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Research Article

A Critical Overview of Turkish Research on 21st Century Skills in Education: 2017-2022

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Abstract

In the world and in Türkiye, the 21st century skills have occupied a very large place and many studies have been conducted. Although the 21st century skills have emerged with the expectations of the business world, the training of the manpower expected by the business world depends on the education that people receive. This has led to the research on the educational aspect of 21st century skills. While there are many studies on 21st century skills related to education in Türkiye, there is no comprehensive study on 21st century skills associated with education. In this study, the years and purposes of the studies on 21st century skills related to education in Türkiye, the data collection methods used, the 21st century skills that were addressed in the studies, and the results that were reached are analyzed in detail. It is expected that the analysis will shed light on those who work and will work on 21st century skills.

Keywords

The 21st century skills, meta-synthesis, Türkiye, skills

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Research Article

Introduction

One of the aims of education is to facilitate the daily lives of individuals, to help them adapt to society and to grow in a healthy way, and to train the necessary workforce for the business world (Taşkın, 2014; Yalçın, 2018). Instead of just providing information to individuals, education should enable individuals to make sense of information, to choose what is important for them among the pieces of information, to associate it with the situations they encounter in daily life, and to use information correctly in this process (Harari, 2018). In every age, individuals in society are faced with constantly changing situations with developing technologies, political and economic situations and the expectations of the business world. This change shows that each age groups needs individuals with different skills than the previous age (Kalemkuş & Bulut Özek, 2021). In the 21st century, people's lives are undergoing change and development in parallel with technological developments. This is not only about the habits in our daily lives or the differentiation of the technological tools we use. Technological developments especially lead to the diversification and restructuring of business life (Anderson, 2008). The change in the business world and system has begun to require individuals to change in accordance with the new conditions. Individuals may not be able to adapt to the ever-changing situations they face with the cultural characteristics of the society they live in by acquiring traditional skills such as reading, writing and mathematics (Çetin & Çetin, 2021). If the education received in school and out-of-school learning activities prepare students for their future adult roles as citizens, employees, managers, parents, etc., children in schools today can meet future challenges and adapt to changing situations (National Research Council [NRC], 2012).

The Secretary's Commission on Achieving Necessary Skills (SCANS) report published by the United States Department of Labor in 1991 explained the skills that the business world expected and what employers and educators can do to ensure that employees have these skills (Eryılmaz & Uluyol, 2015). Today, the business world needs employees who produce knowledge, are creative, work collaboratively, adapt to flexible conditions and solve the problems they face. In addition, the globalizing world expects individuals to communicate with individuals anywhere, work in cooperation and solve the problems they will face (Çetin & Çetin, 2021). Especially since the Covid-19 Pandemic, the dramatic imperatives in change have begun to emerge even more clearly. The process of integrating established systems around the world with technology has accelerated. The rapid operation of all systems through digital platforms has led to a rapid change in the usual order and the need to prepare individuals for this new situation. The business world has started to investigate what kind of characteristics employees should have in accordance with new business environments, new business structure and new job descriptions. In this process, the world of education has conducted studies on what kind of vocational or general knowledge, skills and trainings the individuals of the future may need in order to survive in the new social order. As a result of these studies, changes are made in education programs to provide human resources with the skills expected by the business world (Çoban et al., 2019; Partnership for 21st Century Skills, 2019).

Even though the education systems of countries aim to raise the level of education of individuals in order to carry the development level of their society, culture and civilization

levels further, they also try to meet the needs of the business world in the current world economic system for trained qualified personnel. The abilities, skills, education level and characteristics of qualified employees vary according to the economic and financial structure of the period, the technological structure and sophistication of production and business environments (Bates, 2019). It is estimated that the definition and characteristics of qualified employees required by the new business environments formed according to the change and transformation in the First, Second and Third Industrial Revolutions and the definition and characteristics of qualified employees required by the industrial transformation defined as Industry 4.0, which will be shaped a little more today and, in the future, will be very different. For this reason, it is necessary to train individuals equipped with new knowledge and skills that can respond to the needs that the change in job structure and definition will bring. The traditional education approach to knowledge acquisition cannot meet the skills that employers expect from their employees (Kennedy & Sundberg, 2020). In recent years, states such as China, Japan, the USA and Finland have made updates in their education systems in order to provide these skills to education programs, especially in the early childhood education period (Çetin & Çetin, 2021).

In the 21st century, the change in expectations for the qualifications of the individuals needed due to social, economic, political and technological developments also affects the education system and reveals the situation of making some compulsory changes in the knowledge and competencies to be gained to individuals (Cansoy, 2018). Adaptation to these changes that educational institutions face will fundamentally affect educational institutions. In this sense, individuals need to interpret the events in the world, produce original ideas and products, and learn to live together with different languages and cultures (Kenan, 2005). Developments in the 21st century include technological advances, political developments in the world, economic changes, globalization and multiculturalism. In addition, situations such as easy access to information, proliferation of communication channels, and increased use of technology that cause the problems we face today, which we call the digital age, to have a complex structure (Booth, 2013; Sayın & Seferoğlu, 2016). The 21st century skills are needed to cope with these complex structures of problems and to easily adapt to the relevant situations (Üzümcü & Bay, 2018). As of the 21st century, new generations are demanded to have high-level skills such as producing and transferring knowledge to different fields, actively using digital technologies, problem solving, producing, processing and using data instead of protecting traditions and values, citizenship awareness and mass production (Uçak & Erdem, 2020).

The World Economic Forum (WEF), which was conducted by the business community in 2020, reported the skills demanded in 2022 as analytical and innovative thinking; having active learning strategies; creativity, originality and initiative; ability to design and program new technologies; critical thinking and analysis; ability to solve complex problems; leadership and social influence; emotional intelligence; reasoning, problem solving and quick comprehension; and systems analysis and evaluation. In the same report, the top 15 skills that the business world expects for 2025 are analytical thinking and innovation; active learning and learning strategies; complex problem solving; critical thinking and analysis; creativity, originality and initiative; leadership and social influence; technology use, monitoring and

control; technology design and programming; flexibility, stress tolerance and resilience; reasoning, problem solving and idea generation; emotional intelligence; troubleshooting and user experience; service orientation; systems analysis and evaluation; persuasion and negotiation (WEF, 2020).

In the 2020 World Economic Forum, the skills reported for 2020 and 2025 are similar to 21st century skills. In the literature, AASL (American Association of School Librarians), Wagner, Organization for Economic Co-Operation and Development (OECD) and Partnership for 21st Century Skills (P21) have identified various the 21st century skills. The Framework for 21st Century Learning was developed by teachers, education experts and business leaders to realize the learning outcomes of the 21st century and to provide students with the knowledge and skills they need to succeed in work, life and citizenship (P21 Leadership States 2017). The Partnership for 21st Century Learning (P21), a strategic education project implemented in 21 states in the United States and supported by 33 institutions (P21 Leadership States, 2017), is a valuable example of the application of 21st century skills in curriculum and instruction. They have developed a shared vision to help teachers and schools, as practitioners in teaching, to integrate academic subjects. The framework includes the skills, knowledge and abilities that students need to have to be successful in the world of work. The framework is a blend of content knowledge, mastery of essential learning skills, and language competencies. These the 21st century skills enable the development of key knowledge and understanding among all learners. This knowledge and understanding is built on critical thinking and effective communication. In today's world, students need to learn the basics of critical thinking, problem solving, communication and collaboration in the context of these key competencies. When a school or system is built on these key competencies, students are actively engaged in the learning process and become graduates who are prepared to succeed in today's global economy (Gelen, 2017). P21 divides the 21st century skills into three main categories: *Learning and Innovation Skills*, *Information and Technology Skills*, and *Life and Career Skills* (P21, 2019a; P21, 2019b).

Purpose of the study and research questions

In the literature, AASL (American Association of School Librarians), Wagner, Organization for Economic Co-Operation and Development (OECD) and Partnership for 21st Century Skills (P21) have identified various the 21st century skills. The aim of the study was determined as a meta-synthesis of the research on 21st century skills conducted in Türkiye and the research questions posed for the study are as follows:

1. What is the distribution of the topics studied?
2. Which data collection tools are used for targeted purposes?
3. Which the 21st century skills are addressed?
4. What is the distribution of 21st century skills by years?
5. What kind of results have been achieved?

Importance of research

In the world and in Türkiye, the 21st century skills have occupied a very large place and many studies have been conducted. Although the 21st century skills have emerged with the expectations of the business world, the training of the manpower expected by the business world depends on the education that people receive. This has led to the research on the educational aspect of 21st century skills. While there are many studies on 21st century skills related to education in Türkiye, there is no Comprehensive study on 21st century skills associated with education. In this study, the years and purposes of the studies on 21st century skills related to education in Türkiye, the data collection methods used, which the 21st century skills were addressed in the studies, and which results were reached will be analyzed in detail. It is expected that the analysis will shed light on those who work and will work on 21st century skills.

Limitations of the study

The research covers the studies conducted in the field of 21st century skills between 2017-2022. The limitations of the study are as follows:

- *The studies were written in Türkiye and in Turkish.*
- *Worked with the supervisor and published in peer-reviewed journals accepted for thesis and associate professorship.*
- *The research method is qualitative.*
- *The research sample is students.*

Method

Research Design

According to the criteria determined by the researchers, a meta-synthesis study was used because it was aimed to illustrate the results of the research on 21st century skills and to integrate the results of the findings obtained from the primary studies, indicating the similarities and differences. Qualitative research is a holistic and realistic research method in which methods such as observation, interview, and document review are used in the natural environment (Yıldırım, 1999). Meta-synthesis is a methodological research method that includes a systematic comparison used to illustrate the results of studies on the same subject, analyzing and combining the results, interpreting and synthesizing them with a critical eye by creating themes (Kaleli Yılmaz, 2015; Chrastina, 2018; Polat & Ay, 2016; Yıldırım & Gelmez-Burakgazi, 2020). The aim of meta-synthesis studies is to reveal the similar and different aspects of the studies with a conceptual analysis (Sözbilir & Gül, 2015). According to Sandelowski & Barroso (2003), meta-synthesis is a kind of integration study in which qualitative research findings are combined. According to Chrastina (2018), meta-synthesis

focuses on answering why and how questions and understanding existing knowledge. Its aim is to go beyond summaries and integrate the results of findings from primary studies to reveal new results (Chrastina, 2018).

Data Collection

In the meta-synthesis study, the seven steps identified by Chrastina (2018) for meta-synthesis studies were followed. Of these steps, those related to data collection are expressed as follows.

- *Step 1: Identifying research questions.*
- *Step 2: Identifying keywords appropriate to the subject of the study and conducting a literature review.*
- *Step 3: Sourcing, reviewing, identifying and evaluating resources.*
- *Step 4: Determining the inclusion and exclusion criteria and selecting the studies to be evaluated.*

Three doctoral students and the instructor of the course first determined the research topic and then the research questions. With the keywords “The 21st century skills” and “The 21st century skills” determined by the researchers, it was decided to look at the studies that were conducted within the borders of Türkiye and written in Turkish, and to search these studies in the Council Of Higher Education Thesis System, which includes graduate theses with an academic advisor, and TRDİZİN database, which includes national refereed journals included in Associate Professorship applications by the Interuniversity Board in Türkiye. As a result of the search in the relevant databases between 2017 and 2022, 119 articles and 106 theses were listed and 10 studies were included in the scope of the research in line with the inclusion criteria below: the 21st century skills, Qualitative research methods, participants as only students and Written in Turkish

Table 1

Studies Included in the Study

Operation code	Imprint	Purpose of the study	Sample
X1	Külegel, S. (2020) (Thesis)	The effect of E-STEM activities on the development of 21st century skills in gifted students and their perceptions towards the environment	17 students with special talents (5th and 6th grade)
X2	Erdoğan, Ö.(2019) (Thesis)	The effect of robotic lego education using LEGO sets according to science course outcomes on pre-service science teachers' the 21st century skills	6 pre-service teachers in the 3rd year of Science Education at Amasya University
X3	Yavrutürk, A. and İlhan, T. (2022) (Article)	Examining the opinions and experiences of secondary education students who went abroad within the scope of Erasmus+ Program about their achievements within the scope of 21st century skills	10 students who went to Greece as part of the student mobility program
X4	Baki, Y. (2021) (Article)	Evaluation of the basic competencies that Turkish teachers should have in the 21st century from the perspective of prospective teachers	34 pre-service teachers studying in the 3rd grade
X5	Selçuk, G.(2020) (Article)	To examine the metaphorical perceptions of prospective elementary mathematics teachers towards the 4C field within the scope of 21st century skills	49 pre-service mathematics teachers
X6	Baysal, E., Ocak, G. and Ocak, İ. (2020) (Article)	To reveal the opinions of students who received coding and Arduino trainings about coding, Arduino and STEM based on the skills they gained after these trainings	16 high school students within the scope of Afyonkarahisar Erasmus+ K229 project
X7	Toklu, E. and Şentürk, A. (2020) (Article)	Gifted students' opinions about scratch and code game lab programs most frequently used in game design and coding education courses	In Bursa province, 20 10-year-old students with reported giftedness
X8	Akbas, Y. and Aydin, M. (2019) (Article)	To reveal the project perceptions of pre-service social studies teachers who do not have enough experience in project	145 people consisting of 3rd year prospective teachers
X9	Orhan, E. (2017) (Article)	Teacher education in Türkiye based on the views of prospective teachers	43 final year student teachers
X10	Özçelik, A. and Akgündüz, D. (2017) (Article)	To evaluate the gains achieved by students through STEM education for gifted/talented students	25 middle school students diagnosed as gifted/special talented who have not received STEM education

The aim of the master's thesis published by Külegel (2020) is the effect of E-STEM activities on the development of 21st century skills in gifted students and their perceptions towards the environment. Seventeen students in the 5th and 6th grades from a private secondary school participated in the study. Semi-structured interviews, focus group interviews, the 21st century skills perceptions form, environmental perceptions questionnaire, observation form and daily self-assessment form were used as a source of document analysis and content analysis was performed.

The aim of the master's thesis published by Erdoğan (2019) is to observe the effects of robotic lego education using LEGO sets on 21st century skills of pre-service science teachers. Six pre-service science teachers in the 3rd grade of Amasya University, Department of Mathematics and Science, Department of Science Education participated in the study. Student diaries, mind maps, semi-structured interview forms were used in the study and analyzed with NVivo 9 program.

The aim of the article published by Yavrutürk and İlhan (2022) is to examine the opinions and experiences of secondary education students who went abroad within the scope of the Erasmus+ Program regarding their achievements within the scope of 21st century skills. Ten students who went to Greece within the scope of the student mobility program participated in the study. Semi-structured interview technique was used in the study and analyzed by constant comparative analysis method.

The aim of the article published by Baki (2021) is to evaluate the basic competencies that Turkish teachers should have in 21st century from the perspective of prospective teachers. A total of 34 3rd grade pre-service teachers studying in the department of Turkish Language Teaching participated in the study. A semi-structured interview form consisting of open-ended questions was used in the study and content analysis was conducted.

The aim of the article published by Selçuk (2020) is to examine the metaphorical perceptions of prospective elementary mathematics teachers towards three basic skill areas categorized as "learning and innovation skills", "information, media and technology skills", "life and career skills" within the scope of 21st century skills. 49 prospective mathematics teachers participated in the study. A data collection tool consisting of open-ended questions was used in the study and metaphor content analysis was conducted.

The aim of the article published by Baysal, Ocak, and Ocak (2020) is to reveal the opinions of students who received coding and Arduino trainings about coding, Arduino and STEM based on the skills they gained after these trainings. Sixteen high school students who received coding and Arduino trainings within the scope of Erasmus+ K229 project at Afyonkarahisar Fatih Anatolian High School participated in the study. A semi-structured interview form was used in the study and descriptive analysis was performed.

The aim of the article published by Toklu and Şentürk (2020) is to reveal the opinions of gifted students about scratch and code game lab programs, which are most frequently used in

game design and coding education courses. Twenty 10-year-old students in Bursa province, whose giftedness was determined by a report, participated in the study. A semi-structured interview form was used in the study and content analysis was performed.

The aim of the article published by Akbaş and Aydın (2019) is to reveal the project perceptions of pre-service social studies teachers who do not have enough experience in project. A total of 145 pre-service teachers studying in the 3rd grade of the Faculty of Education participated in the study. Mind maps and a questionnaire consisting of open-ended questions were used in the study.

The aim of the article published by Orhan (2017) is to evaluate teacher education in Türkiye in terms of students' admission to the program, the degree to which they acquire teaching skills and the 21st century skills, and the dimensions of the education they receive based on the views of pre-service teachers. Forty-three pre-service teachers studying in the last year of the Faculty of Education participated in the study. An interview form was used in the study and descriptive analysis was conducted.

The aim of the article published by Özçelik and Akgündüz (2017) was to evaluate the gains achieved by students with STEM education for gifted/talented students. Twenty-five middle school students diagnosed as gifted and talented who had not received STEM education participated in the study. Activity evaluation form was used in the study and descriptive analysis was performed.

Data Analysis

Step 5, one of the seven steps identified by Chrastina (2018) for meta-synthesis studies, is related to data analysis. This step was followed for data analysis.

Step 5: Analyzing the selected studies, creating common themes and sub-themes, and identifying their similarities and differences.

In the data collection phase, 225 studies found as a result of the search were examined according to the exclusion criteria. As a result of the review, 10 studies that met the purpose and research criteria were found (Table 1). For meta-synthesis studies, 10 or 12 primary studies are considered sufficient (Chrastina, 2018). In this context, a sufficient number of studies were reached for the study. The 10 studies were read and reviewed one by one by the researchers. In addition, each author analyzed the studies and created themes. Then, the authors came together and talked about the themes that each other made and created common themes and sub-themes. The common theme of the 10 studies included in the study was created and presented in the findings section.

As evidence of the validity and reliability of the meta-synthesis study, exclusion criteria were determined, and the reasons why a study was not included in the study were recorded on the exclusion table. The three doctoral students and the course instructor, who were the

researchers of the study, read the studies repeatedly according to the problem "Can a framework be created for 21st century skills studied?" and common themes were decided. The whole process was carried out with the confirmation and consensus of the three doctoral students and the course instructor.

Results

In this section, the findings and interpretations obtained as a result of the data analysis are presented according to each sub-problem respectively.

Among the seven steps identified by Chrastina (2018) for meta-synthesis studies, Step 7 is related to findings. This step was followed for the findings.

Topics

In order to seek answers to the questions related to the sub-objective "What is the distribution of the topics addressed for 21st century skills?", the topics and the study code were tabulated together. In this way, it was tried to clarify the problem situation "can a framework be created for the topics covered?"

Table 2

Topics and Working Codes

Topics	Operation code
STEM	X1, X6, X10
The 21st century skills	X1, X2, X3, X4, X5, X6, X7, X8, X9, X10
Erasmus	X3, X6
Coding and Arduino	X6
Robotic Lego training	X2
Teacher competencies	X4, X8
Teaching skills	X4, X9
Teacher training	X9
Game design (Scratch and game lab)	X7
Coding (Programming)	X2, X6, X7
Gifted/Special talented student	X1, X7, X10
Student cross-cultural experience	X3

As seen in Table 2, it is seen that most of the topics on 21st century skills are studied on "The 21st century skills". This is followed by topics on "STEM and gifted/talented students and teacher competencies". Although proportionally low in number, there are also some studies on "Erasmus, Coding and Ardunio, Robotic Lego education, Teacher skills, Teacher training, Game design, Coding programs and Student experience".

Findings from the theme "Data collection tools"

In order to seek answers to the questions related to the sub-objective "How do the data collection tools used for the objectives targeted for 21st century skills show a distribution?", the data collection tools were tabulated together with the sub-theme, theme code and study code. In this way, "can a framework be created regarding the data collection tools used? " problem situation was tried to be clarified.

Table 3

Findings related to Data Collection Tools

Data collection tools	Operation code
Semi-structured interviews	X1, X3, X6, X2, X4, X7
Focus group interview	X1
Observation form	X1
The 21st century skills perceptions form	X1
Student diaries	X1, X2
Self-assessment form	X1
Open-ended questionnaire	X5, X8
Environmental perception form	X1
Mind maps	X2, X8
Individual interview form	X9
Activity evaluation form	X10

As seen in Table 3, it is seen that "Semi-structured interviews" are the most preferred data collection tools used for targeted purposes for 21st century skills. This was followed by "Student diaries and Mind maps" respectively. However, the least used data collection tools were "Focus group interview, Observation form, the 21st century skills perceptions form, Self-assessment form, Environmental perception form, Open-ended questionnaire, Individual interview form and Activity evaluation form".

Distribution of 21st Century Skills

The 21st century skills were tabulated together with the sub-theme, theme code and study code in order to seek answers to the questions related to the sub-objective "How do the 21st century skills show a distribution?". In this way, it was tried to clarify the problem situation "Can a framework be created for 21st century skills studied?".

Table 4

Findings related to 21st Century Skills

21st century skills code	21st century skills	Operation code
B1	Creativity and renewal	X1, X2, X4, X5, X6, X7, X8, X9, X10
B2	Critical thinking and problem solving	X1, X2, X4, X5, X6, X7, X8, X9, X10
B3	Communication and cooperation	X1, X2, X3, X4, X5, X6, X8, X9, X10
B4	Information literacy	X1, X2, X5, X6, X9, X10
B5	Media literacy	X1, X9
B6	ICT literacy	X1, X2, X4, X6, X7, X9
B7	Flexibility and adaptability	X1, X2, X6, X10
B8	Entrepreneurship and self- direction	X1, X3
B9	Social and intercultural skills	X3, X6, X9
B10	Productivity andresponsibility	X1, X2, X6, X7, X10
B11	Leadership and responsibility	X1, X2, X6, X10

As seen in Table 4, it is seen that “Critical thinking and problem solving, communication and collaboration” are the most studied the 21st century skills. In addition, “Creativity and innovation, Social and intercultural skills, Media literacy, ICT literacy, Information literacy” were identified as the other most studied skills by the researchers. This is followed by “Flexibility and adaptability, Entrepreneurship and self-direction, and Productivity and responsibility”. However, the least studied the 21st century skill was found to be “Leadership and responsibility”.

Distribution of 21st century skills by years

In order to seek answers to the questions related to the sub-objective “How do the 21st century. skills show a distribution according to years?”, the skills specified in Table 4 were tabulated together with the sub-theme and years according to years. In this way, it was tried to clarify the problem situation “Can a framework be created on 21st century skills discussed according to years?

Table 5

Findings Obtained from Skills by Years

Year published	Skills Theme Code
2017	B1, B2, B3, B5, B9
2018	-
2019	B1, B2, B3, B6, B10
2020	B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11
2021	B1, B2, B3, B4, B5, B6, B7, B9
2022	B3, B4, B5, B6, B8, B9

As seen in Table 5, it is seen that the 21st century skills were mostly studied in "2020" (f=11). In addition, the years "2021 and 2022" were also determined as the most studied years by the researchers. This is followed by the years "2019 and 2017" respectively. In the year "2018", it was determined that there were no studies on 21st century skills in accordance with the inclusion criteria.

Results of studies on 21st century skills

How do the results obtained on 21st century skills show a distribution? In order to seek answers to the questions for the sub-objective, the results of the study were tabulated together with the sub-theme, theme code and study code. In this way, it was tried to clarify the problem situation "can a framework be created on the results obtained?".

Table 6

Findings Obtained from the Study Results

Study results	Operation code
Increased awareness/sensitivity towards nature	X1
Designing a product with group work	X1, X2, X6, X10
Realization of effective learning	X1
Development of 21st century skills	X1, X2, X3, X6, X7, X10
Development of teachers' design skills	X2
Improving teachers' use of technology	X2
Increased motivation of teachers	X2
Increased student acquisition of 21st century skills	X1, X3, X6, X10
The 21st century competencies that teachers should have	X4, X5, X9
Development of pre-service teachers' technology literacy	X2
Students' game coding program preferences/expectations	X7
Determination of teachers' perception of 21st century skills project	X8
Prospective teachers' views on teacher education	X9
Problems in teacher education	X9
Increased student achievement with STEM education	X10, X1

As seen in Table 6, it is seen that the general results obtained from the studies on 21st century skills are mostly focused on the results of "developing the 21st century skills, increasing student acquisition of 21st century skills and the competencies that teachers should have in the the 21st century". This was followed by the result of "increasing student achievement with STEM education". However, the least achieved results were "Increased awareness/ awareness of nature, Designing products with teamwork, Effective learning, Improving teachers' design skills, Improving teachers' use of technology, Increasing teachers' motivation, Improving teachers' technology literacy, Students' coding program preferences/ expectations, Determining teachers' perception of 21st century skills project, Opinions of prospective teachers and Problems in teacher education".

Discussion and Conclusion

In this study, a systematic and in-depth evaluation of the studies on 21st century skills in the literature, written in Turkish and in Türkiye, with a sample of only students and a qualitative research method, was conducted within the framework of meta-synthesis research steps.

Changes and developments in parallel with social and technological developments in today's world have led to the diversification and restructuring of business life, rather than just the differentiation of habits in daily life or technological tools used (Anderson, 2008). The change in the business world and system has begun to require individuals to change in accordance with the new conditions. While the business world is investigating what kind of qualifications employees should have for new work environments, new job structures and new job descriptions, the education world is working on what kind of professional or general knowledge, skills and training future individuals may need in order to survive in the new social order. Even though education systems aim to raise the level of education of individuals in order to further the level of development of their societies, culture and civilization, they also try to meet the needs of the business world in the current world economic system for trained personnel. The abilities, skills, education level and characteristics of trained employees vary according to the economic and financial structure of the period, the technological structure and sophistication of production and business environments (Bates, 2019; Chalkiadaki, 2018). The skills that are thought to be required for individuals who can respond to the needs brought about by the change in the future job structure and definition and who can take their place in the social order in the world of the future are considered as the 21st century skills in the literature.

In this framework, based on the "Subject" themes in the studies included in the research, the research question "What is the distribution of the subjects studied?" was tried to be answered. It was found that more studies were conducted on STEM, Coding-Programming, and Gifted/Special Talented Students, and when the details of the studies were examined, it was seen that the perceptions and opinions of Gifted/Special Talented students regarding the development of 21st century skills they acquired as a result of STEM activities and coding-based practices were examined. It was found that coding education and STEM-based activities were in parallel with the studies on the relationship between problem solving skills and creativity in the literature (Fessakis, Gouli, & Mavroudi, 2013; Kim & Choi, 2012). The second most studied subject themes were Erasmus, Teacher Competencies and Teaching

Skills. When the details of the studies are examined, the status of teacher competence and efficacy in terms of providing the 21st century skills to students was tried to be examined in line with the views of pre-service teachers. Looking at the literature on the studies included in the research, the importance of teacher competence in teaching the 21st century skills to students was observed (Altınpulluk & Yıldırım, 2020). According to the detailed sub-clustering of the studied subject themes, it was concluded that the studies focused on the examination of activities to develop the 21st century skills and teacher competence that can apply these activities to students.

The 21st Century Skills Framework Theme includes various disciplines and themes such as "mathematics", "science/science", "language acquisition", "reading", "language arts", "world languages", "art", "geography", "history" (Gelen, 2017). However, it is seen that the majority of the studies are numerical-based science, science, technology-oriented studies such as STEM, coding, programming. It was determined in the included studies that problem solving-based product development project activities used by researchers to ensure skill acquisition and development were used and preferred more with numerical-based science, science, technology content topics such as STEM, coding, programming. It is observed in Table 1 that the subject themes that can be defined as social science such as "language acquisition-foreign language", "reading", "language arts", "world languages", "culture", "art", "geography", "history" are very few in the included studies.

When the theme of "Data collection tools" in the studies included in the research to the research question "Which data collection tools were used for the targeted purposes?" is examined, it is seen that "Semi-structured interviews" are more preferred. This was followed by "Student diaries and Mind maps" respectively. The least used data collection tools were "Focus group interview, Observation form, the 21st century skills perceptions form, Self-assessment form, Open-ended question form, Environmental perception form, Open-ended questionnaire, Individual interview form and Activity evaluation form".

When we look at the theme of " the 21st century skills" in the studies included in the research in response to the research question "Which the 21st century skills are addressed?", it is seen that "Learning and Innovation Skills (4C)" are more focused on. This is followed by "Information, Media and Technology Skills" and "Life and Career Skills" respectively. When these skills are analyzed in terms of their detailed content, it can be said that the product development-based activities used in the studies are more involved and the participants play an active role in the activities as a group. As mentioned in the "Subject" themed classification, it can be accepted that STEM and coding-based activities may have increased the impact of participants' "Critical thinking and problem solving skills", "Creative thinking and innovation application skills", "Communication skills", "Collaboration skills", "Information literacy", "Information and communication technologies (ICT) literacy", and "Productivity and responsibility" skills in the studies. Compared to other skills, "Media Literacy", "Entrepreneurship" and "Social and intercultural" skills were found to be included in fewer studies. It is thought that the fact that the problem-solving-based product development project activities, which were determined in the subject theme contents of the studies included in the research, include problem solving, product creation, cooperation in group work and communication skills within the group, caused the "Learning and Innovation Skills (4C)" to be included more in the studies. "Entrepreneurship" and "Social and intercultural" skills, which were found to be included in

fewer studies compared to other skills, are more closely related to the theme of "Erasmus". It is also stated by various sources that the aims of Erasmus student exchange programs are to contribute to the development of intercultural interaction, entrepreneurship, information literacy and foreign language skills (European Commission, 2019; Yavrutürk & İlhan, 2022).

When the theme of "Skills by years" in the studies included in the research on the research question "What is the distribution of 21st century skills by years?" is examined, it is seen that the most studies on 21st century skills were conducted in "2020". Then, the years "2021" and "2022" were determined respectively. This is followed by the years "2019 and 2017" respectively. In "2018", it was determined that there were no studies on 21st century skills that met the inclusion criteria.

When the theme of "Study results" in the studies included in the research in response to the research question "What kind of results were obtained?" is examined, it is seen that most of the studies focused on the result of "developing the 21st century skills". Then, the intensity of the studies on "Designing products with group work" and "Increasing student acquisition of 21st century skills" and "Competencies that teachers should have in the 21st century" are observed, respectively. When the result themes of the studies included in the research are examined in detail, it can be said that the studies focus on the examination of activities to develop the 21st century skills and teacher competence that can make students do these activities.

It was found that project-based activities such as group work and problem-based product development were used more in the studies mainly on "developing the 21st century skills". However, most of these project activities were carried out with extracurricular activities; it is thought that more studies that include the results of research conducted within the course or within the curriculum can contribute to the literature. In addition, the majority of the students who participated in the studies on "developing the 21st century skills" were gifted/talented students, Science High School students and students selected within the scope of Erasmus student mobility. It is thought that conducting studies with student groups from different school types and levels, in which the success status of the participant students is diversified, can make an important contribution to the literature.

In the meta-synthesis study, it was seen that the Learning and Innovation skills, also referred to as the 4Cs, are the most researched and desired skills to be acquired by students. In addition, it was observed that less research has been conducted on life and professional skills expected by the business world. Considering that the emergence points of 21st century skills is the demand from the business world, more research on life and professional skills will ensure the training of the workforce in accordance with the expectations of the business world. The studies conducted were generally realized within the scope of a course. In order to apply the 21st century skills to the education program, the status of students' the 21st century skills and how this situation can be improved with courses can be investigated. In this regard, more studies with the 21st century skills will reveal the current situation, the missing aspects will be identified and planning can be better integrated into the education system.

In order for the planning of 21st century skills courses to be productive for both students and teachers, teachers must first have sufficient knowledge and equipment. Therefore, the

competencies of teachers in terms of knowledge and equipment that can provide these skills can be investigated. The 21st century skills, especially information and communication technology skills, are important for both teachers and students to keep up with the rapidly developing age of technology. In the process of integrating ICT skills into the education system, suggestions can be developed on how teachers can plan their lessons.

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