonstrated higher skill levels compared to those in guidance and psychological counseling and special education programs. Similarly, participants with higher academic performance were found to have a greater command of these skills (see Gökbulut, 2020; Mugot & Sumbalan, 2019).

The qualitative findings serve to both support and deepen the quantitative results, indicating that preservice teachers possess a high level of awareness regarding 21st century skills. Participants especially emphasized core skills such as digital literacy, communication, collaboration, problem solving, and creativity. These are also aligned with internationally recognized frameworks (OECD, 2018; P21, 2019a). The instructional strategies participants described for helping students acquire these skills—such as the use of interactive technologies, project-based learning, and real-world problem solving—correspond to constructivist and student-centered approaches (Saavedra & Opfer, 2012).

Another noteworthy theme that emerged was "career awareness." Participants reported managing their careers by researching professional development opportunities, participating in trainings, and engaging with peers. This reflects the importance of fostering career awareness at an early stage in teacher education, as emphasized by Jia et al. (2016). Furthermore, participants viewed leadership, entrepreneurship, and innovation as integral components of career development.

"Social responsibility and leadership" was another prominent theme in the qualitative findings. Participants stated that they organized school-based social responsibility projects, promoted peer mentoring, and engaged in activities aimed at enhancing social consciousness. These findings are in line with global educational objectives as outlined by the European Union (2019) and UNESCO (2017).

Despite their high levels of awareness, some participants also expressed perceived limitations. Notably, a lack of access to current digital resources and limited opportunities for practical application were mentioned as barriers in developing these skills. This supports prior research (e.g., Egan et al., 2017), which emphasizes the importance of complementing theory-heavy teacher education programs with practical, experience-based components.

In conclusion, this study reveals the general competence levels of preservice teachers regarding 21st century skills and their attitudes toward the instruction of these skills. It offers important insights into the capacity of the education system to cultivate individuals who are well-equipped for the demands of the modern era. In today's educational landscape—shaped by digital transformation, multiculturalism, and rapid change—preservice teachers must be equipped not only with content knowledge but also with skills such as problem solving, creativity, entrepreneurship, leadership, and digital competence. Therefore, teacher education programs must evolve beyond theoretical content to embrace multidimensional structures that incorporate experience-based practices. In doing so, the teachers of the future will not only transmit

knowledge but also guide students in discovering their own competencies and prepare them for the complexities of the 21st century.

Recommendations

Based on the research findings, it is recommended that practice-oriented approaches aimed at fostering 21st century skills be strengthened within teacher education programs. Integrating project-based learning, the use of digital tools, and activities grounded in real-life problems into program content would contribute to preservice teachers' internalization of these skills. Furthermore, in-service training should be provided to faculty members to enhance their competencies in effectively facilitating these skills in classroom settings.

Establishing collaborations among faculties of education, schools, and technology providers is also essential, as such partnerships can create platforms for the dissemination of innovative practices to preservice teachers. Lastly, it is suggested that comparative and longitudinal studies be conducted across different universities to monitor the development of these skills over time.

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