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<https://doi.org/10.1057/s41599-025-05925-2>

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Development of a twenty-first century skills curriculum through the flipped learning approach

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This study aimed to develop a 21st Century Skills Curriculum for undergraduate programs at education faculties, foster awareness of teacher candidates towards 21st century skills within the scope of the curriculum, and ensure that they attach importance to these skills in every part of their lives. The study employed a concurrent mixed-methods design as both quantitative and qualitative methods were used together. In this context, a curriculum development study was carried out for education faculties to be implemented in the spring semester of the 2021-2022 academic year. Following a detailed needs analysis process, the philosophy, structure, and objectives of the curriculum were determined based on learning in the 21st century and the flipped learning approach. Then, the aims, content, teaching-learning processes, and evaluation processes of the curriculum were created. Afterwards, it was implemented with the teacher candidates in an elective course within a faculty of education and evaluated. Data were collected using multiple tools: document analysis (for contextual and needs analysis), the 21st Century Competencies Inventory (used as both pre- and post-test), and three interview forms and diaries developed by the researchers. The findings revealed that the teacher candidates demonstrated an increased awareness and acquisition of 21st-century skills following the curriculum implementation. Furthermore, the results supported the effectiveness of the flipped learning approach in facilitating the development of these competencies. The study concluded by recommending broader integration of the curriculum in teacher education and further research into instructional methods for teaching 21st-century skills.

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Introduction

In today's world, individuals require not just knowledge or diplomas but also various competencies commonly referred to as 21st century skills (EU, 2006; Finegold & Notabartolo, 2010; Ananiadou & Claro, 2009; Carneiro, 2007; Luna Scott, 2015b; P21, 2007; Saavedra & Opfer, 2012; Trilling & Fadel, 2009; Wagner, 2014; ISTE, 2016). These skills are essential due to significant changes brought by globalization, technology, and various societal shifts, which requires individuals to possess skills beyond traditional knowledge as shown in Table 1 (Davies et al., 2011, 3–5; Jerald, 2009, 1–21; Luna Scott, 2015a; Redecker et al., 2010, 12; Saavedra and Opfer, 2012). The World Economic Forum (WEF, 2015) explains in its report that these changes have caused the fourth industrial revolution, which means highly intertwined, intricate, mutually supporting, and developing structures in many different fields, such as robotic designs, the internet of things, artificial intelligence, software, and developments in genetic science in the 21st century. The existence of a strong positive relationship between the basic competencies or skills that individuals need to acquire and the economic growth and welfare level of that country is also supported by extensive research studies (Hanushek & Woessmann, 2011; OECD, 2015; TEDMEM, 2016).

Numerous respected institutions, organizations, non-profit organizations, and researchers worldwide, including ISTE, OECD, UNESCO, European Union, and P21, have been deeply involved in defining, promoting, and teaching 21st-century skills. The most pioneering of the skill sets can be said to be the framework of Partnership for 21st Century Learning, established in 2002 in the United States of America (USA) by the respected figures from the business world, important educational leaders, and politicians (P21, 2007). Based on P21, which we used as the basis for this study, we have identified the basic subjects, key disciplines, and interdisciplinary themes that need to be taught to students. The first group, the basic subjects and key disciplines, includes language acquisition, reading and language arts, world languages, art, mathematics, science, geography, history, government, and citizenship. The second group, interdisciplinary themes, includes global awareness literacy; financial, economic, business, and entrepreneurial literacy; and citizenship, health, and environmental literacy. While teaching these determined disciplines and themes to students, we have placed 21st-century skills, categorized under three headings, at the center and aimed to emphasize these skills at every stage of the teaching process.

These skills include life and career skills (*entrepreneurship and self-direction, social and intercultural skills, flexibility and adaptability, productivity and accountability, leadership and responsibility*), learning and innovation skills (*critical thinking and problem solving, creativity and innovation, communication and collaboration*), and information, media, and technology skills (*information and communication technologies, media and information literacy*). P21 stresses integrating these skills into curricula, assessment practices, teacher professional development, and learning environments to prepare students for future personal and professional success.

In today's rapidly changing world, the need for many countries to adapt to the global world (Bernal, 2014) has increased the tendency for 21st-century skills in recent years, and it is clear that they are needed not only in the business world but in all areas of life (Saavedra & Opfer, 2012). Therefore, unlike previous generations, individuals today must be able to establish effective communication skills, work flexibly and harmoniously with team spirit and cooperation, think critically, solve problems, be creative and innovative, be information, media, and technology literate, develop social and cultural skills, be respectful of different perspectives and cultures, be self-managed, have developed leadership skills and be responsible (AAC & U, 2007; Ananiadou & Claro, 2009; Carneiro, 2007; Greenhill, 2010; Griffin, McGaw & Care, 2012; Günüş, Odabaşı & Kuzu, 2013; NRC, 2011; P21, 2019).

21st-century skills are of great importance for individuals, societies, and countries (Bernhardt, 2015; Washer, 2007; Wagner, 2014). They enable individuals to be successful in advanced reasoning such as critical and creative thinking and problem solving, and in developing positive attitudes and practical skills such as self-confidence, leadership, communication, collaboration and professional development as well as the cognitive, interpersonal and self-management skills necessary to adapt to the ever-changing situations in their lives (Kay, 2009; NRC, 2012; Vockley, 2007). It is also emphasized that in order for countries to have the potential to compete with other countries in the next years, more efforts should be made to provide every member of their societies with these skills and to make students well-skilled individuals of the future (Bozkurt & Çakır, 2016; P21, 2019; Saavedra & Opfer, 2012; Yalçın, 2018; Trilling & Fadel, 2009; Levy & Murnane, 2012; Wagner, 2014). It requires the emergence of a different educational paradigm that is redefined for the 21st

Table 1 Important Shifts in the 21st century.

Demographic change	Increasing global lifespans will require people to pursue multiple careers, and lifelong learning will become more important, changing the nature of learning. In addition, as a result of migration movements, children of minorities will make schools more diverse and different.
Smart systems and automation	As a result of the development of smart machines and automation, individuals will be freed from rote and routine work and have to solve complex tasks or unexpected problems by collaborating with others, which makes complex thinking and communication tasks more crucial.
Globalization	Globalization clearly impacts skill demands in several ways by converting the types of knowledge and skills students will need to compete in a global economy. Thus, global literacy will become more important as people from all over the world collaborate with each other.
Personal risk and responsibility	When it comes to issues like job security, health care, and financial planning, individuals will have to take on an increasingly greater burden of risk and responsibility for their personal well-being.
Workforce	Since human capital is the most important resource in the global knowledge economy, there is now less hierarchy and control in workplaces but more flexible job descriptions, freedom and responsibility, collaboration and teamwork.
The computational world	With the proliferation of sensors, communication tools, and processing powers into everyday things and environments, everything we encounter will be converted into data, which makes data literacy essential.
New media environments	New multimedia technologies are transforming how we communicate, and as technologies for video production, digital animation, augmented reality, gaming, and media editing become increasingly more complex and pervasive, a new ecosystem will appear around these areas.

century (Ananiadou & Claro, 2009; Dede, 2010; Erkut, 2022; Greenhill, 2010; Kay, 2009; Lemke, 2002; Luna Scott, 2015a & 2015c; Reedecker et al., 2010; Kivunja, 2014). For this reason, it is suggested to add the 21st century paradigm to those that have been going on for centuries (tabula rasa, behaviorist, cognitive, individual and social constructivist). In this new paradigm, 21st-century skills are at the forefront; learning processes are student-centered and universal; media technologies and lifelong learning are essential thanks to the internet; high-level thinking and problem-solving skills are supported by giving importance to project-based and flexible content knowledge; and teachers are guides or coaches who use alternative assessment tools (Kivunja, 2014; Erkut, 2022; Deniz & Filiz, 2022).

While 21st century skills are highly regarded in Türkiye, the literature research shows a predominance of descriptive survey studies (Altınpulluk & Yıldırım, 2021; Eskici & Özsevgeç, 2019; Kalemkuş & Özek, 2021; Yılmaz, 2018), focusing on the awareness and use of these skills among students, teachers, and teacher candidates (Atakişi, 2019; Çelebi & Sevinç, 2019; Çınar, 2019; Çolak, 2019; Dağhan, Kibar, Çetin, Telli, & Akkoyunlu, 2017; Erten, 2020; Gökbulut, 2020; Göksun & Kurt, 2017; Gömleksiz, Sinan, & Doğan, 2019; Gülen, 2013; Güler, 2019; Gürültü, Aslan, & Alcı, 2018; Kan & Murat, 2018; Keskin & Yazar, 2015; Kıyasoğlu, 2019; Korkmaz, 2019; Kozikoğlu & Altunova, 2018; Köçge, Özpınar, Şahin & Yenmez, 2014; Murat, 2018a; Orak, 2019; Önür, 2018; Özden, Tayşi, Şahin, Kaya and Bayram, 2018; Şengüleç, 2021; Uyar and Çiçek, 2021). In addition, some studies have explored how well these skills were integrated into curricula and textbooks (Akçay, 2019; Akın, 2017; Atik & Yetkiner, 2021; Bal, 2018; Bektaş, Sellum & Polat, 2019; Belet Boyacı & Güner-Özer, 2019; Bozkurt, 2021; Çelebi & Altuncu, 2019; Çolak, 2018; Demir & Özyurt, 2021; Erdamar & Barasi, 2021; Işıkgöz, 2021; Kalemkuş, 2021; Kardeş, 2020; Koçin & Tuğluk, 2020; Kurdayıoğlu & Soysal, 2019; Tuğluk & Özkan, 2019; Yalı, 2021). Some studies tried to classify 21st-century skills, while other research studies have attempted to develop scales for measuring them (Anagün, Atalay, Kılıç, & Yaşar, 2016; Aydın, 2019; Boyacı & Atalay, 2016; Bozkurt & Çakır, 2016; Çevik & Şentürk, 2019; Göksun & Kurt, 2017; Yılmaz & Alkış, 2019). It became evident that not all skills are covered comprehensively in curricula and textbooks, and while students, teacher candidates, and educators perceived themselves as proficient in these skills, descriptive and experimental research revealed otherwise. In addition, these findings were further supported by Türkiye's low ranking and low performances significantly below the average in international studies such as PISA (Program for International Student Assessment) and PIACC (Program for the International Assessment of Adult Competencies), conducted by OECD (Organisation for Economic Cooperation and Development) to evaluate the effectiveness of education in participating countries and the acquisition of 21st century skills (MNE, 2023; OECD, 2016; OECD, 2019; OECD, 2023; TEDMEM, 2012; TEDMEM, 2015; TEDMEM, 2016).

When all the research findings above are examined, it is clearly demonstrated that there is a significant need for curriculum development initiatives aimed at enhancing 21st-century skills. A review of existing curriculum development studies targeting 21st-century skills reveals that the development of some of the 21st-century skills was partially done through different pedagogical interventions. These include professional learning communities (Saçmalıoğlu, 2019), instructional material design training (Yeni, 2018), integrative instructional models for middle school students (Yavaş, 2021), and limited implementations of flipped learning (Murat, 2018b). Other innovative contexts include the Children's University model (Yeniay Üsküplü, 2019), argumentation-based science instruction (Ecevit & Kaptan, 2019), educational robotics

(Erdoğan, Toy & Kurt, 2020), digital storytelling (Kotluk & Kocakaya, 2015; Çetinkaya & Demir, 2025), technology-based animation tools (Atalay, Anagün & Kumtepe, 2016), Web 2.0 tools (Akçalı & Öztürk, 2024), STEM-based activities (Çetin & Kahyaoglu, 2018), and learning-by-teaching strategies (Aslan, 2015). However, none of these studies systematically integrated all key dimensions of 21st-century skills. The present study addresses this gap by integrating the complete P21 framework into a flipped learning model tailored for Turkish teacher candidates so that they can adopt and integrate these skills into their lives.

Research aim and research questions. This study seeks to equip teacher candidates with 21st-century skills within the scope of a specially designed curriculum, to foster awareness towards these skills and ensure the implementation of these competencies in all their lives. It is expected that teacher candidates will not only incorporate these skills into their future classrooms but also effectively impart them to their students. Therefore, the present study is unique because it reveals how these skills can be acquired by individuals in a practical way by highlighting the importance of imparting these essential skills to teachers and teacher candidates, so that it endeavors to raise an awareness of 21st century skills. In this context, the research sought answers to the following sub-problems:

1. How was the design process of the 21st-century skills curriculum for teacher candidates carried out?
2. How was the implementation process of the 21st-century skills curriculum designed for teacher candidates carried out?
3. In the evaluation process of the 21st-century skills curriculum implemented for teacher candidates:
 - a. Was there a difference between the pre-test and post-test results of the 21st Century Competencies Inventory applied to teacher candidates?
 - b. What kind of changes occurred in the views of teacher candidates regarding 21st-century skills after the implementation of the 21st-century skills curriculum?
 - c. What were the opinions of teacher candidates regarding the effectiveness (perceived usefulness, engagement, and challenges) of the implementation process of the 21st-century skills curriculum based on the flipped learning approach?

Research Methodology

General Background. This study employed a mixed-methods research model, integrating both qualitative and quantitative approaches to evaluate the 21st Century Skills Curriculum effectively. The curriculum, considered as an intervention in our study, was delivered to participants as part of an elective course, aiming to assess the curriculum's effectiveness and answer the research questions comprehensively. Given the experimental nature of the intervention, the study combined both research approaches for a more comprehensive understanding (Creswell, 2014; Creswell & Clark, 2018; Johnson, Onwuegbuzie & Turner, 2007). Since data were collected at various stages (before, during, and after the intervention), a concurrent intervention design was used, allowing qualitative insights to enrich the experimental framework (Creswell, 2014).

Research environment and participants. The 21st Century Skills Curriculum was implemented with 24 second- and third-year teacher candidates (18 female and six male) from six different

teacher training programs over 14 weeks, with two hours of instruction per week. The teacher candidates enrolled in this elective course on a voluntary basis and represented various fields, including English and Turkish language teaching, psychological counseling, primary school mathematics teaching, preschool teaching, and classroom teaching.

Instrument and procedures. The study utilized a combination of quantitative and qualitative data collection methods. For quantitative data, the 21st Century Competencies Inventory, developed by Yılmaz and Alkış (2019) and proven to be valid and reliable, was administered as a pre-test at the beginning and as a post-test at the end of the course. This inventory includes 80 items rated on a 5-point Likert scale, with subscales for knowledge, skills, character, and meta-learning. For qualitative data, document analysis, interview forms, and reflective diaries were used. The document analysis drew from extensive literature on 21st century skills to inform the conceptual framework and needs analysis. The participants completed three interview forms developed by the researchers: a *preliminary interview form* before the intervention, a *final interview form*, and a *course evaluation form* after the intervention. In addition, diaries are defined as a tool for recording participants' thoughts and feelings about the research topic or process in question regularly and repetitively at certain periods of time (Gürbüz & Şahin, 2017; Farrah, 2012; Thorpe, 2004). The current study used a *researcher's diary*, in which the researcher described the experiences during the implementation process, and a *reflective diary form*, which was a self-evaluation form written by the participants at the end of each lesson (every week).

Data analysis. Quantitative data were analyzed using SPSS 22.0 with a significance level of 0.01. Cronbach's Alpha reliability coefficients for the 21st Century Competencies Inventory were recalculated for the study, confirming high reliability (0.933 and 0.961 for pre-test and post-test, respectively). Subsequently, as the Shapiro-Wilk test indicated that the data were normally distributed, parametric tests were employed in the data analysis. The dependent samples t-test was used to assess any significant differences between pre-test and post-test scores, with effect sizes calculated using Cohen's (1988) formula. For qualitative data, manual content analysis was performed on the semi-structured interview responses and reflective diary entries, identifying themes and categories supported by direct quotes. Along with the researchers, an independent expert participated in the qualitative analysis process. The analysis followed a systematic process beginning with the identification of meaning units, which were then coded and clustered into categories and subsequently into broader themes. This process aimed to uncover underlying patterns and insights into participants' experiences and perceptions regarding the curriculum implementation. The researchers and an independent expert with expertise in qualitative research collaboratively conducted the qualitative data analysis. To ensure the trustworthiness and credibility of the analysis, inter-rater reliability was calculated using the formula proposed by Miles and Huberman (1994), based on independently coded transcripts. The resulting agreement rate of 95% was deemed excellent, indicating a high level of coding consistency between raters. Any discrepancies in coding were reviewed jointly and resolved through discussion and consensus, enhancing the dependability of the findings.

Research results

The results of the study are presented according to the research questions that guided the study.

How was the design process of the 21st Century skills curriculum carried out? A program can be conceptualized as a structured design that sequences specific stages to achieve pre-determined goals. It encompasses a system involving individuals, a field of study grounded in foundational principles, a body of knowledge, and a framework for learning experiences (Demirel, 2015; Ellis, 2015; Gordon, Oliva, & Taylor, 2019; Gültekin, 2017; Ornstein & Hunkins, 2016). While program development processes may vary across different models, the design phase of the 21st Century Skills Curriculum commenced with a comprehensive document analysis, which included an extensive literature review on 21st century skills and was followed by interviews to gather teacher candidates' views on these skills. Following this, the curriculum's general structure and core elements were established. It encompassed thinking skills, literacies, and life skills. Its primary objective was to equip teacher candidates with these competencies to enhance the individual, the surrounding society, and ultimately, the global community. This goal aligned with progressive and reconstructive educational philosophies, and the curriculum also incorporated innovative, learner- and society-centered methodologies, emphasizing the flipped learning approach. Especially the flipped learning approach was adopted in the curriculum, as it aligned well with contemporary learning needs. It supported the development of key skills, encouraged higher-order thinking, allowed the integration of technology to extend learning beyond the classroom, enabled more efficient use of limited in-class time (two hours per week), and incorporated various assessment methods into the learning process (Bergmann & Sams, 2012; Bishop & Verleger, 2013; O'Flaherty & Philips, 2015).

Regarding core elements, the curriculum's overarching aims and specific learning outcomes were derived based on insights from the needs analysis, program design principles, the flipped learning approach, and the contextual setting for curriculum implementation. By adopting a modular approach that allowed for both independent and integrated learning units, 21st-century skills were systematically arranged in the curriculum to align with the identified learning outcomes. Utilizing the flipped learning approach, the curriculum aimed to keep teacher candidates actively engaged during in-class sessions, encouraging the application of critical and higher-order thinking skills, collaborative activities (discussion, role play, educational games, etc.), and production of tangible outcomes by the end of each course. The out-of-class learning experience was enriched with supplementary materials, including sharing documents, videos, and articles through some platforms. Consequently, the curriculum integrated technology-supported, student-centered, activity-based, and active learning methodologies. Alternative assessment methods, such as reflective diaries, class participation, activity engagement, presentations, and lesson plan development, were used to evaluate learning outcomes effectively (Annex 1 provides a comprehensive overview of the curriculum and its components).

In the initial phase of the needs analysis, an in-depth examination was conducted to assess the scope and significance of 21st-century skills, the level of awareness among individuals in Türkiye, and the emphasis placed on these skills within Turkish curricula and textbooks. This analysis utilized various resources, including articles, international and national reports, theses, dissertations, and relevant statistics, all focused on the theme of 21st-century skills from individual, societal, and disciplinary perspectives. The findings from these studies revealed that both teachers and students generally lacked proficiency in many essential skills (Akçay, 2019; Akin, 2017; Atik & Yetkiner, 2021; Bal, 2018; Bektaş, Sellum & Polat, 2019; Belet-Boyacı & Güner Özer, 2019; Çelebi & Altuncu, 2019; Çolak, 2018; Demir & Özyurt, 2021; Erdamar & Barasi, 2021; Işıkğöz, 2021; Kalemkuş,

2021; Kardeş, 2020; Koçin & Tuğluk, 2020; Kurudayıoğlu & Soysal, 2019; Tuğluk & Özkan, 2019; Yalı, 2021), and that these skills were insufficiently integrated into curricula and textbooks (Atakışi, 2019; Çelebi & Sevinç, 2019; Çınar, 2019; Çolak, 2019; Gökşun & Kurt, 2017; Köğçe et al., 2014; Şengüleç, 2021; Orak, 2019). This outcome aligns with the conclusions of previous literature reviews (Yılmaz, 2018; Eskici & Özsevgeç, 2019). Türkiye's low performance on international assessments such as PISA and PIACC, along with its declining rankings in these evaluations, further validated these findings (İşeri, 2019; MNE, 2023; OECD, 2023).

A preliminary interview form comprising four open-ended questions was administered in the second stage to the participants enrolled in the 21st Century Skills Curriculum to enhance the needs analysis process. The purpose was to assess their initial understanding of 21st-century skills, their level of awareness, the contribution of their undergraduate education to these skills, and their capacity to teach these skills to their future students. The analysis of the responses revealed that, while most teacher candidates recognized the importance of these skills, they were unclear about the specific skills encompassed. Many perceived these skills as limited to technology and noted that, aside from individual efforts, their undergraduate education provided minimal support for developing these competencies. Furthermore, although some teacher candidates believed these skills could enhance their professional lives, they expressed that they would attempt to teach them only to the extent of their understanding. Overall, the findings indicated a lack of sufficient awareness of the skills among the teacher candidates. Based on these findings, it was concluded that the teacher candidates would benefit from a dedicated 21st Century Skills Curriculum. Consequently, the curriculum design process commenced, during which the program's foundational elements were established, and its implementation was initiated (see Annex 1).

How was the implementation process of the 21st Century skills curriculum designed for teacher candidates carried out?

The 21st Century Skills Curriculum was implemented over a 14-week period, with a drama classroom selected as the setting to facilitate practical activities, including educational games, creative drama, and role-play, which enabled teacher candidates to interact and collaborate more with each other during the sessions. To enhance the emphasis on 21st-century skills, implementing a greater number of related activities is essential. During the initial session, teacher candidates were reminded that the course prioritized critical thinking, open discussion, and freedom of expression. They were also encouraged to set aside any religious, political, ideological, cultural, sexual, or racial biases upon entering the classroom, fostering an environment free from prejudice. Emphasis was placed on valuing freedom of thought and expression, with weekly activity-based group work and continuous skill application integrated into the course. To support the flipped learning approach used in the curriculum's implementation, we provided them preparatory videos and documents in advance and equipped them with foundational knowledge on each week's topic. To enhance the effectiveness of the flipped learning approach and incorporate technology, various WEB 2.0 educational tools were utilized, including platforms like *WhatsApp*, *EDMODO*, *Google Classroom*, and *Mentimeter*. These tools not only enriched the flipped learning experience but also integrated technological innovations into the course and diversified the assessment process. As for the challenges encountered during the implementation, issues with internet connectivity were observed during activities that required online access. Additionally, since the course was an elective offered for only two hours per week, time constraints were frequently reported.

To assess the teacher candidates' weekly achievement of course objectives, and evaluate the course process and activities, as well as encourage self-reflection, they were instructed to complete reflective diaries on Google Classroom after each lesson. The open-ended prompts in these diaries, which included reflections on "What I felt," "What I learned," "What I noticed," "How I will use what I learned," and "How I evaluate my skills," were analyzed through content analysis alongside the researcher's own diary entries to provide a comprehensive account of the implementation process. Annex 2 includes examples of reflective diary analyses from three different weeks.

The insights gained from the reflective diaries revealed that the teacher candidates were generally positive about the lessons, expressing feelings of enjoyment, comfort, excitement, freedom, and curiosity. They suggested that a supportive and motivating classroom environment be established, enhancing their engagement and motivation. The flipped learning approach used in the 21st Century Skills Curriculum facilitated an active learning environment that fostered higher-order thinking and creativity, enabling them to produce creative outputs, such as posters and stories, contributing to an effective learning experience. Furthermore, the reflective diaries aided them in identifying both their strengths and areas for improvement regarding 21st-century skills. Self-reflection helped them acquire new insights, correct misconceptions, and recognize the need for further skill development.

It was anticipated that the teacher candidates would continue to address their learning needs, aided by the skill of "learning how to learn." Most of them also indicated that the methods and activities experienced in the course served as valuable models for incorporating 21st-century skills into their teaching. This suggested that it is essential for them to apply these skills in other courses and that adopting a 21st-century learning approach across all courses will be beneficial. The sample statements from their reflective diaries are provided below:

"Today, we talked about critical and creative thinking and did practical activities, which made me feel very happy. I had question marks in my mind when choosing this course. I wasn't sure, but at the end of the lesson today, I said, I'm glad I chose this course. I am extremely excited as it will contribute a lot to me." (17TC) (Week 2).

"I can help students to do activities that emphasize the importance of communication and help them to establish healthy communication and find solutions to communication problems by including team work in the lesson." (11TC) (Week 5).

"I learned today that most of the information I receive and encounter on social media is not useful or unbiased. In addition, being technologically literate and social media literate is a must in today's world in the 21st century." (1TC) (Week 7).

"Today was honestly one of the most enjoyable classes because activities like drama have always interested me. That's why I think I had a very good lesson." (3TC) (Week 8).

"I realized the mistakes I made regarding time management, how important the issue of ethics is for me, and that our differences are actually very valuable." (10TC) (Week 10).

"I think I don't have much of an entrepreneurial spirit. Because taking risks, which is one of the most important points about entrepreneurship, was very distant for me, but I believe that this can be overcome by receiving training in this field from a young age. And I think training should be given to increase it." (13TC) (Week 11).

"I can use what I have learned to create a classroom environment where everyone is sensitive and sensible towards each other, where everyone is open about their thoughts, where everyone can freely express their opinions by leaving stereotyped forms such as absolutely right or absolutely wrong, and to create a productive and efficient generation as required by the age." (14TC) (Week 13).

Table 2 T-Test and Effect Size Values for Dependent Samples of Inventory Data.

		\bar{x}	s	95%CI	t	p	d
Knowledge Subscale	Pre-test	3.70	0.47	3.502-3.898	-3733	0.001**	0.52
	Post-test	4.20	0.46	4.006-4.394			
Skill Subscale	Pre-test	3.82	0.41	3.647-3.993	-4566	0.000**	0.63
	Post-test	4.40	0.43	4.218-4.582			
Character Subscale	Pre-test	3.84	0.48	3.637-4.043	-3330	0.003**	0.47
	Post-test	4.30	0.48	4.097-4.503			
Meta-Learning Subscale	Pre-test	3.73	0.35	3.582-3.878	-4750	0.000**	0.67
	Post-test	4.37	0.55	4.138-4.602			
Total Scale	Pre-test	3.77	0.37	3.614-3.926	-4574	0.000**	0.60
	Post-test	4.30	0.42	4.123-4.477			

**p < 0.01

How was the evaluation process of the 21st Century skills curriculum for teacher candidates carried out? The 21st Century Skills Curriculum evaluation incorporated multiple tools, including the 21st Century Competencies Inventory, the Preliminary and Final Interview Forms, the Reflective Diary Form (discussed above), and the Course Evaluation Form.

Is there a difference between the pre-test and post-test results of the 21st Century competencies inventory applied to teacher candidates? The dependent samples t-test was employed to determine whether there was a significant difference between the pre-test results, administered at the beginning of the course, and the post-test results, conducted at the end of the course. Additionally, the effect size of the difference was calculated using Cohen's (1988) formula, with all findings shown in Table 2.

As can be seen from the means, standard deviations, and p-values presented in Table 2, the analysis revealed significant improvements in favor of the post-tests across all sub-scales and the overall scale since the p-values were below 0.01 in both the sub-scales and the overall scale ($p < 0.01$). In addition, it can be seen that all of the calculated effect sizes (d) ranged from 0.47 to 0.67, and the observed significant differences in their competencies were at a medium level according to Cohen's (1988) classification of effect sizes (0.2 = small, 0.5 = medium, 0.8 = large).

After the implementation of the 21st Century Skills Curriculum, what kind of changes occurred in the views of the teacher candidates about 21st century skills? During the final week of implementing of the 21st Century Skills Curriculum, the Final Interview Form was administered to the teacher candidates to evaluate their progress in acquiring 21st century skills, their learning outcomes related to these skills, and their development of awareness over the 14-week period. The findings from this analysis are presented alongside the results of the Preliminary Interview Form to provide a more detailed depiction of the observed changes.

Thoughts of the Teacher Candidates on 21st Century Skills After the Implementation. Following the implementation of the 21st Century Skills Curriculum, the teacher candidates were asked to share their thoughts on 21st century skills and to identify which skills they considered important. The findings from this final interview were compared with those from the preliminary interview to highlight any changes in their perceptions. These comparative results are presented in Table 3 to illustrate the shifts in understanding and the prioritization of skills as a result of the program.

As shown in Table 3, their thoughts both before and after the implementation were grouped under three overarching themes: *Adaptation and Change, Cognitive and Life Skills, and Cultural,*

Global, and Social Skills. It reveals that the teacher candidates increasingly viewed 21st-century skills as globally significant in adapting to the changing demands of the modern world. Initially, they primarily associated these skills with technology. However, after implementing the curriculum, their understanding expanded to include higher-order cognitive skills, questioning abilities, keeping up with advancements in technology and science, language acquisition, cultural awareness, and addressing global challenges. This shift suggests that the emphasis of the course on free thinking and questioning encouraged them to value advanced and various cognitive processes. Furthermore, by integrating real-world problems into the curriculum, they recognized global awareness as a critical skill.

Table 3 also indicates that the skills that the teacher candidates considered important both before and after the implementation were categorized under three overarching themes including, *Thinking and Problem-solving, Digital and Information Literacy, and Personal, Social, and Leadership skills.* It is highlighted that the teacher candidates identified a broader range of skills as important after the implementation compared to their initial perceptions. At the same time, they moved beyond a technology-centric view to appreciate the importance of higher-order thinking skills and their global relevance. Also, significant changes were observed in their awareness and prioritization of 21st-century skills, including critical thinking, creative thinking, leadership, media literacy, and information and technology literacy. They placed increased value on communication, collaboration, and other personal, social, and life skills. These results underscore that a course structure emphasizing higher-order thinking and collaboration significantly enhanced their awareness of 21st-century competencies. The following are some of the statements made by the teacher candidates, reflecting their evolved perspectives on 21st-century skills:

Before the implementation:

When I think of 21st century skills, what comes to mind are the competencies needed to adapt to the age of technology. Therefore, I believe that skills such as software literacy, navigating the virtual world, and using cryptocurrency are particularly important. (1TC).

"21st century skills may include reasoning ability, algorithmic thinking, and programming skills." (5TC).

"Being able to communicate, use a computer, write code, operate software and Office programs, speak effectively in front of an audience, know how to use Web 2.0 tools and apply them in practice, conduct research, and synthesize information." (11TC).

After the implementation:

"I think that 21st century skills will be useful in every aspect of our lives and that is why I find them important." (21TC).

"When I think of 21st century skills, I think of skills such as following the development of technology and science, never giving up on questioning, and being conscious. Our age requires being conscious and questioning." (9TC).

Table 3 Thoughts of the Teacher Candidates on 21st Century Skills Before and After Implementation.

Themes	Thoughts Before Implementation		Thoughts After Implementation	
	Codes	f	Codes	f
Adaptation and change	Adapting to the age of technology	10	Adapting to the century we live in	10
			Keeping up with the development of technology	8
			Technological changes	5
			Following the development of science	6
			Economic changes	4
			Global issues	4
			Coding	3
Cognitive and life skills	Life skills Providing the principle of vitality	3 2	Higher level cognitive skills	9
			Questioning	6
			Ways of thinking	4
Cultural, global and social skills	Providing the necessary skills of the age	9	Global skills	10
			Cultural skills	7
			Learning a language	7
			Skills required for the continuity of the social structure	2
Thinking and problem solving	Skills Considered Important Before Implementation Creative Thinking Critical Thinking Problem Solving & Decision Making Analytical / Reasoning Skills	4 2 2 2	Skills Considered Important After Implementation Critical Thinking	18
			Creative Thinking	10
			Problem Solving & Decision Making	12
Digital and Information Literacy	Software and coding skills Skills to use technological tools Media Literacy Cryptocurrency	7 7 1 1	Digital & Information Literacy	21
			Media Literacy	12
			Communication literacy	10
				13
Personal, Social and Leadership Skills	Effective Communication Constructivist Approach Skills Grammar Skills	4 3 1	Collaboration	17
			Leadership	13
			Productivity	10
			Ethic	9
			Entrepreneurship	9
			Innovation	8
			Learning to Learn	8
			Empathy	7
			Adaptability & Flexibility	7
			Taking Responsibility	6
			Time Management	6
			Financial Literacy	6
			Health Literacy	5
			Self-Regulation	5
			Taking Initiative	5
Self-Efficacy	4			
Reliability	1			

“The skills required to keep up with the times and develop in line with the needs of the age are creativity, innovation, information and media literacy, communication skills, problem solving, critical thinking... Although each skill is important on its own, it is very important to be able to combine and use them.” (15TC).

Teacher Candidates’ Self-Assessment of Their 21st Century Skills Before and After Implementation. When the participants were asked to evaluate their proficiency in these skills after the implementation of the curriculum, their responses revealed that 13 participants considered themselves sufficient while 11 participants regarded themselves as partially sufficient in these skills. Their detailed evaluations are presented in Table 4.

Based on the findings presented in Table 4, it can be seen that the evaluations of the teacher candidates before and after the implementation were grouped under four overarching themes, including *Cognitive and Problem-Solving, Digital and Information Literacy, Personal and Social Skills, and Cultural and Global Awareness*. Thus, it can be inferred that the teacher candidates perceived themselves as more proficient in a broader range of 21st-century skills following the implementation process. A

notable improvement was observed in their self-assessment of critical and creative thinking abilities and in problem-solving and analytical thinking skills. Furthermore, they acknowledged possessing more and various essential life skills, such as digital and information literacies, collaboration, leadership, adaptability, and entrepreneurship to varying degrees more than before. A holistic evaluation of these findings suggests a marked enhancement in the teacher candidates’ perceived competencies compared to their self-assessments before the intervention. They reported a heightened sense of competence in 21st-century skills, an increased recognition of their abilities across various dimensions, and a greater awareness of these essential skills. Some statements from their reflections are provided below:

Before the implementation:
“As someone who has gone through a rote-based education system, my mindset is still shaped by that experience. I don’t think I possess any 21st-century skills.” (3TC).
“I feel like I am familiar with the 21st century itself, but I don’t believe I actually have the required skills.” (17TC).
“I think I am somewhat competent in the field of technology.” (20TC).

Table 4 Evaluations of the Teacher Candidates Regarding Their 21st Century Skills Before and After the Implementation.

Themes	Evaluations Before Implementation		Evaluations After Implementation	
	Codes	f	Codes	f
Cognitive and Problem-Solving	Critical thinking skills	2	Critical thinking	12
	Creative thinking	2	Creative thinking	11
	Ability to learn to learn	1	Analytical thinking	5
	Decision making skills	1	Problem solving	5
Digital and Information Literacy	Ability to use technological tools	3	Technology literacy	8
			Information literacy	7
Personal and Social Skills			Media literacy	7
	Communication skills	3	Collaboration	8
			Adaptability	6
			Leadership	6
			Entrepreneurship	5
			Empathy	4
			Health literacy	4
			Self-regulation	4
			Taking responsibility	1
			Time management	1
Cultural and Global Awareness	Foreign language skills	1	Global citizenship	6
	Esthetic skill	1	Cultural awareness	3
	Production skills	1		

After the implementation

“I think I have gained critical thinking skills. Because now I am investigating the truth of the things I see and hear. Regarding leadership, I realized that it is necessary for a leader to listen to other views.” (5TC).

“I feel partially lacking in 21st century skills, I have recently learned what these skills are, so I will gradually acquire these skills.” (17TC).

“I don’t like taking risks when it comes to entrepreneurship. I think my communication skills are good. I have cultural awareness. “I don’t believe every piece of information I see about media literacy without being sure of its source.” (19TC).

Contribution of 21st Century Skills to Teacher Candidates’ Professional Growth and Their Teaching of These Skills Before and After the Implementation

The teacher candidates were asked to reflect on how 21st century skills could contribute to their professional practice once they entered their teaching careers and how they might impart these skills to their students. An analysis of their responses revealed that 17 participants perceived these skills as significantly contributory while seven considered them as partially contributory. Notably, none of them expressed that these skills would lack utility in their profession. Before the implementation, 14 of them did not respond to this question, suggesting a lack of clarity or understanding regarding the relevance of these skills. The findings indicate that all the teacher candidates, following the implementation process, acknowledged the importance of 21st century skills in their professional development.

Furthermore, when examining their perspectives on equipping their future students with these skills, it was evident that all the participants believed they could successfully teach these competencies. Before the implementation, 14 teacher candidates had left this question unanswered. Thus, the results suggest a notable

increase in their confidence and perceived competence in integrating 21st century skills into their professional practices. Their detailed responses, including comparisons of their pre- and post-implementation perspectives, are provided in Table 5.

An examination of Table 5 reveals that the contribution of 21st century skills to teacher candidates’ professional growth before and after the implementation were grouped under three overarching themes including *Effective Teaching and Professional Competence, Communication, Flexibility and Adaptation, and Creativity and Critical Thinking* while their ways to gain 21st century skills before and after the implementation were categorized under five overarching themes including *Active Learning and Engagement, Curriculum Design and Responsibility, Technology and Information Awareness, Skill Support and Learning Resources, and Personal and Social Modeling*. The findings indicated that, unlike their perspectives before the implementation, teacher candidates believed that 21st-century skills would contribute significantly to their professional practices. Specifically, they emphasized benefits such as creating interactive lessons, fostering collaborative relationships with colleagues, developing critical thinking, addressing problems with sensitivity, devising collaborative solutions, and effectively integrating technological tools into their teaching. These findings suggest that the researchers’ emphasis on interaction, communication, teamwork, and active learning, aligned with the principles of 21st-century education, positively influenced the teacher candidates’ perceptions. Furthermore, concerning integrating these skills into their teaching practices, the teacher candidates, in contrast to their pre-implementation views, reported that they could incorporate these skills into their lessons using a wider variety of methods. These included designing sample activities and games, addressing current events, tailoring lessons to meet the demands of the modern era, preparing lesson plans, assigning students tasks that encourage independent thought and self-realization, and utilizing digital resources. In addition, the alignment between the teacher candidates’ statements and the instructional processes employed during the course uncovered personal and social modeling, and it underscores the instructor’s role as an effective role model and facilitator for integrating 21st-century skills. Selected statements from the teacher candidates are presented below:

Before the implementation:

“I would like to apply the skills I will learn to my students, but these skills also change according to the demands of the era. Since I don’t know what future conditions will be like, I think I might struggle when the time comes.” (3TC).

“When I start teaching, using different methods while explaining this topic will help me be clearer and more understandable.” (16TC).

“I believe that using technology will make it easier for me to deliver my lessons.” (20TC).

After the implementation:

“I think it will contribute a lot when I start my career, I will try to transfer these skills to the students, and I will organize my lessons accordingly.” (15TC).

“When I become a teacher, I examine the children’s social environment and opportunities. I empathize with them and encourage them to be assertive. I give them tasks in many activities to keep them active. “I do group work; for example, I make them take responsibility by looking after plants in class.” (2TC).

“It will enable me to use skills such as critical thinking and collaboration more effectively at the department. Since I studied preschool, I know the importance of teaching these skills to children at an early age and organizing interactive activities.” (14TC).

Changing Perceptions of the teacher candidates Before and After the Implementation

Table 5 Contribution of 21st Century Skills to Teacher Candidates' Professional Growth and Their Teaching of These Skills Before and After the Implementation.

Themes	Contribution of 21st-century skills to the profession of teacher candidates			
	Before Implementation		After Implementation	
	Codes	f	Codes	f
Effective Teaching and Professional Competence	In ensuring active teacher	5	In investigating ways to make the lesson interactive	4
			In using technological tools in the classroom	1
			In carrying out the teaching-learning process consciously	1
Communication, Flexibility and Adaptation	In being able to add versatility In supporting communication skills	4 2	In relationships with colleagues	4
			In being able to cooperate	2
			In being sensitive to problem	1
			In providing common sense among people	1
Creativity and Critical Thinking	In increasing creativity In facilitating adaptation to innovations In supporting comprehension skills	2 2 2	In adapting to the school environment	1
			In critical thinking	3
			In being able to produce solutions	3
Active Learning and Engagement	Using different methods and techniques such as drama, experiments and group work Organizing extracurricular activities Doing book reading	5 3 1	Ways of teacher candidates to gain 21st-century skills	
			Giving example activities	6
			Organizing games and events	5
			Making students active during lessons	1
			Providing a free-thinking environment	1
Curriculum Design and Responsibility			Providing versatility	1
			Preparing a lesson plan	3
			Assigning duties and responsibilities	3
			Keeping informed of current events	5
Technology and Information Awareness	Using technological tools	3	Using digital resources	2
			Being aware of the needs of the age	3
Skill Support and Learning Resources	Taking advantage of some of the courses I took during my undergraduate	3	Supporting the development of skills	5
Personal and Social Modeling			Setting an example with attitudes and behaviors	2
			Questioning	2
			Raising people sensitive to global problems	2
			Allowing students to self-actualize	1

To gain deeper insights into the evolving perceptions of the teacher candidates following the implementation, they were asked to respond to reflective prompts, including: “Before the 21st century skills course, I was thinking ... Now I think ... Before the 21st century skills course, I felt ... Now I feel ... Before the 21st century skills course, I didn’t know ... Now I know ...” The responses provided by them are presented in Table 6.

As shown in Table 6, the evolving thoughts of the teacher candidates before and after the course were grouped under three overarching themes including *Understanding and Beliefs about 21st-Century Skills*, *Growth Mindset and Self-Efficacy*, and *Leadership and Entrepreneurship Communication* while their evolving beliefs before and after the course were categorized under four overarching themes including *Conceptual Understanding*, *Importance and Value*, *Application and Literacies*, and *Critical Engagement and Communication*. Regarding their feelings before and after the course, they were grouped under four themes: *Negative Feelings*, *Positive Feelings*, *Awareness and Consciousness*, and *Self-efficacy*. It was observed that at the outset of the course, the teacher candidates predominantly associated 21st-century skills with technology, felt inadequate, lacked knowledge about these skills, and were unfamiliar with various literacies. They also held misconceptions, such as perceiving critical thinking as negative and viewing leadership as an innate

trait. Additionally, most of them expressed feelings of anxiety and incompleteness, anticipating difficulty and boredom with the course content. These findings suggest that before the implementation, they were unaware of the breadth and significance of 21st-century skills, lacked foundational knowledge in numerous literacies, exhibited negative emotional responses toward the course, and held erroneous beliefs about the nature of these skills. Following the implementation of the 21st Century Skills Curriculum, it can be inferred that they developed a greater appreciation for the universal relevance of 21st century skills, recognizing their importance and correcting previous misconceptions. They expressed heightened awareness, feelings of competence, and satisfaction in their understanding of 21st-century skills.

Furthermore, the findings reveal that the teacher candidates acknowledged the necessity of acquiring these skills for themselves and their ability to impart them effectively to students. Despite this positive shift, one participant remarked on feeling hopeless due to the perceived insufficiency of their skill development up to that point. Overall, the results indicate that they now possess a broader and more accurate understanding of 21st-century skills, including their connection to diverse literacies, higher-order thinking processes, and essential competencies. Their enhanced awareness and self-perception of competence

Table 6 Changing Perceptions of the Teacher Candidates.

Themes	Before the course I was thinking...		After the course I am thinking...	
	Codes	f	Codes	f
Understanding and Beliefs about 21st Century Skills	Technology-related skills	8	Every individual should have 21st-century skills	9
	What 21st-century skills are	4	21st-century skills are various	3
	Technology literacy is not important	1	21st-century skills are not just about technology literacy	2
	Memorization is important	1	21st-century skills are more important	1
	21st-century skills won't work	1		
Growth Mindset and Self-Efficacy	Critical thinking is bad	1		
	I don't have 21st-century skills	3	How I impart 21st-century skills to students	3
	How I can learn 21st-century skills	1	I have 21st-century skills	3
	I can't impart 21st-century skills	1	I gained 21st-century skills	2
			I have critical and creative thinking	1
Leadership and Entrepreneurship Communication	Leadership is innate	4	Leadership is not innate, it can be acquired	5
	Entrepreneurship is innate	2	Entrepreneurship is a skill that can be learned and developed	1
Negative Feelings	The leader is not open to different opinions	1		
	Before the course I felt...		After the course I am feeling...	
Positive Feelings Awareness and Consciousness Self-efficacy	Insufficient (5); I would have a hard time (4); Uneasy (4); Missing (3); Sad (2); Insecure (1); Insignificant (1); I would get bored (1); Bad (1)	22	Hopeless (1)	1
	Comfortable (1)	1	Happy (3); Lucky (2); Relaxed (1)	6
Conceptual Understanding	Unconscious (2); Uninformed (1)	3	Conscious (7); I am aware of 21st-century skills (4)	11
	Underdeveloped (1)	1	Equipped (2); I am better at finding solutions to problems (2); Sufficient (2); More proficient at 21st century skills (1); Self-confident (1); I can be compatible at teamwork (1); Responsible (1); I can express myself comfortably in society (1); Useful (1)	12
Importance and Value	Before the course I didn't know		After the course I know	
	What 21st-century skills are	9	What 21st-century skills are	6
	The scope of 21st-century skills	7	21st-century skills are more comprehensive	3
	Some of the 21st-century skills	3	21st-century skills are universal	1
	21st-century skills are free-thinking skills	1		
Application and Literacies	The importance of 21st-century skills	4	The importance of 21st-century skills	4
	We need 21st-century skills	2	The importance of technology	2
	The impact of technology on our lives	2	The importance of entrepreneurship	1
	It is necessary to raise awareness about 21st-century skills	1	The importance of media	1
	The importance of personal development	1	The importance of 21st-century skills in personal development	1
Critical Engagement and Communication	The importance of entrepreneurship	1		
	How to impart 21st-century skills to life	1	In what situations I can use 21st-century skills	3
	Difficulty in accessing true information	1	I have 21st-century skills	2
	What media literacy is	1	My level of 21st-century skills	1
	What health literacy is	1	How to make an effective presentation	1
		I am more knowledgeable about technology literacy	1	
		What media literacy is	1	
		What health literacy is	1	
		Being able to make negative and positive criticism on every subject	2	
		The importance of being a good listener	2	
		Information that I am not sure about its accuracy should be questioned	1	

reflected the positive impact of the curriculum. Some statements from the teacher candidates are as follows:

Their thoughts:

"I knew that 21st century skills were limited in terms of being able to use technology. But now I know most of these skills and I consider myself lucky to have learned them thanks to you" (3TC).

"In the past, I used to make decisions from a narrow and ordinary perspective. But now, I think more critically and creatively." (4TC).

"I didn't know what 21st century skills were. But now I feel like I am aware of most of the 21st century skills, even if I don't have all of them." (5TC).

"I didn't know 21st century skills were so comprehensive. But now I have learned the importance of 21st century skills. I think I am not inadequate in these skills." (10TC).

"I used to believe that leadership was an innate trait. But now, I think leadership skills can be acquired through personal development and learning." (11TC).

Their feelings:

"I felt comfortable because I was aware of the needs of the age. But now I feel hopeless because I think I haven't developed myself enough for this age." (21TC).

"I felt that passing this course was enough; it wouldn't do me much good. But now I'm glad I chose this lesson. Every student

should take this course. Especially those in the field of education should take this course. I think the course was useful.” (23TC).

What are the opinions of the teacher candidates regarding the implementation process of the 21st century skills curriculum based on the flipped learning approach? The Course Evaluation Form was administered to gather insights from the teacher candidates regarding the flipped learning approach implemented during the 14-week 21st-century skills course, their perspectives on the out-of-class and in-class learning activities aligned with this approach, the assessment tools employed, and their suggestions for additional skills or topics to incorporate into the course process. The findings acquired through this form are presented below.

The opinions of teacher candidates on the flipped learning approach used at the 21st century skills course. The teacher candidates were asked to express their opinions on delivering the 21st Century Skills course using the flipped learning approach. Their responses were analyzed and are summarized in Table 7.

An examination of Table 7 reveals that their opinions on the flipped learning approach were categorized under four overarching themes: *Effectiveness and Efficiency*, *Preparation and Resources*, *Engagement and Motivation*, and *Active Learning and Application*. It is highlighted that the teacher candidates expressed overwhelmingly positive opinions regarding using the flipped learning approach in the 21st-century skills course. They generally perceived this approach as more effective than traditional lectures and significantly enhancing the course experience. Specifically, the out-of-class learning process (preparation and resources) was considered particularly beneficial. It allowed them to prepare for the course using diverse resources, increasing their subject knowledge and readiness. This, in turn, was reported to improve learning efficiency and outcomes. The flipped learning approach was also noted to enhance engagement and motivation by capturing the interest, desire, and attention of the participants.

Additionally, the in-class learning process (active learning and application) was valued for fostering student-centered and intellectually stimulating environments, encouraging different perspectives, promoting responsibility, and facilitating the effective use of time. These findings underscore the appropriateness of incorporating the flipped learning approach into the 21st

Century Skills curriculum. Some statements from the teacher candidates are as follows:

“I think it increased the efficiency of the course. Being informed about the course subject and preparing before the course increased my interest and desire.” (9TC).

“I find the course to be successful on this subject, at least we had an idea about the subject before entering the class. I think it is more effective than plain narration.” (11TC).

“I think flipped learning is very logical, listening to theoretical information in class is boring, it was nice to do activities and participate actively.” (18TC).

The opinions of teacher candidates on the in-class learning, out-of-class learning, and assessment processes of the 21st century skills course. The teacher candidates were requested to provide their views regarding the resources and tools utilized in the out-of-class and in-class learning processes of the 21st-century skills course. Specifically, they were asked about their opinions on the files and videos shared during the out-of-class learning process, the active learning applications implemented during the in-class learning process, such as EDMODO, Google Classroom, WhatsApp, and www.mentimeter.com, which were integrated as part of Web 2.0 technologies, and the evaluation methods employed to assess 21st century skills, including reflective diaries, presentation assignments, and lesson plan preparation tasks. The findings derived from their responses are summarized in Table 8.

As indicated in Table 8, the opinions of teacher candidates on the in-class learning, out-of-class learning, and assessment processes of the 21st-century skills course were categorized under four themes, including *Shared files and videos during the out-of-class learning process*, *Methods/techniques used in the in-class learning process*, *Tools used in the in-class learning process*, and *Evaluation methods*. It is understood that they expressed overwhelmingly positive opinions regarding the out-of-class learning process of the 21st-century skills course. They described the shared content as valuable, high-quality, comprehensive, compatible with the course objectives, and supportive of personal development. These findings suggest that the out-of-class learning process effectively contributed to their personal and professional growth, fostering their sense of responsibility for self-directed learning and enhancing their capacity for lifelong learning. Furthermore, the fact that the participants found the learning process enjoyable and engaging suggests that it broke the

Table 7 The Opinions of the Teacher Candidates on the Flipped Learning Approach.

Themes	Codes	f
Effectiveness and Efficiency	It contributed positively to the course	22
	It makes learning permanent	8
	It is more effective than narration method	7
	It prevents loss of time	6
	It increases the efficiency of the course	5
	It increases learning	5
Preparation and Resources	It is useful for preparing for the lesson	20
	It informs about the subject of the lesson	5
	It provides access to valuable resources	3
	The course content is compatible with the subject matter	3
Engagement and Motivation	It increases interest and desire	12
	It draws attention	4
	It provides different perspectives	4
	It provides a rich thinking environment	2
Active Learning and Application	It creates a student-centered learning environment	3
	It shows how we can apply theory into practice	3
	It teaches responsibility	2

Table 8 The Opinions of Teacher Candidates on the In-Class and Out-of-Class Learning and Evaluation Processes of the 21st Century Skills Course.

Themes	Codes	f	
Shared files and videos during the out-of-class learning process	Contributing to personal development	11	
	Useful to prepare for class	9	
	Beautiful	5	
	Interesting	4	
	Sufficient	3	
	Very rich	3	
	Consistent with the subject	2	
	Comprehensive	2	
	High quality	2	
	Raising awareness	2	
	Detailed and long	2	
	Reliable sources	1	
	Methods/techniques used in the in-class learning process	It provides a pleasant time	24
		Active participation is ensured	12
It increases productivity		10	
It makes learning easier		8	
It contributes to socialization		6	
It reduces monotony		7	
It provides professional experience		5	
It provides permanence		5	
It shows the importance of teamwork		5	
Provides an environment for discussion		5	
It is motivating		4	
It provides learning by doing and experiencing.	3		
Tools used in the in-class learning process	They are useful applications	20	
	It facilitates communication.	13	
	It facilitates access to resources	11	
	It makes it easier to get feedback.	8	
	It makes information exchange practical	5	
	It facilitates evaluation	4	
	It increases the efficiency of the course	4	
	It gives practicality	4	
	It teaches the digital way of learning	2	
	It activates participation through technological means	2	
	Evaluation methods	It is quite effective	12
It is effective in ensuring permanence.		6	
It is more effective than the exam		5	
It is an innovative system		4	
It is efficient		4	
It helps improving self-assessment		4	
They are practical applications		4	
It ensures that it is recorded in a digital environment.		3	
It saves time		1	
It improves remembering		1	

monotony often associated with traditional coursework, making learning more dynamic and appealing. However, some teacher candidates noted challenges, such as the detailed and lengthy nature of some content, which they found difficult to manage due to their heavy academic workload.

In addition to their views on out-of-class learning, the teacher candidates shared highly favorable opinions regarding the methods, techniques, and tools employed during in-class learning process. The findings suggest that in-class activities were enjoyable, promoted active engagement, enhanced knowledge retention, and facilitated learning by providing hands-on experiences. Moreover, these practices motivated and inspired teacher candidates to adopt similar methods in their future teaching practices, as they gained valuable professional insights. The group work within the course also encouraged social interaction and collaboration, further enriching the learning environment. They frequently highlighted the benefits of the tools utilized in the in-class process and noted that these tools improved communication, facilitated access to resources, supported feedback and information exchange, and enhanced overall efficiency.

Regarding the assessment methods used to evaluate 21st-century skills, they expressed highly positive opinions. They viewed tools such as reflective diaries, presentations, and lesson plan assignments as effective, practical, innovative, and efficient. These tools were particularly appreciated for supporting self-assessment, enabling digital record-keeping, and saving time. These findings suggest that including diverse assessment methods increased their interest in the course and positively impacted their learning experience. Overall, the findings indicate that combining innovative teaching methods, digital tools, and diverse assessment techniques contributed significantly to their satisfaction with the course and supported their professional development. Some of their statements are as follows:

“I think you presented and shared very rich content, we reached sufficient content and we had the opportunity to access different content from the videos and files you shared.” (9TC).

“I think it takes boredom out of the lesson, makes the lesson enjoyable, reduces the monotony, and since these activities make the individual active in learning, I think the necessary knowledge and skills are acquired more easily.” (1TC).

“It was a very nice and innovative system not to have an exam as an evaluation.” (17TC).

“Thanks to these applications, everything we covered in class was recorded and we could go back and look at it whenever we wanted, which was nice. The diaries were also nice, it was great to keep our actions and thoughts in the virtual classroom.” (19TC).

Suggestions from teacher candidates on additional skills and topics for the 21st century skills course. When the teacher candidates were asked about the additional skills or topics they would like to see incorporated into the 21st-century skills course, the majority expressed satisfaction with the course’s existing content, considering it comprehensive and sufficient. However, some suggested additional skills and topics that could further enrich the course. Their recommendations are presented in Table 9.

The reflections of the teacher candidates, as outlined in Table 9, revealed that they suggested incorporating additional skills and topics into the 21st century skills course, including self-awareness, communication, history literacy, coding and software, preservation of cultural life, historical awareness, anxiety management, politics, art, artificial intelligence, and societal gender inequality. Among these, societal gender inequality aligns with the United Nations’ Sustainable Development Goals, while self-awareness and communication are integral to 21st-century skills. This feedback suggests the potential need for a more detailed focus on these areas within the curriculum. Furthermore, the teacher candidates’ call to include diverse topics reflects their awareness of broader societal and technological challenges, emphasizing their need for professional development across multiple domains.

Table 9 Suggestions from Teacher Candidates on Additional Skills and Topics for the 21st Century Skills Course.

Thoughts	f	Thoughts	f
Skills		Topics	
Self-awareness	2	Coding and software	2
Communication	1	Preservation of cultural life	1
History literacy	1	Historical awareness	1
Diction	1	Anxiety management	1
		Politics	1
		Art	1
		Artificial intelligence	1
		Societal gender inequality	1

These suggestions highlight an opportunity to broaden the scope of the course to better address their evolving expectations and educational needs. Some of their statements are as follows:

“The issue of raising awareness about societal gender inequality can be added.” (1TC).

“Maybe it can be an awareness-raising exercise on political issues, supported with critical thinking.” (5TC).

“There may be skills and practices related to speaking and diction.” (6TC).

“Historical awareness, protecting cultural life, history literacy can be added.” (22TC).

Discussion

In alignment with the first research sub-problem, a 21st Century Skills Curriculum was developed. Initially, a comprehensive needs analysis was conducted using document analysis and interview methods. The document analysis involved a systematic review of the accessible literature focusing on 21st-century skills, their importance, and scope, as well as the current state of such skills in Turkey. Additionally, through a preliminary interview form, the perceptions, opinions, and awareness of teacher candidates regarding 21st-century skills were explored. According to the findings, before implementation, the teacher candidates predominantly associated 21st-century skills with technology, lacked comprehensive knowledge of these skills, did not feel proficient in them, held certain misconceptions. They also believed that their undergraduate courses did not adequately support the development of these competencies. These insights highlighted the necessity for such a curriculum and suggested that its implementation would contribute significantly to teacher education and address a gap in the field.

The curriculum design process commenced following the needs analysis. The curriculum’s philosophy, approach, general features, and components were shaped based on data from the needs analysis and established program design principles. Consequently, the 21st Century Skills Curriculum was crafted to emphasize technology, creativity, and critical thinking. It was structured to align with student needs and interests, focus on inquiry and problem-solving, and incorporate elements of reconstructionist and progressivist philosophies, as well as the 21st century learning framework (Beers, 2011; Dede, 2005; Leadbeater, 2008; Luna Scott, 2015c; McLoughlin & Lee, 2008; NRC, 2012; P21, 2019; Saavedra & Opfer, 2012; Trilling & Fadel, 2009; Vockley, 2007; Windschitl, 2009). The curriculum aimed to foster awareness of 21st century skills among the teacher candidates by integrating digital tools, adopting a student-centered approach, addressing real-world problems, applying active learning methods, enhancing higher-order thinking skills, and utilizing technology-supported alternative assessment strategies.

A central component of the curriculum was the flipped learning approach (FLN, 2014; Fulton, 2012; Hayirseven & Orhan, 2018; Karakaş, 2021), which supports 21st-century learning by enabling diverse methodologies, eliminating spatial and temporal constraints, and enhancing the efficiency of in-class and out-of-class learning processes. Based on these principles, the general objectives and intended outcomes of the program were established. Regarding content design, a modular approach was adopted to allow flexibility in sequencing skills as per the needs highlighted in the literature. The teaching and learning processes were structured to incorporate digital tools for out-of-class learning using visual, auditory, and written materials, while in-class sessions emphasized active learning. The teacher candidates were encouraged to employ higher-order thinking skills, engage in collaborative activities, and work in groups. The evaluation process incorporated alternative tools, such as reflective diaries for self-assessment, preparation of materials for out-of-class learning, active participation in in-class activities, and the creation of presentations and lesson plans. As a result, a 14-week curriculum outline encompassing all its components was developed, as detailed in Annex 1. A review of the literature revealed that while previous studies aimed to develop specific 21st century skills through particular techniques within the context of individual course programs (Aslan, 2015; Atalay, Anagün, & Kumtepe, 2016; Ecevit & Kaptan, 2019; Erdoğan, Toy, & Kurt, 2020; Kotluk & Kocakaya, 2015; Murat, 2018b; Saçmalhoğlu, 2019; Yavaş, 2021; Yeni, 2018), a comprehensive curriculum explicitly designed to enhance teacher candidates’ awareness of 21st century skills has not been identified.

When it comes to the implementation phase, the 21st Century Skills Curriculum was conducted in accordance with the second sub-problem of the research. The curriculum was applied over a 14-week period within the scope of an elective drama course, involving 24 teacher candidates. Each session lasted two hours per week and adhered to the planned curriculum structure. The classes were conducted in a drama classroom where students were seated in a U-shaped arrangement, which positively impacted the learning process. This layout broke away from traditional classroom arrangements, fostering the principles of the 21st-century learning approach by facilitating discussions, enhancing group work activities, and creating a more engaging and inclusive classroom environment. This finding aligns with the studies in the literature, indicating that classroom design significantly influences learning. Specifically, U-shaped or semi-circular layouts promote interaction, allow teachers to reach students more easily, and enable flexibility and movement for both students and instructors—key considerations for 21st-century education (Harvey & Kenyon, 2013; Khaloufi, 2016; Şahin, 2019; Yale, 2016).

Given that 21st-century skills emphasize higher-order thinking, critical thinking, literacies, and life skills, teacher candidates were encouraged to set aside preconceived notions and embrace freedom of expression during lessons. This approach resulted in a highly productive classroom environment that was consistent with the principles of the 21st-century learning approach. Notably, all 24 teacher candidates demonstrated a consistently high level of attendance throughout the course. Normally, it is a challenge often faced in modern education systems where absenteeism and school dropout rates are significant concerns (Boyacı & Öz, 2018; Karacabey & Boyacı, 2018; MNE, 2013). These findings underscore the potential benefits of courses designed focusing on technology integration, student interests, and needs, emphasizing that such courses can lead to higher engagement and productivity. Incorporating technological tools throughout the curriculum further demonstrated that learning is no longer confined to the physical classroom. In line with the 21st-century learning approach, information was accessible to

students any time, highlighting the shift away from traditional constraints of time and place in education (Beers, 2011; McLoughlin & Lee, 2008; Saavedra & Opfer, 2012). During in-class activities, active learning methods were prioritized, with a strong focus on fostering higher-order thinking, teamwork, critical inquiry, diverse perspectives, and problem-solving related to real-world challenges. The evaluation process was designed to reflect the principles of the 21st-century learning approach. The teacher candidates were assessed based on their course participation, the quality of the products and outputs they generated, self-evaluations through reflective diaries, and presentations that developed their written and oral communication skills while promoting global awareness. Additionally, preparing lesson plans encouraged them to apply 21st-century skills within their professional practice. Both the learning-teaching and evaluation processes of the curriculum were consistent with the 21st-century learning framework, as supported by the literature (Çulha, 2022; Finegold & Notabartolo, 2010; Shaffer & Gee, 2012; Kyllonen, 2012; McFarlane, 2011; NRC, 2011; P21, 2019; Silva, 2009; Voogt & Roblin, 2010).

The findings emphasize the significance of alternative assessment approaches, particularly in the current era where artificial intelligence (AI) tools, such as ChatGPT, challenge traditional assessment methods. The studies by Susnjak and McIntosh (2022), Talan and Kalınkara (2023), and Bozkurt and Sharma (2023) reveal that AI systems can demonstrate critical thinking skills and are increasingly utilized for their efficiency in remote examinations. This situation highlights the necessity of incorporating innovative assessment strategies aligned with the evolving educational landscape.

The quantitative findings derived from administering the 21st Century Competencies Inventory as a pre-test and post-test to teacher candidates revealed a moderately significant difference in their scores. This outcome indicates the effectiveness of the 21st Century Skills Curriculum. Additionally, data obtained from the final interview form, designed to elicit more detailed qualitative insights, further supported these findings. The results highlighted that the teacher candidates significantly benefited from the training. Before the implementation, they primarily associated 21st-century skills with technology. However, following the implementation, they redefined these skills as comprehensive, higher-order, global life competencies essential for adapting to the demands of the modern era. While the teacher candidates initially prioritized skills such as using technological tools, creative thinking, and effective communication, their perceptions evolved post-implementation. They came to value broader life skills such as critical and creative thinking, leadership, media and information literacy, communication, collaboration, and problem-solving. When asked to evaluate their proficiency in these areas, teacher candidates expressed confidence in their literacies and other life skills, particularly thinking skills. However, they acknowledged deficiencies in certain areas. They also desired to improve these competencies, demonstrating that they had developed a deeper understanding of the scope and importance of 21st-century skills and significantly enhanced their awareness. Teacher candidates noted that 21st-century skills would benefit their teaching practices and emphasized the importance of integrating these competencies into their lessons. They attributed their ability to adopt these skills to the methods, techniques, and digital tools utilized by the instructor during the curriculum. This finding underscores the critical role of instructors as role models in student engagement and skill transfer. Research supports the notion that educators must exhibit strong personal, social, and professional qualities, serving as effective role models by integrating 21st-century skills into both in-class and out-of-class learning processes, such as encouraging critical discussions, providing real-

time problem-solving tasks, and using collaborative digital tools (Azer, 2005; Karataş, 2020; Özüdoğru & Çakır, 2014; Shein & Chiou, 2011). Overall, the teacher candidates reflected positively on the course, emphasizing its professional and personal benefits. They highlighted how the training enhanced their professional development, increased their awareness of 21st-century skills, and contributed meaningfully to their growth as educators. These findings suggest that the 21st Century Skills Curriculum was highly effective in equipping teacher candidates with the skills and awareness necessary for their future roles in education.

The findings obtained from the Course Evaluation Form indicated that the flipped learning approach, which served as the foundation of the 21st Century Skills Curriculum, produced highly positive outcomes. These included fostering a student-centered learning environment that encouraged higher-order thinking skills, assigning responsibilities to students, enhancing their interest and motivation toward the course, promoting diverse perspectives, and contributing positively to learning retention. These results align with the existing literature on the flipped learning approach and 21st-century skills, which emphasizes similar benefits (Akçayır & Akçayır, 2018; Aslan, 2022; Bishnoi, 2020; Fung, Poon, & Ng, 2022; Hayırsever & Orhan, 2018; Mitsiou, 2019; O'Flaherty & Philips, 2015; Philips & Trainor, 2014). Furthermore, some teacher candidates desired additional skills or topics to be integrated into the 21st-century skills course. Thus, we suggest that they have developed an interest in receiving training in diverse areas and that designing new courses tailored to their evolving interests and needs could be highly beneficial.

Conclusions

In conclusion, the rapid transformations brought about by the 21st century, including advancements in technological and social domains and global developments, necessitate acquiring and applying of 21st-century competencies across personal, social, and professional spheres. These competencies, often referred to as 21st century skills, are vital for thriving in today's world (Carneiro, 2007; Davies et al., 2011; Erkut, 2022; Jerald, 2009; Kay, 2009; Levy & Murnane, 2012; Luna Scott, 2015a; Reedecker et al., 2010; Rushkoff, 1999; Saavedra & Opfer, 2012). For teacher candidates, who play a vital role in shaping the future by educating the next generation, acquiring these skills and recognizing their significance is essential. A teacher candidate equipped with 21st-century skills will be capable of employing advanced cognitive processes, including critical and creative thinking, problem-solving, reasoning, and analytical skills. They will effectively organize their lives, capitalize on learning opportunities, and engage in lifelong learning through collaboration, communication, self-regulation, and learning to learn.

Additionally, they will leverage technology, media, and information literacy to access and generate knowledge from vast data sources, enhancing their capabilities in all aspects of life. Competencies in financial, health, and environmental literacies will enable them to improve their quality of life. At the same time, ethical awareness, time management, and entrepreneurial spirit will prepare them to address challenges and contribute to society meaningfully. By understanding the principles of 21st-century leadership, they will embrace responsibility, take calculated risks, and value active citizenship and diversity. Most importantly, these educators will strive to integrate 21st-century skills into their teaching practices, fostering these competencies in their students. For nations aspiring to achieve parity with developed countries, enhance the well-being of their citizens, implement democratic and social reforms, and attain global competitiveness through educational excellence, prioritizing the development and dissemination of 21st-century skills is indispensable.

Limitations of the study. This study has several limitations that need be considered when interpreting the findings. First, the sample consisted of 24 teacher candidates (18 female, six male) who voluntarily enrolled in an elective course offered within an education faculty. Their self-selection may introduce volunteer bias since those who opted into the course might have had a higher intrinsic interest in 21st-century skills or educational innovation. Though female participants represented the majority of the sample, it reflects the general trend in teacher education programs in Turkey, where female enrollment is typically higher. Second, although participants were drawn from six different teacher training programs, the relatively small sample size and its implementation within a single elective course during one semester limit the generalizability of the results. Thus, the study does not claim to represent the broader population of teacher candidates. It may not capture the long-term or cross-curricular impacts of the developed curriculum, but it still provides insights that may be transferable to similar educational settings. Despite these limitations, we think that the study offers a structured foundation for future replications in broader and more diverse teacher education contexts.

Implications and recommendations. The acquisition of 21st-century skills is essential for all educators. Therefore, we recommend that a 21st Century Skills Course based on the flipped learning approach be integrated as a compulsory component in undergraduate teacher education programs. Given the universal importance of these skills, the 21st Century Skills Curriculum can be adapted for implementation across other undergraduate programs or faculties to equip all students with these essential competencies. Currently, the course is offered as an elective, delivered for two hours per week. However, the observations during the implementation indicated that certain lessons required additional time. Thus, the course duration could be extended to include both theoretical and practical components. Alternatively, education faculties could introduce separate courses dedicated to each specific 21st-century skill, enabling teacher candidates to engage with these competencies in greater depth and breadth. Consequently, it is strongly suggested that the inclusion of 21st-century skills should be emphasized across all teacher education curricula.

Furthermore, ensuring that all academic staff in education faculties are aware of and proficient in these skills is critical for successful implementation. More extensive applied research is needed to support the development and integration of 21st-century skills with larger cohorts by adapting them to STEM or humanities programs, thereby addressing diverse cultural/educational contexts. Such research could explore strategies for ensuring that teacher candidates acquire these skills and actively incorporate them into their personal and professional practices. Applied studies involving administrators, teachers, and students could also provide valuable insights into fostering 21st-century competencies among learners across diverse educational contexts.

Data availability

The quantitative and qualitative data of the research are available. It can be accessible on request.

Received: 18 November 2024; Accepted: 3 September 2025;

Published online: 31 October 2025

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Acknowledgements

This research was published as a Phd dissertation by the first author under the supervision of the second author at Duzce University, 2023. This research received no funding from any agency or institution.

Author contributions

AD developed the research design, managed the data collection process, and wrote the main sections of the manuscript. FEA edited all the parts of the manuscript and revised the final draft.

Competing interests

The authors declare no competing interests.

Ethical approval

This study was approved by the Institutional Ethics Committee of Duzce University under ethics approval number 2021/83, on March 30, 2021. The approval covered all stages of the research process, including participants, data collection, and data analysis. Ethical approval was obtained prior to data collection. All procedures involving human participants were carried out in accordance with the ethical standards of the committee and the Declaration of Helsinki.

Informed consent

In the present study, written informed consent was obtained from all the participants in the beginning of the implementation on February 15, 2022. The participants were informed about the objectives of the study, the confidentiality of their responses, and the risk in the study. Also, all collected data were anonymized to protect participant identity and ensure confidentiality.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-025-05925-2>.

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