International Journal of Contemporary Educational Research (IJCER)

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Article History
Received: 28.12.2022
Received in revised form: 18.03.2023
Accepted: 29.03.2023
Article Type: Research Article

To cite this article:

Uyar, A. (2023). 21st century skills of pre-service teachers and visions of faculties of education in acquiring 21st century skills. *International Journal of Contemporary Educational Research, 10* (1), 262-278. https://doi.org/10.33200/ijcer.1274201

International Journal of Contemporary Educational Research
Volume 10, Number 1, March 2023, Page 262-278 ISSN: 2148-3868

21st Century Skills of Pre-service Teachers and Visions of Faculties of Education in Acquiring 21st Century Skills

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Abstract

This study aims to reveal the situation of pre-service teachers in terms of having 21st century skills and their opinions on faculties of education in terms of enabling them to acquire these skills. In the study, which was designed as an explanatory mixed method, 621 pre-service teachers and 26 pre-service teachers were included in the quantitative and qualitative dimensions, respectively. To collect the data, the "Multidimensional 21st Century Skills Scale" and the "Semi-Structured Interview Form" were used. In the analysis of quantitative data, descriptive statistics, an independent sample T-test, an ANOVA test, and the Scheffe test were used. In the analysis of qualitative data, content analysis was used. In the quantitative aspect of the study, it was concluded that the 21st century skills of the pre-service teachers were at a high level. In the qualitative dimension of the study, it was obtained that pre-service teachers had learning and innovation skills, knowledge, media and technology skills, life and career skills; they thought that teachers, parents, academicians, the individual himself or herself, and bureaucrats were responsible for enabling them to acquire 21st century skills; there were strengths of faculties of education in enabling them to acquire 21st century skills.

Keywords: 21st century, 21st century skills, Pre-service teachers, Faculties of education.

Introduction

Since 21st century skills are comprehensive and multidimensional, it is not possible to make a standard definition for them. For this reason, many institutions and organizations have created some classifications about what 21st century skills should be. Among various project studies and published reports aimed at identifying 21st century skills, the Partnership for 21st Century Skills [P21] is the most widely accepted one and has the largest stakeholder network. The Partnership for 21st Century Skills [P21], 2019) expressed these skills as "problem solving, innovation and creativity, cooperation, and communication skills within the scope of learning and innovation skills; information, media, and technology literacy within the scope of information, media, and technology skills; flexibility and adaptability; entrepreneurship and self-management; productivity and accountability; social and intercultural skills; leadership and responsibility skills within the scope of life and career skills".
21st century skills can be described as the skills that individuals are expected to have in the century that we live in. This expectation has led to the need to teach 21st century skills to individuals. In parallel, teachers, education professionals, and business leaders have provided a framework for these skills (Bozkurt, 2021; P21 Leadership States, 2017). In this framework, which was put forward as the 21st Century Learning Framework (P21, 2019), it is aimed that students acquire 21st century skills by providing active participation in the learning process with the support systems of a) Standards & Assessments, b) Curriculum & Instruction c) Professional Development d) Learning Environments.

It is only possible for students to acquire 21st century skills with an effective education. With an effective education to be carried out under the responsibility of teachers, these skills can be gained at all educational levels, from primary school to higher education (Anagün et al., 2016). In this context, the competencies of teachers and pre-service teachers who will enable 21st century learners to acquire these skills become prominent. To effectively enhance and implement 21st century skills, teachers must possess a comprehensive understanding of these skills. As the instructor of future teachers, teacher training plays a crucial role in providing them with the necessary knowledge and skills to master these competencies (Valli, Perkkilä, & Valli, R. (2014). Numerous studies in the

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literature have emphasized that educators must take into account the requirements of the 21st century when designing their instructional approaches and that learners of the 21st century should possess novel knowledge and abilities (Burns & Sinfield, 2004). Teachers who will enable the students to acquire these skills should be open to developments, can empathize with their students, have effective communication skills, solve problems, be open to criticism, and apply teaching methods and techniques that enable the active participation of students (Bayrak Özmutlu & Ergan, 2022; Michaels et al., 2015). Within this context, pre-service training of teachers is of great importance in the training of teachers with these qualifications.

Faculties of education play a vital role in preparing future teachers with the skills and knowledge required to thrive in the 21st century. Faculties of education must equip their students with the necessary competencies to enable them to effectively teach these skills to their own students. By providing future teachers with an education that emphasizes these skills, the faculties of education can ensure that the next generation of students will have the skills and knowledge necessary to succeed in a rapidly changing world (Bayrak Özmutlu & Ergan, 2022). This aim can be achieved by updating the curriculum implemented in the faculties of education. The variability in the needs of the learners, developing teaching technologies, dynamic professional development understanding, and student-based learning approaches have made it necessary to update the curriculum implemented in the faculties of education within the framework of 21st century skills (Arslan, 2020; Turkish Education Association [TED], 2009); Yalçın, 2018). For these updated studies, information is needed on what the 21st century skill levels of pre-service teachers are and what variables affect their skills; what the strengths and weaknesses of faculties of education are in acquiring 21st century skills, and what should be done to acquire these skills in the faculties of education. In this context, when the studies on the subject are examined, it is seen that the literature does not contain enough data for updating the curriculum. Within this context, this study tries to provide the data needed for updating the curriculum in the faculties of education.

In the literature, various studies have been conducted to develop an assessment tool to determine the 21st century skill levels of teachers and pre-service teachers (Anagün et al., 2016; Çevik & Şentürk, 2019), to examine the 21st century skill levels of pre-service teachers and to examine these skills in terms of some variables (Aktaş, 2022; Aydın & Tan Şişman, 2021; Canpolat, 2021; Erten, 2020; Gömleksiz, Sinan, & Döner Doğan, 2019; Kozikoğlu & Altınova, 2018; Özdemir Özden et al., 2018), to obtain pre-service teachers' opinions by quantitative research (Bayrak Özmutlu & Ergan, 2022), and to obtain pre-service teachers' opinions using mixed method (Bozkurt, 2021). In this study, unlike other studies, the 21st century skill levels of pre-service teachers are revealed according to the number of social activities they participate in, the 21st century skills that pre-service teachers think they have, their opinions on the stakeholders responsible for enabling students to acquire 21st century skills, the strengths and weaknesses of the faculties of education, and what needs to be done by the faculties of education. In most studies, it has been emphasized that studies examining the 21st century skills of pre-service teachers who will train 21st century learners should be conducted and that data should be provided for policies to be developed in this regard (Anagün et al., 2016; Arslan, 2020; Aydın & Tan Şişman, 2021; Bayrak Özmutlu & Ergan, 2022; Kozikoğlu & Altınova, 2018). Motivated by the information presented in the literature, this study will make it possible to reveal the current situation of the faculties of education in the process of acquiring 21st century skills. In addition, the data obtained will contribute to the updating of the studies of the curriculum implemented by the faculties of education.

Based on this, the aim of the study is to reveal the situation of pre-service teachers in terms of having 21st century skills and their opinions on the conditions of faculties of education in terms of enabling them to acquire these skills. Within the scope of this purpose, the following questions were sought to be answered:

1. What are the 21st century skill levels of pre-service teachers?
2. Do pre-service teachers' 21st century skill levels differ significantly according to gender, GPA, and the number of social activities they participate in?
3. What are the 21st century skills that pre-service teachers think they have, and what are their opinions on the role of faculties of education in enabling them to acquire these skills?

Methodology

In this section, the design of the research, participants, data collection tools, data collection process, and data analysis are presented.

Research Design

In the study, an explanatory mixed method design was preferred. Mixed-methods research forms a synthesis between quantitative and qualitative research. In this way, the weaknesses of both research methods are eliminated. In the explanatory design, the research problem starts with a quantitative study and a qualitative study is carried out to explain the quantitative data (Creswell, 2021). In this design, qualitative data is collected with the thought that quantitative data will not be enough to explain the research results, and these collected data are evaluated together with quantitative data.

Participants

In the study, quantitative and qualitative data were obtained. Accordingly, in this section, the data related to the population and the sample of the quantitative data and the participants related to the qualitative data are given below under separate sub-titles.

Population and Sample for Quantitative

The population of the study consisted of pre-service teachers studying at Hatay Mustafa Kemal University in the academic year 2022-2023. In the sample of the study, there were 621 pre-service teachers selected from the specified population by the convenience sampling method. Convenience sampling is a method in which the most suitable sample is determined in terms of time, money, and labor based on the purpose of the study (Balcı, 2020; Büyüköztürk et al., 2020). The descriptive data of the pre-service teachers included in the sample of the study are shown in Table 1.

Table 1. Descriptive data of pre-service teachers in the sample group

Variables	N	%
Gender		
Male	262	42.2
Female	359	57.8
Grade		
1st Grade	94	15.1
2nd Grade	81	13.0
3rd Grade	189	30.4
4th Grade	257	41.4
GPA		
Less than 2.50	65	10.5
2.50-3.00	220	35.4
3.01-3.50	291	46.9
3.51-4.00	45	7.2
Graduated High School Type		
Anatolian High School	409	65.9
Vocational High School	50	8.1
Imam Hatip High School	29	4.7
Other	133	21.4
Number of Social Activities Participated in		
1	267	43.0
2	151	24.3
3	100	16.1
4 and above	103	16.6
Education Level of Mother		
Illiterate	104	16.7
Primary School	303	48.8
Secondary School	85	13.7
High School	83	13.4
University	46	7.4
Education Level of Father		
Illiterate	23	3.7
Primary School	235	37.8
Secondary School	119	19.2
High School	124	20.0

University	120	19.3
Total	621	100

When Table 1 is examined, it is seen that 262 (42.2%) of the pre-service teachers were male and 359 (57.8%) were female; 94 (15.1%) of them were in the 1st grade, 81 (13%) of them were in the 2nd grade, 189 (30.4%) were in the 3rd grade, and 257 (41.4%) were in the 4th grade. The GPA of 65 students (10.5%) was below 2.50; 220 students (35.4%) had a GPA in the range of 2.50-3.00; 291 students (46.9%) had GPA a in the range of 3.00-3.50, and 45 students (7.2%) had a GPA in the range of 3.51-4.00. Moreover, it is seen that most of them were Anatolian high school graduates, participated in 1 social activity, and their parents were primary school graduates.

Participants of Qualitative Data Collection

In the study, maximum variation sampling, one of the purposive sampling methods, was used to get the opinions of pre-service teachers on 21st century skills. In maximum variation sampling, similar situations are determined in relation to the problem being investigated, and research is carried out on these situations (Büyüköztürk et al., 2020). The most important purpose of this sampling method is to reflect the diversity of individuals who may be parties to the researched problem at the maximum level (Yıldırım & Şimşek, 2018). Accordingly, in the study it has been tried to ensure maximum diversity by including pre-service teachers with low, medium, and high 21st century skill levels. Within the scope of the study, interviews were conducted with 26 pre-service teachers. The data reflecting the descriptive characteristics of the pre-service teachers who participated in the study is given in Table 2.

Tablo 2. Descriptive data of the interviewed pre-service teachers

Code	**Gender**	**Grade**	**GPA**	**The number of participants in social activities**	**Graduated High School Type**	**Education Level of Mother**	**Education Level of Father**
I1	Female	4th	2.80	7	IMHS	Illiterate	Illiterate
I2	Female	3rd	3.30	5	AHS	Primary	University
I3	Male	4th	2.60	15	AHS	Primary	Secondary
I4	Male	4th	3.00	16	AHS	Primary	University
I5	Male	3rd	3.00	8	AHS	Primary	Secondary
I6	Female	4th	2.90	1	AHS	Primary	High School
I7	Female	4th	3.07	1	AHS	Secondary	Secondary
I8	Female	3rd	3.00	3	AHS	Primary	Primary
I9	Female	3rd	1.50	18	AHS	Primary	High School
I10	Male	4th	3.00	20	AHS	Primary	University
I11	Female	4th	2.80	3	AHS	Illiterate	Primary
I12	Female	4th	2.98	2	AHS	Illiterate	Primary
I13	Male	4th	2.95	14	AHS	High School	High School
I14	Male	4th	2.63	23	IHHS	High School	University
I15	Female	4th	2.87	8	AHS	Primary	University
I16	Female	4th	3.40	5	IHHS	Primary	Primary
I17	Male	4th	3.00	9	AHS	Primary	Illiterate
I18	Female	4th	3.01	4	AHS	Primary	University
I19	Male	4th	3.52	4	AHS	Illiterate	Illiterate
I20	Female	4th	2.50	2	AHS	University	University
I21	Female	4th	2.99	5	AHS	Lise	Primary
I22	Female	4th	3.12	10	AHS	Primary	University
I23	Female	4th	2.90	4	AHS	Secondary	Secondary
I24	Male	4th	3.00	4	AHS	Illiterate	Illiterate
I25	Female	4th	2.95	8	AHS	Secondary	University
I26	Female	3rd	3.00	5	AHS	Secondary	Secondary

Note: I: Interviewee; IHHS: Imam Hatip High School; AHS: Anatolian High School

As can be seen in Table 2, nine of the pre-service teachers were male and seventeen of them were female. In addition, they were mostly in 4th grade, their GPA was between 2.50-3.00, they participated in social activities, and they were Anatolian high school graduates.

Data Collection Tools

In this section, information about the data collection tools used in the study is given.

Multidimensional 21st Century Skills Scale

In the study, the *"Multidimensional 21st Century Skills Scale"* developed by Çevik and Şentürk (2019) was used to determine the 21st century skill levels of pre-service teachers. There are different scales measuring 21st century skills in the literature. However, since this scale includes all dimensions of 21st century skills, it was preferred within the scope of the study. The scale consists of "Information and Technology Literacy Skills", "Critical Thinking and Problem-Solving Skills", "Entrepreneurship and Innovation Skills", "Social Responsibility and Leadership Skills" and "Career Consciousness". There are 41 items on the scale, 34 of which are positive and 7 of which are negative. The items on the scale, which is a 5-point Likert type, range as "Totally Agree: 5, Agree: 4, Neither agree nor disagree: 3, Disagree: 2, Strongly Disagree: 1". The lowest score that can be obtained from the scale is 41, and the highest score is 205. The high mean score obtained from the scale was interpreted as a high level of 21st century skills of pre-service teachers. In the original study, the Cronbach's Alpha reliability coefficients of the sub-dimensions of the scale were calculated as .84, .79, .76, .73 and .75, respectively. Within the scope of this study, the Cronbach's Alpha reliability coefficients of the sub-dimensions of the scale were found to be .88, .75, .86, .78, .80, respectively. The Cronbach's Alpha reliability coefficient of the overall scale was determined to be .90. According to this value, it can be said that the scale has a high degree of reliability (Büyüköztürk, 2020).

Semi-Structured Interview Form

In the study, a semi-structured interview form developed by the researcher was used to get the opinions of pre-service teachers about 21st century skills. First, a draft interview form was created by considering the purpose of the research and the principles of developing a semi-structured interview form (Yıldırım & Şimşek, 2018). The draft interview form was sent to the experts to examine and get the necessary feedback. For this purpose, six experts—two in the field of qualitative research, two in the field of curriculum and instruction, one in the field of measurement and evaluation, and one in the field of Turkish education—were consulted, and they provided feedback on the draft interview form. After getting expert feedback, a new question was added to the interview form, and one question was changed. Some of the changes made to the interview form are as follows:

1. The question of *"Who do you think has a role in the development of 21st century skills? What should these people do? Can you explain?"* was added to the interview form.
2. The question of *"What are the negative aspects of faculties of education in gaining 21st century skills? Explain?"* was changed to *"What are the aspects of faculties of education that you see as lacking (problematic) in enabling students to acquire 21st century skills? Please explain?"*

Finally, pilot interviews were conducted with three pre-service teachers using the interview form. As a result of these interviews, it was determined that there were no questions that were unclear or understood differently.

Data Collection Process

In the study, first of all, the "*Multidimensional 21st Century Skills Scale"* and the *"Personal Information Form"* were applied to determine the 21st century skill levels of pre-service teachers. These forms were printed out and filled out by the students in October 2022. It took approximately ten days to collect the quantitative data. After the collection of quantitative data, the collection of qualitative data was started. After the pre-service teachers to be interviewed were determined, the interviews were held in four separate sessions. Seven pre-service teachers were interviewed in the first session, five in the second session, six in the third session, and six in the fourth session. The pre-service teachers were informed about the purpose and scope of the study. Additionally, it was stated that if there was a question that was not understood, they could ask questions. They were requested to write explanatory and long answers instead of short ones while answering the questions. In this process, necessary explanations were made to the pre-service teachers who wanted explanations about the questions in the interview form. The collection of qualitative data took seven days.

Data Analysis

In the study, the mean scores obtained from the scale were taken as the basis for the analysis of quantitative data. Descriptive statistics such as the arithmetic mean, standard deviation, min, and max were used to calculate the 21st century skill levels of pre-service teachers. Since the scale used in the study is a 5-point Likert-type scale in the range of 1-5 points, the 21st century skill levels of pre-service teachers were divided into five levels. The Score Interval= (Highest score- Lowest score)/5 formula was used to determine the levels (Guvendi & Serin, 2019; Kaplanoğlu, 2014). According to this formula, the score range was determined as (5-1)/5=0.8. According to this calculation, regarding the 21st century skill levels of pre-service teachers, 1-1.79 mean score range was very low, 1.80-2.59 mean score range was low, 2.60-3.39 mean score range was moderate, 3.40-4.19 mean score range was high, 4.20-5.00 mean score range was very high. To determine the analyses to be made to find answers to the sub-problems, it was checked whether the data showed a normal distribution. For this, skewness and kurtosis values for each variable in the sub-problem, as well as the results of Shapiro-Wilk and Kolmogorov Smirnov analysis, were examined. Since the skewness and kurtosis values were between -1.5 and +1.5 (Tabachnick & Fidell, 2013) and the significance level was higher than .05 ($p>.05$) in Shapiro-Wilk and Kolmogorov-Smirnov analyses, it was seen that the data showed a normal distribution. For this reason, parametric tests were used in the analysis. An independent sample t-test was used to determine whether the 21st century skill levels of pre-service teachers differed significantly according to the gender variable. An ANOVA test was used to determine whether the 21st century skills of the pre-service teachers differed significantly according to their GPA and the number of social activities they participated in. The Scheffe test was used to determine in which groups these significant differences occurred.

In the analysis of the qualitative data, content analysis techniques were used. Content analysis is expressed as a technique in which themes, categories, and codes are systematically created by using words or phrases to reflect the essence of the content in a text (Büyüköztürk et al., 2020). The main purpose of content analysis is to reach the concepts that can explain these data and the relationships between these concepts to explain the data obtained as a result of the interview (Yıldırım & Şimşek, 2018). The obtained data were transferred to the Microsoft Word document. These documents were transferred to the qualitative data analysis program, and content analysis was performed. The data in the document was divided into meaningful sections, and descriptive codes were given to these sections. In the next stage, the common aspects of these codes were determined and grouped under categories. After the codes, categories, and themes were created, the data were reviewed again. In this process, it was checked whether the codes were correct, and whether the themes were correct, whether the codes were under the appropriate theme, and accordingly, necessary corrections were made. The data from the interviews were presented in the findings section using frequency (f) and interviewee codes of I1, I2, I3 ….., I26. The analysis of the interview data was carried out by two different researchers. After this stage, the percentage of agreement between the analysis results of the researchers was calculated (Miles & Huberman, 1994). As a result of this calculation, the percentage of agreement was determined to be 96%. After this process, the researchers came together, the findings were compared, and a consensus was reached on the inconsistent findings.

Findings

In this section, the findings obtained are presented. The descriptive statistics results related to the 21st century skill levels of pre-service teachers are shown in Table 3.

Table 3. 21st century skill levels of pre-service teachers

Variable	Sub-dimensions	N	Min	Max	$\bar{X}$	Ss
21st Century Skills	Information and Technology Literacy Skills	621	2.27	5.00	4.15	.50
	Critical Thinking and Problem-Solving Skills	621	1.00	5.00	3.99	.78
	Entrepreneurship and Innovation Skills	621	1.40	5.00	3.49	.68
	Social Responsibility and Leadership Skills	621	1.00	5.00	3.64	.66
	Career Consciousness	621	1.67	5.00	4.44	.58
	Total Mean Score of 21st Century Skills	621	2.63	5.00	3.96	.43

According to Table 3, it was determined that the 21st century skill levels of pre-service teachers ($\bar{X}$ = 3.96) were at a high level. In addition, it was obtained that the 21st century skill levels of pre-service teachers in terms of information and technology literacy ($\bar{X}$ = 4.15), critical thinking and problem solving ($\bar{X}$ = 3.99), entrepreneurship and innovation ($\bar{X}$ = 3.49), social responsibility and leadership ($\bar{X}$ =3.64) skills were at a high level, and career consciousness skill levels ($\bar{X}$ = 4.44) were at a very high level. The findings regarding whether the 21st century skill levels of pre-service teachers differ in terms of the gender variable are given in Table 4.

Table 4. 21st Century Skill Level of Pre-Service Teachers in Terms of Gender Variable

Variable	Gender	N	$\overline{X}$	S	sd	t	p
21st Century Skill	Male	262	3.94	.42	-.822	619	.411
	Female	359	3.97	.43			

When Table 4 is examined, it is determined that the 21st century skill levels of pre-service teachers did not differ significantly in terms of the gender variable (p>.05). The descriptive statistics data of the 21st century skill levels of pre-service teachers in terms of the GPA variable are shown in Table 5.

Table 5. 21st Century Skills of Pre-Service Teachers in Terms of GPA Variable

Variable	Group	GAP	N	$\overline{X}$	S
21st Century Skills	1	Less than 2.50	65	3.71	.47
	2	2.51-3.00	220	3.95	.44
	3	3.01-3.50	291	4.01	.39
	4	3.51-4.00	45	4.03	.48

When Table 5 is examined, it is seen that there are differences in the 21st century skill levels of pre-service teachers according to the GPA variable. The results of the analysis on whether these differences are significant are given in Table 6.

Table 6. The Change in 21st Century Skill Levels of Pre-Service Teachers in Terms of GPA Variable

Variable	Source of Variance	Sum of squares	Degrees of freedom	Mean Squares	F	p	Difference
21st	Between G.	4.715	3	1.572			1-2
Century	Within G.	11.941	617	.181	8.663	.000	1-3
Skills	Total	116.656	620				1-4

*p<.05

When Table 6 is examined, it is determined that the 21st century skill levels of pre-service teachers differ significantly according to the GPA [$F_{(3,617)}$ =8.663, p<.05]. According to Scheffe test results, it was concluded that the 21st century skill levels of pre-service teachers whose GPA was between 2.51-3.00, 3.01-3.50, 3.51-4.00 were higher than those of pre-service teachers with a GPA below 2.50. Descriptive statistics data on the 21st century skill levels of pre-service teachers in terms of the number of social activities they participated in are presented in Table 7.

Table 7. Descriptive Data on the 21st Century Skill Levels of Pre-Service Teachers in Terms of the Number of Social Activities Participated in Variable

Variable	Group	Number of Social Activity	N	$\overline{X}$	S
21st Century Skills	1	1	267	3.86	.44
	2	2	151	4.03	.41
	3	3	100	4.02	.38
	4	4 and above	103	4.05	.42

When Table 7 is examined, it can be said that there are differences in the 21st century skill levels of pre-service teachers in terms of the number of social activities they participate in. The results of the analysis conducted to determine whether these differences were significant or not are shown in Table 8.

Table 8. The Change in 21st Century Skill Levels of Pre-service Teachers in terms of the Number of Social Activity Participated in Variable

Variable	Source of Variance	Sum of squares	Degree of freedom	Mean squares	F	p	Difference
21st	Between G.	4.574	3	1.525			1-2
Century	Within G.	112.082	617	.182	8.393	.000	1-3
Skills	Total	116.656	620				1-4

*p<.05

It is seen that the 21st century skill level of pre-service teachers differed significantly according to the number of social activities they participated in [$F_{(3,617)}$=8.393, p<.05]. According to the Scheffe test results, it was determined that the 21st century skill levels of pre-service teachers who participated in 2, 3, and 4 or more different types of social activities were higher than those who participated in only 1 type of social activity.

The opinions of pre-service teachers on the 21st century skills they think they have are given in Figure 1.

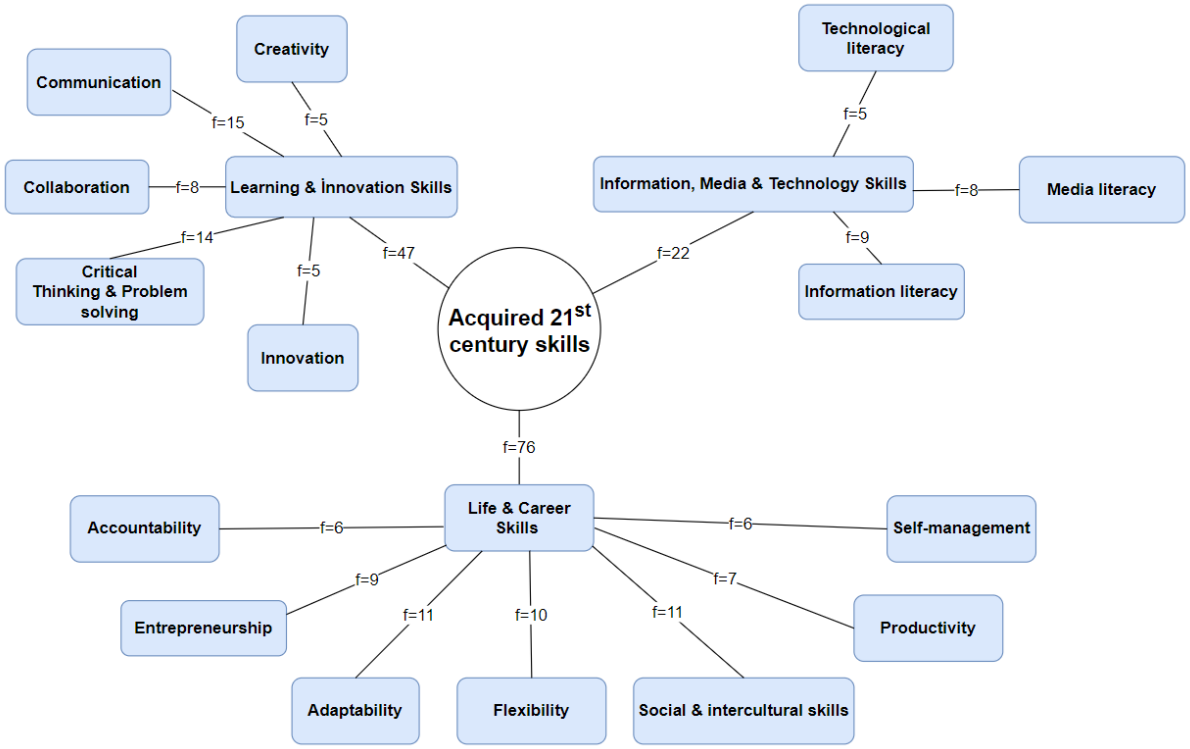

Figure 1. Acquired 21st century skills

As can be seen in Figure 1, pre-service teachers stated that they have learning and innovation skills, knowledge, media and technology skills, and life and career skills. Some sample quotations on pre-service teachers' opinions on this theme are given below:

> I12: *"I think my problem-solving skills and communication skills are good. I am a social person and can handle problems more or less."*
> I14: *"I have social and cultural skills. I have friends in more than 20 countries. I know different cultures more than ever before."*
> I6: *"I have entrepreneurship skills. I have an active personality. I have entrepreneurship and problem-solving skills in every business."*
> I23: *"I think I have communication skill. It is a necessity for me to be in contact with people due to the department I study, so I think my communication skills have improved."*
> I21: *"I think I have social and intercultural, media literacy, flexibility and adaptability, cooperation, and communication skills. Some are compulsory acquired skills. For example, the spread of the media has made it necessary for us to reach everything through the media."*
> I14: *"Media literacy, technology literacy, social, and intercultural skills. I have these three skills. Media literacy: I follow national and international news sources and informative websites. Technology literacy: I follow all kinds of technological devices. Games on PlayStation, upcoming cinemas, and newly released sites are my area of interest."*

The opinions of pre-service teachers on the stakeholders responsible for enabling the students to acquire 21st century skills are shown in Figure 2.

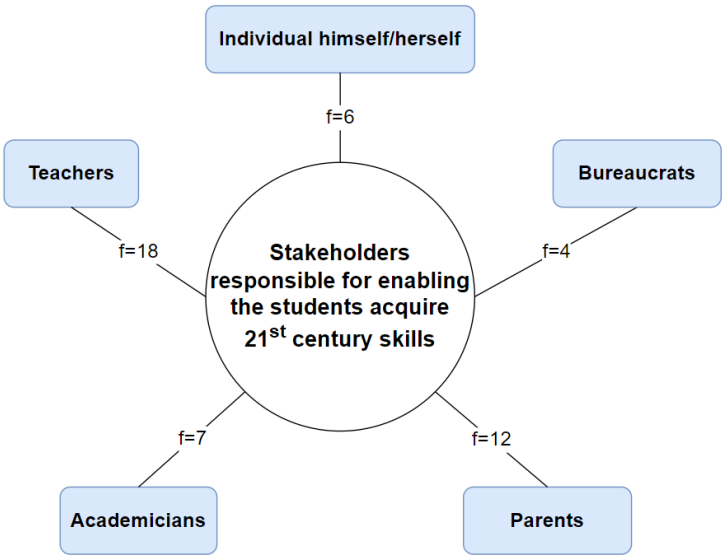

Figure 2. Stakeholders responsible for enabling the students to acquire 21st century skills

Pre-service teachers stated that teachers, parents, academicians, the individual himself/herself, and bureaucrats are responsible for enabling the students to acquire 21st century skills. Some of the sample quotations on this theme are presented below:

> I11: *"Heads of state, families, and teachers have responsibilities. The state should allocate a certain budget for people to acquire skills. Families and teachers should help them acquire these skills."*
> I16: *"It is necessary to enable the individuals to acquire these skills from infancy. For this, the family has the greatest responsibility, followed by the teachers."*
> I19: *"The greatest responsibility falls on the teachers. First of all, teachers need to have these skills. So basically, I think the greatest responsibility is in the faculties of education."*
> I18: *"Family members and teachers have responsibilities. Family members should try to ensure that their children adapt to the developing society. Teachers should help students know themselves and should pay attention to their interests and guide them."*
> I2: *"Universities have the main responsibility. They are environments that offer practice and implementation where these skills will be revealed. Individuals should be given the opportunity to explore these aspects of themselves with quality activities that are free from the anxiety of grades."*
> I5: *"Every development starts in the person himself/herself. If people want to change, they change."*
> I7: *"With a project carried out jointly by the Ministry of Technology and the Ministry of National Education, productivity can be increased to a higher level."*

The opinions of pre-service teachers on the strengths of faculties of education in enabling them to acquire 21st century skills are shown in Figure 3.

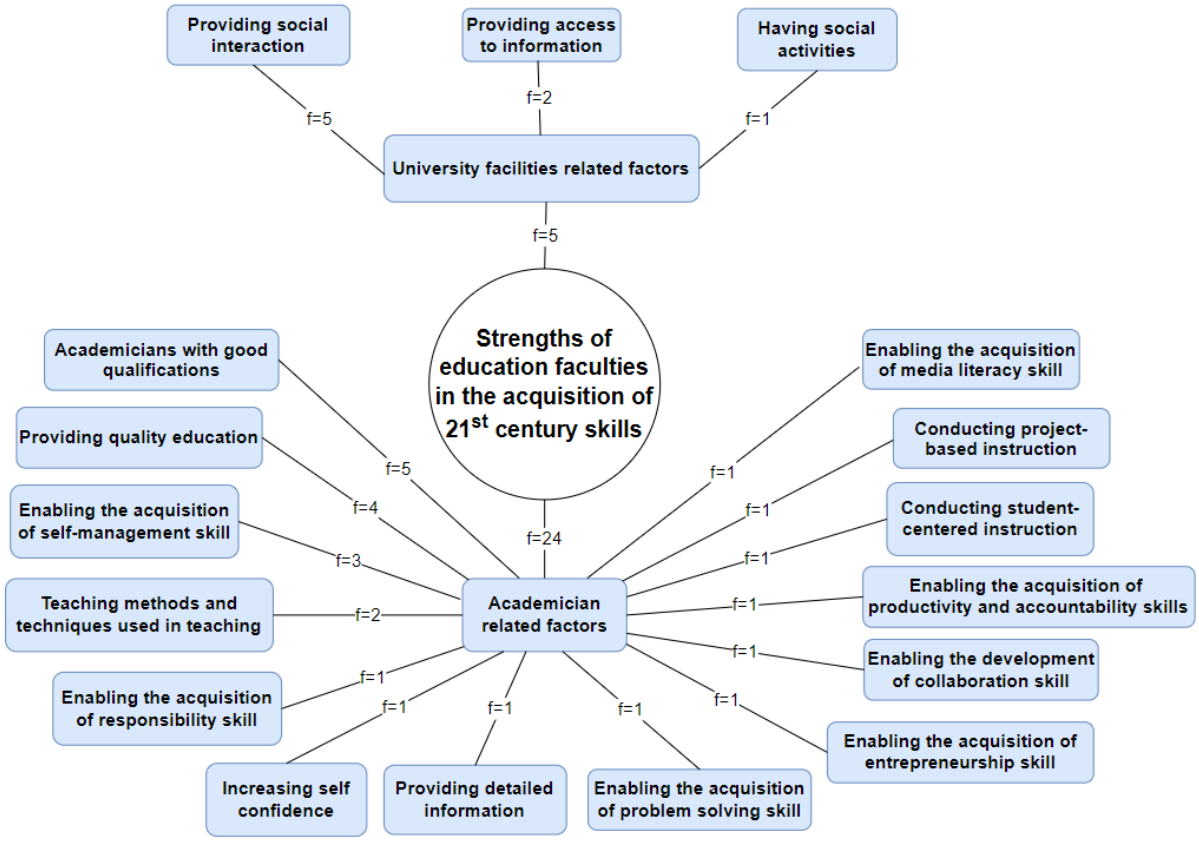

Figure 3. Strengths of education faculties in the acquisition of 21st century skills

Pre-service teachers stated that the faculties of education have strengths in enabling them to acquire 21st century skills due to the academicians and the facilities of universities. Some of the responses on this theme are given below:

> I20: *"Adequate in terms of knowledge. Academicians who do their job right set the right example for us."*
> I24: *"Faculties of education are very successful in providing these skills. An interactive learning environment is provided through social media."*
> I18: *"They are effective in acquiring skills such as entrepreneurship and self-management, cooperation, productivity, and accountability. For example, making presentations, giving group assignments."*
> I12: *"The faculty of education only increased my self-confidence in presentations. It also improved my communication skills as it provided a social environment."*
> I2: *"It offers opportunities for responsibility and self-management skills. Homework, community service practices, and internships pave the way for this."*
> I21: *"They actively assign tasks to students. They teach by doing and experiencing the project assignments they give."*

The opinions of pre-service teachers on the weaknesses of faculties of education in enabling them to acquire 21st century skills are shown in Figure 4.

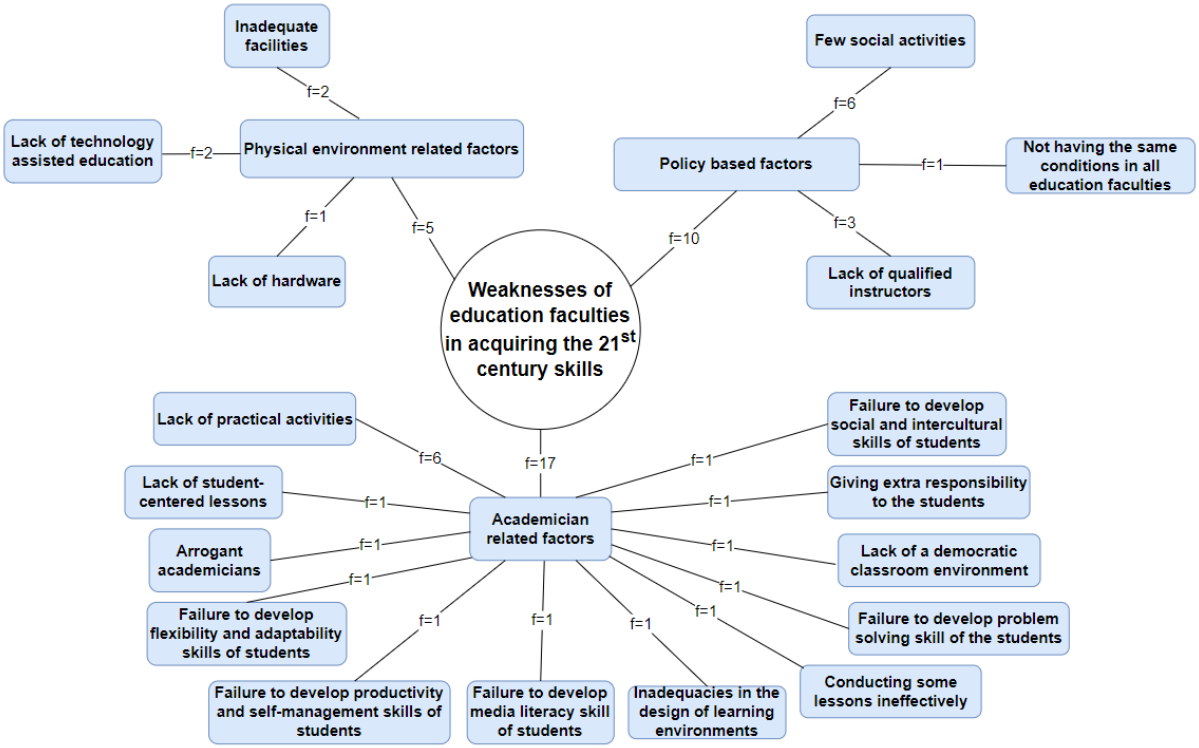

Figure 4. Weaknesses of faculties of education in acquiring the 21st century skills

Pre-service teachers emphasized that faculties of education had weaknesses resulting from academicians, politics, and physical facilities in terms of enabling them to acquire 21st century skills. Some of the sample quotations on this theme are presented below:

> I16: *"No event, program, or internship is arranged for us to practice our skills. That leaves the information hanging around for some of us."*
> I20: *"The biggest and most important deficiency is the academicians who do not apply the course they teach. For example, they talk about the constructivist education approach, but they conduct the classes with perennialism and essentialist understanding. They talk about democracy and freedom but humiliate the student. They do not tolerate different opinions. Unfortunately, there is a reality called academic arrogance."*
> I12: *"Our faculty does little or no activity. This reduces interaction."*
> I13: *"I do not think that all academicians are at the same level. Some academicians have shortcomings."*
> I2: *"Opportunities for the development of 21st century skills are not provided. These skills are overlooked as a more goal-oriented approach is adopted. This situation causes the education system to continue with the memorization system."*

The opinions of pre-service teachers on the aspects of faculties of education that need to be developed to enable them to acquire 21st century skills are given in Figure 5.

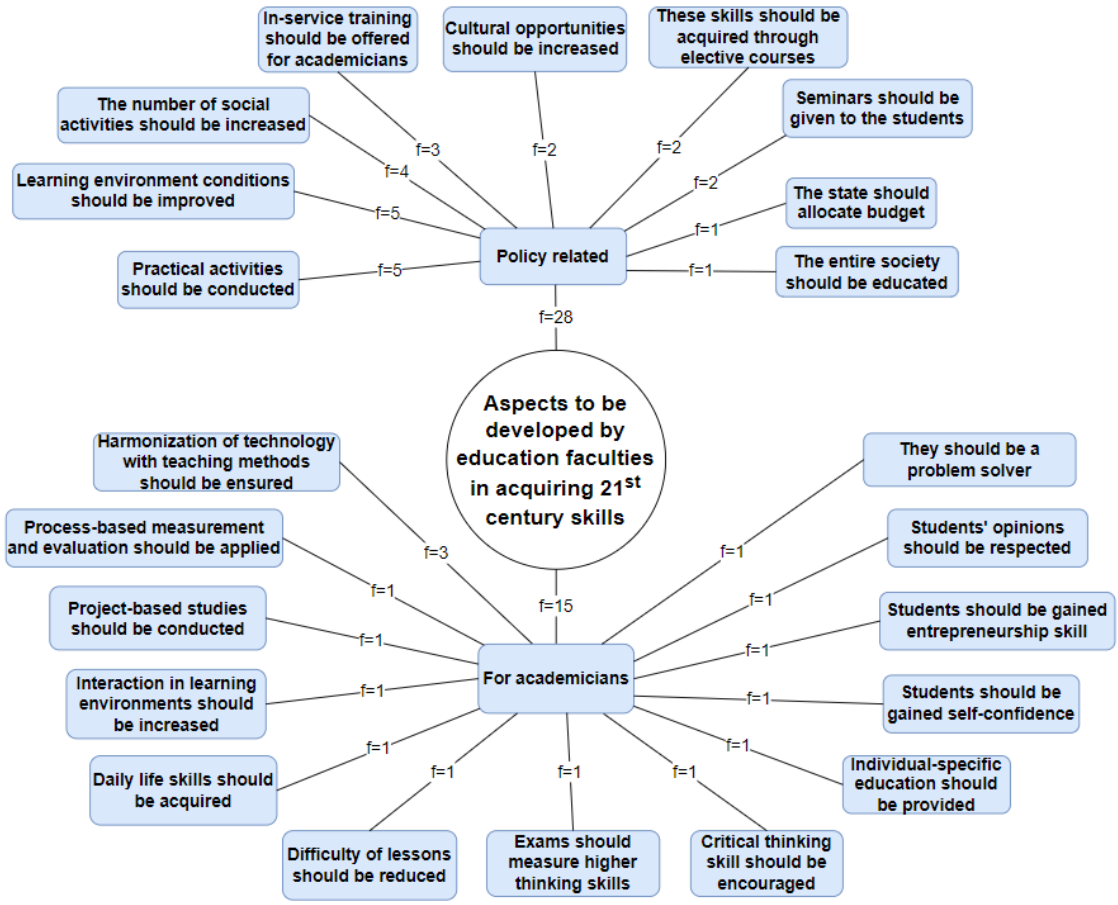

Figure 5. Aspects to be developed by faculties of education in acquiring 21st century skills

Pre-service teachers made suggestions for academicians and policies in the context of acquiring 21st century skills. Sample quotations on this theme are presented below:

> I3: *"First of all, academicians should improve themselves by keeping up with the technology and the methods and techniques they use."*
> I2: *"More social activities should be conducted within the course. There is a need for the implementation of process evaluation and project-based training. It is a must that rote understanding and grade anxiety be put in the background."*
> I5: *"It would be better if students gained more learning outcomes related to life skills."*
> I19: *"More social events should definitely be organized. In addition to this, really useful elective courses should be offered that will increase self-confidence and initiative in students."*
> I20: *"Indeed, there is a need for teachers who believe in democracy, free thought, and human rights. There is a need for academics who are committed to finding solutions instead of criticizing and who will take responsibility for what they can do."*
> I16: *"Academicians should not just explain the skills to be gained by teacher candidates on theory; they should put them into practice. Within this, some internship applications or projects should be developed."*
> I17: *"It may be more beneficial for the faculty to be more open to technological developments and constantly update itself."*

Conclusion and Discussion

In the study, it was examined whether the 21st century skill levels of pre-service teachers differ in terms of gender, GPA, and the number of social activities they participate in variables. In addition, the opinions of pre-service teachers were taken on the 21st century skills they think they have, the stakeholders responsible for enabling the students to acquire the 21st century skills, the strengths and weaknesses of faculties of education, and what needs to be done by these faculties. The findings suggest that pre-service teachers possess high levels of 21st-century skills. These skills include information and technology literacy, critical thinking and problem-solving,

entrepreneurship and innovation, social responsibility, leadership skills, and career consciousness skills. The study found that the pre-service teachers' levels of these skills were either high or very high. This implies that they may be well-equipped to meet the challenges and demands of the 21st-century workforce, which places a premium on these skills. In the literature, there are studies with similar findings. Aktaş (2022) concluded that pre-service teachers' information and technology literacy, critical thinking and problem solving, social responsibility, and leadership skills, which are among the 21st century skills, were high, and career consciousness skills were at a very high level. Similarly, Canpolat (2021) found that pre-service teachers had high levels of information and technology literacy, critical thinking and problem solving, social responsibility and leadership, and entrepreneurship and innovation skills. In addition, there are studies with the findings that pre-service teachers had a high level of 21st century skills (Aydın & Tan Şişman, 2021; Bozkurt, 2021; Erten, 2020; Gömleksiz, Sinan & Döner Doğan, 2019; Kozikoğlu & Altınova, 2018; Özdemir Özden et al., 2018). However, unlike these results, there are studies with the findings that the entrepreneurial and innovation skills of pre-service teachers were at a moderate level (Aktaş, 2022; Canpolat, 2021), and that their career consciousness skills were at a high level (Canpolat, 2021), which contradict the findings obtained in this study. Aktaş (2022) states that the reason for the high career consciousness skills of pre-service teachers may be due to the "Career Planning" course being taught in the faculties of education. He emphasizes that with this course, pre-service teachers will have information about many professions, especially the teaching profession, and that their career consciousness can increase in this way. The reason for the high level of 21st century skill level of pre-service teachers obtained from the scale and its sub-dimensions may be due to the good qualifications of the academicians and their ability to conduct the teaching process effectively. As a matter of fact, pre-service teachers expressed the strengths of faculties of education in enabling them to acquire these skills as having academicians with good qualifications and providing quality education. In addition, another reason for the high 21st century skills of pre-service teachers may be due to the social activities they participate in. In the study, it was also found that as the type of social activity participated in increased, the 21st century skill levels of pre-service teachers also increased. This indicates that there is a positive correlation between participation in social activities and 21st century skills.

In the study, it was determined that the 21st century skill levels of pre-service teachers did not differ significantly in terms of the gender variable. This suggests that male and female pre-service teachers have similar levels of perceptions of the 21st century skills identified by the study. This is a positive finding, as it indicates that both genders are equally capable of acquiring these skills and that there is no inherent gender-based barrier that prevents individuals from developing these skills. Similar to the finding obtained from the study, there are studies in the literature in which the 21st century skills of pre-service teachers do not differ significantly in terms of gender (Aktaş, 2022; Bozkurt, 2021; Canpolat, 2021; Erten, 2020; Geçgel et al., 2020; Gömleksiz, Sinan & Döner Doğan, 2019; Kozikoğlu & Altınova, 2018; Özdemir Özden et al., 2018). On the other hand, Çevik and Şentürk (2019) found that the 21st century skills of male students were significantly higher than those of female students, which contradicts this study. In conclusion, the study suggests that pre-service teachers, regardless of their gender, possess high levels of 21st century skills. This is an encouraging result, as these skills are crucial for success in today's rapidly changing and increasingly competitive job market.

It was also obtained that GPA significantly affected the 21st century skills of pre-service teachers. Accordingly, it was concluded that the 21st century skills of pre-service teachers with high GPA were higher than those with low GPA. Similarly, in his study, Canpolat (2021) found that pre-service teachers with high GPA had higher 21st century skills than pre-service teachers with low GPA. In some studies, unlike the findings obtained in this study, it was determined that academic achievement did not significantly affect the 21st century skills of pre-service teachers (Geçgel et al., 2020; Özdemir Özden et al., 2018). The fact that pre-service teachers with high academic success also have high 21st century skills shows that in the education process the development of both academic success and 21st century skills is aimed. Moreover, it can be interpreted that the curriculum in the faculties of education aims to improve academic achievements and 21st century skills.

It was determined that the number of social activities participated in significantly differentiated the 21st century skills of pre-service teachers. It was determined that the 21st century skills of pre-service teachers who participated in 2, 3, 4, and above social activities had higher levels than pre-service teachers who participated in only one social activity. Based on the information given, it becomes evident that engaging in multiple social activities may have a positive impact on the development of 21st century skills among pre-service teachers. Therefore, encouraging pre-service teachers to participate in a variety of social activities may help them to enhance their 21st century skills. By incorporating project-based learning into pre-service teacher training programs, educators can provide opportunities for students to develop these skills while also gaining practical experience.

In the study, pre-service teachers stated that they have problem solving, communication, adaptability, flexibility, social and intercultural, information literacy, entrepreneurship, cooperation, leadership and responsibility, media

literacy, productivity, self-management, accountability, innovation, creativity, and technology literacy skills. This finding suggests that pre-service teachers possess a range of 21st century skills, which highlights the potential for pre-service teachers to be well-prepared for the demands of the modern workforce. These skills are also critical for success in many professions, and the fact that pre-service teachers possess them suggests that they may be well-equipped to meet the demands of their future careers. Additionally, this finding may suggest that pre-service teacher education programs are effective in developing these skills, which could have a positive impact on the future of education.

Pre-service teachers stated that teachers, parents, academicians, the individual himself/herself, and bureaucrats are responsible for the acquisition of 21st century skills. In the study of Bayrak Özmutlu and Ergan (2022), pre-service teachers stated that the school and parents are responsible for acquiring 21st century skills. In the study of Karagöz and Dilekli (2018), university students stated that in addition to the teacher, the individual is also responsible for acquiring these skills. Cansoy (2018) stated that the primary responsibility for acquiring 21st century skills is in the family. He stated that by acting with this awareness, families should spend quality time with their children, guide them in line with their interests and curiosities, and act in cooperation with the school. In addition, he emphasized that community participation also contributes to the skill development of students. He also indicated that students could acquire content knowledge from different learning environments; therefore, it is necessary to make plans with different segments of society and to ensure that students learn by doing and experiencing. The findings obtained in this study and in the literature suggest that there is a need for collaboration and coordination among these different stakeholders to ensure that pre-service teachers are better equipped with the skills needed for the 21st century workforce. Teachers and academicians can play a significant role in providing the necessary training and education, while parents and the individual themselves can contribute to the development of these skills through their own efforts and attitudes. Bureaucrats and policymakers also have a responsibility to ensure that the necessary resources and policies are in place to support the acquisition of 21st century skills among pre-service teachers. By recognizing and acknowledging the shared responsibility among different stakeholders, it can lead to a more comprehensive and effective approach to improving pre-service teacher education and the acquisition of 21st century skills.

In the study, pre-service teachers identified the strengths of faculties of education in enabling them to acquire 21st century skills as good qualifications of academicians, providing qualified education, gaining self-management skills, teaching methods and techniques used in the teaching process, gaining responsibility skills, increasing self-confidence, providing detailed information, student-centered teaching, project-based teaching, providing social interaction, providing access to information, and providing social activities. They also stated that the faculty of education helped them acquire skills in problem solving, innovation, cooperation, productivity, accountability, and media literacy. In his doctoral study, Brown (2018) conducted research on two P21 sample schools, examining the best practices of 21st century skills in learning environments. In the study, it was found that in sample schools that provide 21st century skills, project-based studies are emphasized, measurement and evaluation are applied strongly, integration between school and society is ensured, technology integration is provided in the teaching process, and communication, cooperation, critical thinking, and innovation skills are strongly integrated into the curriculum (Brown, 2018).

In the study, pre-service teachers stated that the lack of practical activities, the lack of student-centered lessons, the arrogance of academicians, the over-responsibility, the lack of a democratic classroom environment, the ineffectiveness of some lessons, the inadequacies in the learning environment, the lack of social activities, the lack of qualified teaching staff, not having the same conditions in all faculties of education, the inadequacy of the opportunities offered, the lack of technology-supported education, and the lack of equipment were the weaknesses of the faculties of education in acquiring the skills of the 21st century. In addition, they stated that faculties could not develop skills such as flexibility and adaptability, productivity and self-management, media literacy, social and intercultural competence, and problem solving. It appears that pre-service teachers have identified several weaknesses in their education programs that impact their acquisition of 21st century skills. Therefore, it can be argued that there is a need for improvement in the faculties of education to ensure that pre-service teachers are better equipped with the skills needed for the 21st century workforce. In the literature, in various studies, the weakness of the faculties of education was stated by the pre-service teachers. In the study conducted by Aydın and Tan Şişman (2021), the pre-service teachers stated that 21st century skills were not sufficiently included in the undergraduate education process and that the teaching provided was not qualified to provide these skills. Criticisms of faculties of education in Turkey that skill-based teaching approach is not adopted (Eret Orhan et al., 2017; Yüksel, 2015; Yurdakul, 2018) indicate that faculties of education are inadequate in providing 21st century skills. By addressing these weaknesses, faculties of education can help to ensure that pre-service teachers are prepared to meet the demands of their future careers and contribute to a more successful and innovative society.

Finally, pre-service teachers made suggestions for the aspects of faculties of education that should be developed to enable the pre-service teachers to acquire 21st century skills. In terms of policy-oriented suggestions, they stated

that practical activities should be carried out, the conditions of the learning environment should be improved, the number of social activities should be increased, in-service training should be provided for academicians, cultural opportunities should be increased, these skills should be gained through elective courses, seminars should be given to students, the state should allocate a budget, and the entire society should be educated. In terms of the suggestions for academicians, they stated that technology compatibility with teaching methods should be ensured, process-based assessment and evaluation should be applied, project-based studies should be carried out, interaction in learning environments should be increased, the difficulty of the courses should be reduced, exams should measure high-level thinking skills, individualized education should be given, students' opinions should be respected, and academicians should be problem solvers. In addition, they stated that academicians should provide them with daily life, critical thinking, assertiveness, and self-confidence skills. Based on these findings, it can be said that there is a need for policy-oriented and academic-oriented suggestions to address the weaknesses identified in pre-service teacher education. The policy-oriented suggestions indicate that improvements need to be made to the learning environment, the number of social activities should be increased, and practical activities should be carried out. In-service training for academicians and increased cultural opportunities can also play a role in improving pre-service teacher education. The academic-oriented suggestions suggest that there is a need for academicians to focus on ensuring that teaching methods are compatible with technology, process-based assessment and evaluation is applied, project-based studies are carried out, and interaction in learning environments is increased. Additionally, individualized education and measuring high-level thinking skills are important for the acquisition of 21st century skills. Academicians should also focus on being problem solvers and respecting student opinions. In the study of Bayrak Özmutlu and Ergan (2022), pre-service teachers stated that a problem-based teaching method should be applied and that drama, brainstorming, and discussion techniques should be used to acquire 21st century skills. In addition, pre-service teachers emphasized the need to integrate technology and art, cooperate with other institutions, and organize extracurricular activities. In the study of Bozkurt (2021), pre-service teachers stated that in order to acquire 21st century skills, teachers should be role models, skill-oriented courses should be included in the curriculum, it should be tested whether these skills are acquired, the hours of school experience lessons should be increased, and alternative assessment methods should be used. Erten (2020) found that in order for pre-service teachers to acquire 21st century skills, they should first of all gain information, technology, and media literacy skills; include different course contents and applications; determine what people's orientations are and provide training in this direction; and intensify practice-oriented studies. They also stated that activities such as courses, seminars, and conferences that will contribute to their development should be carried out. Overall, the implications of this finding suggest that there is a need for a comprehensive approach to improving pre-service teacher education. This includes both policy-oriented and academic-oriented suggestions, as well as a commitment from the entire society to ensure that pre-service teachers are better equipped with the skills needed for the 21st century workforce. By addressing these implications, faculties of education can help to ensure that pre-service teachers are prepared to meet the demands of their future careers and contribute to a more successful and innovative society.

Recommendations

In line with the results obtained from the study, the following suggestions can be made:

- In order for pre-service teachers to acquire 21st century skills, these skills should be integrated into the course contents, teaching processes, and curriculum in the faculties of education.
- Elective courses that can directly impart 21st century skills should be included in the curriculum of the faculty of education.
- The qualifications of pre-service teachers should be increased with in-service trainings to be provided to academicians who will carry out the teaching processes and be role models in acquiring 21st century skills.
- Since the acquisition of any skill cannot be the success of curriculum and academicians alone, pre-service teachers should make an individual effort to acquire 21st century skills. Pre-service teachers should participate in activities such as courses, seminars, etc., where they can use and develop these skills in daily life.
- Future studies can be carried out with pre-service teachers studying in different programs. Inferences about the 21st century skills of pre-service teachers can be obtained by carrying out studies specific to the program (for example, preschool teaching).

Acknowledgements or Notes

I would like to thank the pre-service teachers studying at Hatay Mustafa Kemal University Faculty of Education who participated in the study.

Conflicts of Interest

There is no conflict of interest with any person in this study.

Ethical Approval

Ethical permission (E-21817443-050.99-233076) was obtained from Hatay Mustafa Kemal University Rectorate Ethics Committee.

References

Aktan, C. C. & Vural, İ. (2016). Information society, new basic technologies and new economy [Special issue]. *New Türkiye, 88*(1), 1-37.

Aktaş, İ. (2022). Examination of 21st century skills of pre-service teachers in terms of various variables. *Journal of Interdisciplinary Educational Research, 6*(12), 187-203.

Anagün, Ş., Atalay, N., Kılıç, Z. & Yaşar, S. (2016). The Development of a 21st Century Skills and Competences Scale Directed at Teaching Candidates: Validity and Reliability Study. *Pamukkale University Journal of Faculty of Education, 40*(40), 160-175.

Arslan, A. (2020). Determining the 21st century skills that should be instilled to students from the perspective of pre-service teachers before and after the pandemic, (Special Issue: Education in Turkey and the World during the pandemic), *Journal of National Education*, 553-571.

Ayçiçek, B., & Karafil, B. (2021). Investigation of University Students' Lifelong Learning Tendencies in Terms of Various Variables. African Educational Research Journal, 9(1), 121-133.

Aydın, A. & Tan-Şişman, G. (2021). 21st Century Skills in Pre-Service English Teacher Education, *TEBD*, *19*(2), 1223-1251. https://doi.org/10.37217/tebd.975533

Balay, R. (2004). Globalization, Information Society and Education. *Journal of Ankara University Faculty of Educational Sciences, 37*(2), 61-82.

Balcı, A. (2020). Research Methods, Techniques and Principles in Social Sciences (15th Edition). Ankara: Pegem Academy.

Bayrak Özmutlu, E. & Ergan, S. N. (2022). Preservice Teachers' Views about 21st Century Skills and Teaching. *Teacher Education and Training, 3*(2), 81-105. https://doi.org/10.55661/jnate.1082299

Bozkurt, F. (2021). Evaluation of social studies teaching undergraduate program in terms of 21st century skills. *Pamukkale University Journal of Faculty of Education, 51,* 34-64. doi:10.9779/pauefd.688622

Brown, S. (2018). *Best practices in 21st century learning environments: a study of two P21 exemplar schools* (Unpublished PhD thesis), Brandman University, California.

Burns, T., & Sinfield, S. (2004). *Teaching, learning and study skills*: A guide for tutors. Sage.

Büyüköztürk, Ş. (2020). Handbook of data analysis for social sciences (28th Edition). Ankara: Pegem Academy.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö.E., Karadeniz, Ş. & Demirel, F. (2020). Scientific Research Methods (28th Edition). Ankara: Pegem Academy.

Canpolat M., (2021). The Relationship Between Candidates Teachers' 21st Century Skills and Their Emotional Intelligence Levels. *Journal of Higher Education and Science, 11*(3), 527-535. https://doi.org/10.5961/jhes.2021.472

Cansoy, R. (2018). 21st Century Skills According to International Frameworks and Building Them in the Education System. *Journal of Human and Social Sciences Research, 7*(4), 3112-3134. http://www.itobiad.com/issue/39481/494286

Chai, C. S., Jong, M., Yin, H. B., Chen, M. & Zhou, W. (2019). Validating and modelling teachers' technological pedagogical content knowledge for integrative science, technology, engineering and mathematics education. *Educational Technology & Society, 22*(3), 61-73.

Creswell, J. W. (2021). Introduction to Mixed Method Research (trans. M. Sözbilir). Ankara: Pegem Academy.

Çevik, M. & Şentürk C. (2019). Multidimensional 21st century skills scale: Validity and reliability study. *Cypriot Journal of Educational Science, 14*(1), 11-28.

DeCoito, I. & Estaiteyeh, M. (2022). Transitioning to online teaching during the COVID-19 pandemic: An exploration of STEM teachers' views, successes, and challenges. *Journal of Science Education and Technology, 31,* 340–356. Doi: 10.1007/s10956-022-09958-z

Drucker, F. P. (1994). Post-Capitalist Society. İstanbul: Inkilap Bookstore.

Eret Orhan, E., Ok, A. & Capa Aydin, Y. (2017). We train, but what do they think? Preservice teachers' perceptions of the adequacy of their teacher education in Turkey. *Asia-Pacific Journal of Teacher Education, 46*(2), 183–198. doi:10.1080/1359866X.2017.1355050

Erten, P. (2019). Preservice teachers' perceptions of 21st century skills competence and their views on gaining these skills. *Journal of National Education, 49*(227), 33-64.

Geçgel, H., Kana, F., Vatansever, Y. Y. & Çalık, F. (2020). Determining the multi-dimensional 21st century skills of pre-service Turkish teacher. *International Journal of Turkish Literature Culture Education*, *9*(4), 1646-1669.

Gömleksiz, M. N., Sinan, A. T. & Doğan, F. D. (2019). Perceptions of prospective teachers of Turkish, Turkish language and literature and contemporary Turkish dialects of the 21st century skills and competences. *AVRASYA Journal of International Studies*, *7*(19), 163-185.

Karagöz, Ş. & Dilekli, Y. (2018). Examining the awareness of duty and responsibility in the acquisition of 21st century skills according to young people in terms of some variables. Bingöl, Z., Karadağ, L. & Bozgeyikli, H. (Ed.), *In the 3rd Youth and Research Congress* (1-17). Nahçivan.

Kozikoğlu İ. & Altunova N. (2018). The Predictive Power of Prospective Teachers' Self-efficacy Perceptions of 21st Century Skills for Their Lifelong Learning Tendencies. *Journal of Higher Education and Science*, *8*(3), 522-531. http://dx.doi.org/10.5961/jhes.2018.293

Köğce, D., Özpınar, İ., Mandacı Şahin, S., and Aydoğan-Yenmez, A. (2014). Instructors' views on standards for the 21th century learners and lifelong learning. *Dicle University Journal of Ziya Gökalp Faculty of Education, 22*, 185-213.

Michaels, R., Truesdell, E. & Brown, B. (2015). Incorporating 21st century skills into teacher preparation programs: A collaborative approach. *Journal of Scholastic Inquiry: Education*, *5*(1), 47–72.

Miles, M, B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded Sourcebook.* (2nd ed). Thousand Oaks, CA: Sage.

Murphy, S., MacDonald, A., Danaia, L. & Wang, C. (2019). An analysis of Australian STEM education strategies. *Policy Futures in Education*, *17*(2), 122–139. Doi: 10.1177/1478210318774190

Özdemir Özden, D., Karakuş Tayşi, E., Kılıç Şahin, H., Demir Kaya, S., & Bayram, F. Ö. (2018). Pre-service teachers' perceived efficacy beliefs towards the 21st century skills: the case of Kütahya. *Electronic Turkish Studies, 13*(27), 1163-1184. Doi: 10.7827/TurkishStudies.14928

P21. (2017). Leadership States, http://www.p21.org/members-states/partner-states

P21. (2019). Framework for 21st century learning. Retrieved from https://www.battelleforkids.org/networks/p21/frameworks-resources

Şan, İ. & Orhan Karsak, H. G. (2021). Meta-literacy in education. E. Koçoğlu (Ed.), Literacy skills in education-II (s. 71-100). Pegem Academy.

Tabachnick, B. G. & Fidell, L. S. (2013). Using multivariate statistics. Boston: Pearson.

TED. (2009). Turkish Education Association teacher qualifications. Ankara: Adım Okan Printing.

Trilling, B., and Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco, CA: Jossey-Bass

Valli, P., Perkkilä, P., & Valli, R. (2014). Adult pre-service teachers applying 21st century skills in the practice. *Athens Journal of Education, 1*(2), 115-130.

Yalçın, S. (2018). 21st century skills and tools and approaches that are used to measure these skills. Journal of Ankara University Faculty of Educational Sciences. *51*(1), 183-201. Doi: https://doi.org/10.30964/auebfd.405860

Yıldırım, A. & Şimşek, H. (2018). Qualitative research methods in the social sciences (11th Edition). Ankara: Seçkin Yayıncılık.

Yıldırım, B. & Şahin Topalcengiz, E. (2019). STEM pedagogical content knowledge scale (STEMPCK): A validity and reliability study. *Journal of STEM Teacher Education*, *53*(2), 120. Doi: 10.30707/JSTE53.2Yildirim

Yüksel, S. (2015). Transformation in teacher training policies: Training the 21st century teacher. *Journal of the Association of Private Schools of Turkey*, *32*, 23–28.

Yurdakul, H. I. (2018). Examination of the changed program of undergraduate primary school teaching. *Ulakbilge Journal of Social Sciences*, *6*(29). doi:10.7816/ulakbilge-06-29-10

Zulirfan, Z., Yennita, Y. & Rahmad, M. (2020). STEM at home: Provide scientific activities for students during the covid-19 pandemic. *Journal of Physics, Conference Series*, *1655*(1). Doi: 10.1088/1742-6596/1655/1/012068