21st-century Skills as Predictors of Pre-Service Teachers' Professional Qualifications: A Cross-Sectional Study

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Article Info	Abstract
	This study aimed to determine the impact of teacher candidates' 21st-century skills on their professional competence by controlling for gender, grade level, and income status. Three hundred eighty teacher candidates from different classes and departments were selected to participate in the study. The data obtained using the Multidimensional 21st-Century Skills and Professional Competence Scales were analyzed using the structural equation modeling method. The results indicate that teacher candidates' 21st-century skills positively affect their professional competence when controlling for gender, grade level, and income status. The findings emphasize the importance of pre-service teachers for their future careers to have 21st-century skills such as information and technology literacy, critical thinking and problem-solving, entrepreneurship and innovation, social responsibility and leadership, and career consciousness. It has been concluded that teacher training programs should be designed to support teacher candidates in acquiring 21st-century skills and developing their professional competencies.

Introduction

In the 21st century, education has been significantly transformed by rapid technological developments, globalization, and changing social needs. Therefore, it is increasingly recognized that equipping teachers with the skills necessary to be successful in a dynamic educational environment plays a critical role. The concept of 21st-century skills emerges as an emerging framework to address the competencies individuals need to succeed in the modern world.

Teachers' role in facilitating students' learning experiences (Hattie & Timperley, 2007; Stronge, 2007; Woolfolk, 2014) and preparing them for the challenges of the 21st century cannot be ignored. Therefore, it is paramount to ensure that teachers are adequately equipped to meet the evolving demands of the contemporary educational environment. In this context, the relationship between pre-service teachers' professional competencies and 21st-century skills has become an area that needs to be examined.

This study examines how 21st-century skills predict pre-service teachers' professional competencies. Accordingly,

a cross-sectional study explores the relationship between prospective teachers' 21st-century skills and professional competencies. Our research findings aim to light the vital role of 21st-century skills in determining pre-service teachers' professional competencies. In addition, the results of this study will help determine the steps to be taken for the development of teacher education programs and encourage teacher candidates to acquire these skills.

Teacher Qualifications

Research has shown that teachers who receive better education impact their interactions with children positively by increasing their sensitivity, responsiveness, and positivity while providing broader language and cognitive experiences (Early et al., 2007; Ginsburg et al., 2008; Mashburn & Pianta, 2006; Raver et al., 2009). On the other hand, teachers with less education may exhibit more authoritarian, punitive, and indifferent attitudes toward their students. Thus, the quality of education children receive is often closely linked to the quality of their teachers (Ingersoll, 2001; Kini & Podolsky, 2016).

Teacher qualification refers to all the knowledge, skills, attitudes, and values a teacher should have. These qualities assist teachers in creating a quality teaching environment necessary to teach students effectively. Zeichner and Liston (1987) state that teacher qualification is a complex concept that includes teachers' skills, knowledge, and attitudes when making teaching decisions. Darling-Hammond (2006) defines teacher quality as a combination of knowledge, skills, attitudes, and values that determine teachers' capacity to influence their students' learning. It also emphasizes that teacher qualification requires teachers to maximize their students' learning continually. Korthagen and Vasalos (2005) define teacher quality as all the characteristics that enable teachers to be effective in their profession. These characteristics are stated as the professional identity, professional knowledge, professional attitude, and professional action of the teacher as the professional identity, professional knowledge, professional attitude, and professional action of the teacher.

Furthermore, Shulman (1987) defines teacher qualification as the ability of teachers to understand their pedagogical content and present it in a way that students can understand. It also emphasizes that teacher qualification includes understanding students' learning needs and developing appropriate instructional strategies. Darling-Hammond and Bransford (2005) state that teacher qualification combines interdisciplinary knowledge, teaching skills, social and emotional intelligence, ethics, and values students use to influence their learning processes.

OECD (Organization for Economic Cooperation and Development) (2005) defines teacher qualification as a combination of knowledge, skills, and attitudes required to teach effectively and efficiently and emphasizes that teacher qualification includes elements such as planning, implementation, evaluation, and continuous improvement of the teaching process. The common point of these explanations is that teacher qualification brings together the knowledge, skills, attitudes, and values needed to influence students' learning. We also emphasize the importance of continuously improving the quality of teachers. Factors such as teacher qualification, professional identity, professional knowledge, professional attitude, and professional action are necessary to teach students best.

Research has revealed that technology, student-centered teaching, communication skills, cultural awareness, and cooperation are necessary competencies for the teaching profession. Their skills in using technology and integrating digital technologies into educational processes help teachers improve their students' learning experiences (Dunn & Kennedy, 2019). Student-oriented teaching enables students to participate more in learning processes and helps them achieve their learning goals (Alsalhi et al., 2019).

Communication skills support teachers in communicating more effectively with students and enable students to be more active in their learning processes (Khan et al., 2017). Cultural awareness of teachers allows students to be sensitive to their own cultures, which improves students' learning experiences (Nieto & Zoller Booth, 2010). Teachers' cooperation skills contribute to the development of students' social skills. Collaboration skills also help teachers collaborate better with their colleagues. (Chan et al., 2021). Therefore, developing these competencies by teachers can help students become more successful and involved in learning processes.

The Ministry of National Education in Turkey outlines teacher qualifications using six dimensions: Personal and Professional Values, Professional Development, Student Recognition, Teaching and Learning Processes, Monitoring and Evaluating Teaching and Development, School-Family-Community Relations, and Program and Content Knowledge (MoNE, 2017). The Personal and Professional Values dimension consists of valuing students, considering their differences, and being a role model for them. In addition, constantly trying to improve and following the legal regulations related to teaching are other characteristics of the dimension. The Student Recognition dimension includes competencies such as recognizing all students' characteristics, interests, and needs and understanding the sociocultural environment to which they belong.

The Teaching and Learning Processes dimension consists of all the teacher's plans, practices, and management skills related to the learning and teaching process. The Monitoring and Evaluating Teaching and Development dimension consists of competencies for evaluating students in terms of development and learning. In addition, enabling students to evaluate themselves and their peers is another feature of the dimension. The School2-Family-Community Relations dimension consists of competencies related to knowing the characteristics of the school environment, including natural, sociocultural, and economic factors. The Program and Content Knowledge dimension consists of competencies related to the field of expertise. The dimension's characteristics are knowing and applying the fundamental values and principles of the National Education System and the relevant field's approaches, aims, principles, and techniques (MoNE, 2017). The Ministry of National Education expects teachers to demonstrate these qualities.

Factors Affecting Teacher Qualifications

Various factors may affect pre-service teachers' professional competencies, including skills in learning processes (Igberadja, 2016), personality traits (Aydın et al., 2013), demographic characteristics (Konuk, 2011), pedagogical knowledge (Koh et al., 2010), teaching experiences (Öksüz & Coşkun, 2012), and social and cultural characteristics (Vincent et al., 2014). Each of these factors can affect pre-service teachers' professional competencies differently. In this study, the effects of gender, class level, and income status, as well as 21st-century

skills, on the professional competencies of teacher candidates were investigated. In this context, the theoretical framework of the research was formed.

Gender may affect the professional competencies of teacher candidates depending on factors such as equal opportunities, social expectations, and role models they encounter in their education life. There are studies stating that gender affects the professional competencies of teacher candidates. For example, Ahiatrogah (2017) examined whether gender differences among distance education students affect their teaching skills. In this context, the relationships between students' teaching skills, learning styles, gender, and socio-economic status were discussed in the study.

The research revealed that female teacher candidates are more advantageous than male students regarding teaching skills. This study emphasized that the gender factor should be considered in developing the professional competencies of teacher candidates. Igberadja (2016) revealed that the gender of teachers and their professional competencies impact the performance of vocational and technical education students. Tican and Deniz (2019) stated that teacher candidates' 21st-century teacher skills differ according to gender. The researchers reported that female teacher candidates had higher administrative, techno-pedagogical, affirmative, and generative skills. As a result, studies have revealed that gender affects teacher candidates' teaching proficiency.

Grade level may be an important reason for the difference in the professional competencies of teacher candidates. An advanced teaching skill may require concepts and skills learned in later grades. Studies claim that teacher candidates' professional skills improve over time (Korthagen, 2004; Putnam & Borko, 2000). For example, Sorge et al. (2019) revealed that the structure of pre-service teachers' professional knowledge consists of different components and that pre-service teachers' professional knowledge develops over time. Another variable claimed to be influential on the professional development of teacher candidates is income (Demirez, 2019). Income status can affect pre-service teachers' professional development due to access to education, school resources, and support at home. For example, low-income students may have less access to school resources than high-income students.

Along with the demographic characteristics of teacher candidates, their 21st-century skills may also affect their professional competencies. Valtonen et al. (2021) stated that 21st-century skills are indispensable in teacher education. 21st-century skills express the qualities needed by our age, which is in the process of rapid change and development in the world. These skills include critical thinking, problem-solving, creativity, communication, cooperation, the use of technology, cultural awareness, and global citizenship (Göksün & Kurt, 2017). The professional competencies of teacher candidates are expected to be compatible with 21st-century skills.

21st-Century Skills and Teacher Qualifications

21st-century skills refer to a wide range of skills necessary for individuals to succeed in their personal, professional, and social lives. These skills have emerged due to technological developments, globalization, and rapidly changing labor market conditions. It traditionally includes basic academic skills such as reading, writing, and math and new skills such as problem-solving, critical thinking, communication, collaboration, creativity,

digital literacy, and cultural awareness. These skills are thought necessary to increase individuals' productivity, support global cooperation, and make the most of the opportunities provided by digital technologies (Trilling & Fadel, 2009). These skills can help people solve complex problems, develop innovative solutions, and succeed in a rapidly changing world.

Partnership21 (P21, 2015), 21st-century examines learner skills under three main headings and each main heading in various numbers. These main topics are listed as "learning & innovation skills," "information, media & technology skills," and "life & career skills." Learning & innovation skills are critical to today's students because today's world is changing rapidly and becoming more and more complex. Students must have these skills to succeed in their future lives and work environments. These skills include Creativity and Innovation, Critical Thinking and Problem Solving, Communication, and Collaboration. However, today we live in an environment influenced by technology and media. In this environment, features such as easy access to information, rapid technological changes, and the ability to collaborate on an unprecedented scale come to the fore. Therefore, today's individuals are expected to use communication technologies effectively. These skills are subdivided into Information Literacy, Media Literacy, and ICT (Information, Communications, and Technology) Literacy. In addition, today's individuals should possess life and career skills to cope with complex problems and succeed in the workplace. The core Life and Career Skills identified by P21 are Flexibility and Adaptability, Initiative and Self-Direction, Social and Cross-Cultural Skills, Productivity and Accountability, and Leadership and Responsibility.

In today's world, 21st-century skills are becoming increasingly important in all areas of life. In this context, the teaching profession is also crucial in determining and developing the 21st-century skills that teacher candidates should have. These skills can form the basis of a modern teaching approach that requires trainees to impart knowledge to their students and to help them develop critical thinking, communication, collaboration, and other essential skills. A study stated that teachers with 21st-century skills are more effective in increasing students' learning skills (Darling-Hammond et al., 2020). This study highlights the link between pre-service teachers' learning skills and professional competencies.

Today, the rapid development of technology and changing business world expectations require teachers to have 21st-century skills. These skills include the qualities that will enable students to succeed in the global world. Therefore, teacher candidates' learning and applying 21st-century skills will positively affect their professional competencies. Research shows that pre-service teachers' having 21st-century skills helps them become more creative, innovative, and effective in learning environments (Care et al., 2012; Voogt & Roblin, 2012). Prospective teachers' use of 21st-century skills helps them develop more qualified teaching techniques (Lahey, 2009). Accordingly, pre-service teachers can create more qualified learning environments.

Recent studies show that 21st-century skills have become more important in modern education systems compared to previous years (Afandi et al., 2018; Bedir, 2019; Bakir, 2019; Kalu-Uche & Eze, 2020; Urbani et al., 2017; Tican & Deniz, 2019). In today's world, it is not enough for students to learn only basic academic knowledge. They also need to have these skills in order to cope with the complexity of the world. Therefore, equipping

prospective teachers with 21st-century skills is vital for their student's success.

Pre-service teachers with 21st-century skills can better manage learning environments and learning materials. This situation creates effective learning environments and increases students' motivation (Johnson et al., 2014). Equipping prospective teachers with 21st-century skills increases their professional competence and helps them prepare for their future business life more qualified (Trilling & Fadel, 2009). As a result, teacher candidates' having 21st-century skills can positively affect teachers' professional competencies. These skills will help teachers improve their students' learning environments and prepare them for future work lives.

Purpose of the Research

Increasing the professional competencies of teacher candidates has strategic importance in terms of increasing the quality of the education system, ensuring the sustainability of the education system, and supporting the progress and development of society. For this reason, studies aimed at training teacher candidates and increasing the number of qualified teachers are of critical importance for the future of the education system. The importance of teachers learning 21st-century skills has been emphasized in many studies in the field of education (Fadel & Trilling, 2009; Kalu-Uche & Eze, 2020; Voogt & Roblin, 2012).

However, the number of studies on the relationship between pre-service teachers' professional competencies and 21st-century skills is limited. Some studies have shown that pre-service teachers' training in 21st-century skills helps them be more successful in teaching (Halverson & Sheridan, 2014; Zheng, Warschauer). In addition, prospective teachers' acquisition of 21st-century skills is essential and has been studied extensively (Bedir, 2019; Karakoyun & Lindberg, 2020; UNESCO, 2015; Urbani et al., 2017).

Additionally, research has explored the levels of these skills among prospective teachers (Afandi et al., 2018; Aslan, 2015; Bakir, 2019; Jia et al., 2016; Magno & Eugenio, 2019; Tican & Deniz, 2019). This study examined the relationship between pre-service teachers' professional competencies and 21st-century skills, considering gender, class level, and income status. This research will explain how learning 21st-century skills help prospective teachers develop their professional competencies. The results will contribute to developing more qualified teacher education programs.

The conceptual framework of the research is shown in Figure 1. 21st-century skills consist of Information and Technology Literacy Skills, Critical Thinking and Problem Solving Skills, Entrepreneurship, and Innovation Skills, Social Responsibility and Leadership Skills, and Career Consciousness. Professional competence consists of Program and Content Knowledge, School-Family Relations, School Environment, Following and Assessing Teaching and Development, Professional Development, Personal and Professional Values. Gender, class level, and income status are control variables. The hypothesis of this research is expressed as follows:

H_1: When gender, class level, and income status are controlled, 21st-century skills of teacher candidates positively affect their professional competence.
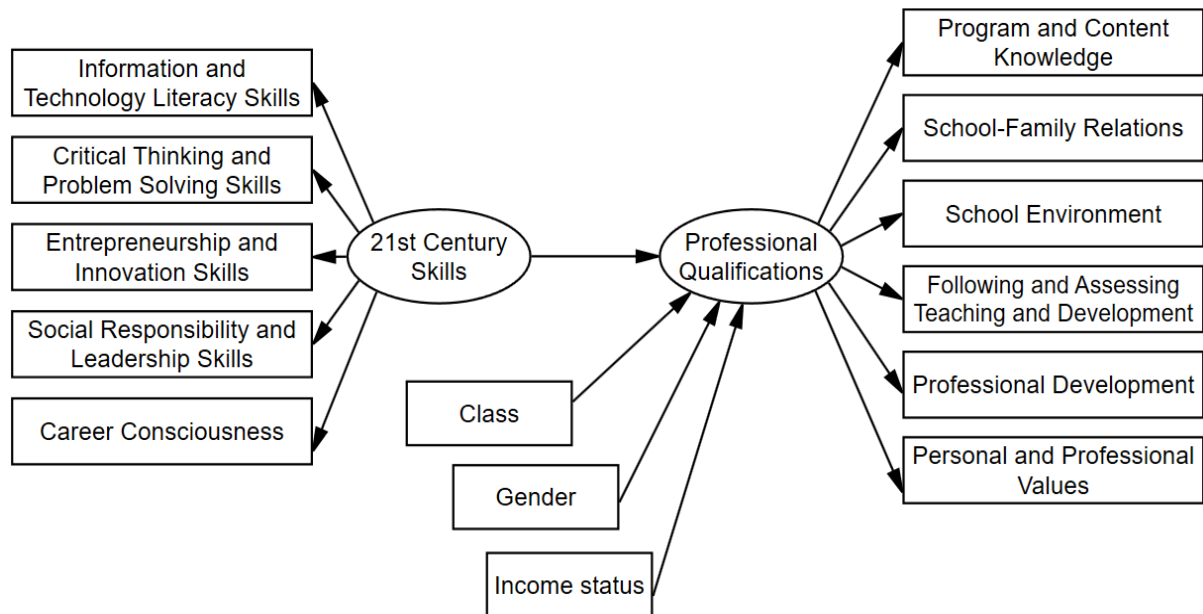
Figure 1. Conceptual Framework

Method

Research Model

This research was conducted under correlational research designs. Correlational research designs examine the relationships between two or more variables by measuring the correlation coefficient. This coefficient, which measures the direction and strength of the relationship between variables, is essential for analyzing the data obtained from these designs (Karasar, 2000). Calculated relationships provide an opportunity to predict some outcomes. This study examined the relationships between pre-service teachers' 21st-century skills and professional efficacy perceptions based on the correlational research design.

Participants

The target population of this research consists of 4554 Turkish teacher candidates studying at Bursa Uludağ University Faculty of Education. The minimum number of students to be randomly selected to represent 4554 pre-service teachers at the 95% confidence interval ($\alpha= .05$) was calculated as 355 (Yazıcıoğlu & Erdoğan, 2014). In this direction, 380 pre-service teachers studying in different classes and departments were randomly selected to participate in the research.

In this study, data were collected on the demographic characteristics of the participants and the diagnostic features of pre-service teachers. 84.7% (n=322) of the participants were female, and 15.3% (n=58) were male. 27.9% (n=106) of the pre-service teachers were first-year students, 25.8% (n=98) were second-year students, 24.2% (n=92) were third-year students, and 22.1% (n=84) were senior students. The distribution of teacher candidates according to diagnostic characteristics is shown in Table 1.

Table 1. Distribution of Participants by Diagnostic Characteristics

Variable		f	%
Class	1	84	22.1
	2	98	25.8
	3	92	24.2
	4	106	27.9
Gender	Female	322	84.7
	Male	58	15.3
	German	23	5.9
	Computer and Instructional Technologies	15	4.0
	Science	20	5.4
	French	21	5.6
	Elementary Mathematics	20	5.4
	English	67	17.6
Department	Music	15	4.0
	Preschool	30	8.0
	Special education	32	8.5
	Guidance and psychological counseling	34	9.1
	Painting-Work	15	3.9
	Class	36	9.4
	Social studies	22	5.9
	Turkish	28	7.3
	Low	87	22.9
Income status	Medium	262	68.9
	High	31	8.2

Measuring Tools

Multidimensional 21st-century Skills Scale

In this study, the Multidimensional 21st-century Skills Scale developed by Çevik and Şentürk (2019) was employed to assess the 21st-century skills of students aged 15-25. The scale adopts a 5-point Likert-type response format and encompasses five distinct dimensions. These dimensions include information and technology literacy skills (15 items), critical thinking and problem-solving skills (6 items), entrepreneurship and innovation (10 items), social responsibility and leadership skills (4 items), and career awareness (6 items). Higher scores on the scale indicate a greater perception of possessing 21st-century skills. The internal consistency of the scale dimensions was evaluated using Cronbach's alpha coefficients, which ranged from .75 to .87 in this study. These findings demonstrate that the scale exhibited high reliability in terms of internal consistency.

Professional Qualification Scale for Pre-service Teachers

The Professional Qualification Scale for Pre-service Teachers, developed by Yengin et al. (2021), was used to determine the professional competence perceptions of teacher candidates. The 5-point Likert-type scale has six dimensions. These dimensions are; personal and professional values (5 items), professional development (4 items), following and assessing teaching and development (7 items), school environment (3 items), school-family relations (4 items), program and content knowledge (5 items). High scores from the overall scale indicate that the perception of professional competence is high. This study examined the scale's reliability by calculating Cronbach's alpha coefficients. The alpha coefficients calculated for the scale dimensions took values between .82 and .92. It was observed that the scale's reliability based on internal consistency was high.

Data Analysis

Structural equation model analysis was applied to test the hypothesis developed in this study. Structural equation modeling is a statistical approach to test and predict causal relationships and verify structural theories (Kline, 2011). The predictive relationships between pre-service teachers' 21st-century skills and their perceptions of professional competence were examined by applying the structural equation model analysis.

Some assumptions were checked before the analysis. The skewness and kurtosis coefficients were used to test the normal distribution assumption. The fact that these coefficients are in the range of ±1.5 indicates that the assumption of normal distribution is met (Tabachnick & Fidell, 2013). The calculated coefficients ($-1.41 \leq$ Skewness $\leq -.16$, $.81 \leq$ Kurtosis ≤ 1.35) were within the specified range, and the normal distribution assumption was met. Cook distance values were calculated, and multiple outliers were controlled (Cook, 1979). It was observed that there were no multivariate outliers in the data set (Cook distance <1). The fact that the Mardia kurtosis coefficient is less than 8 indicates that the multivariate normal distribution assumption is met (Kline, 2011). In this study, the Mardia kurtosis coefficient calculated with AMOS was calculated as 6.37. This value showed that the multivariate normal distribution assumption was met. VIF (Variance Inflation Factor) values were calculated to examine the multicollinearity. VIF>10 values indicate multicollinearity (Everitt, 1998). The highest calculated VIF value was 5.16, which showed no multicollinearity between the variables. It was observed that the data were suitable for multivariate analysis. Analyzes were performed using IBM SPSS 25.0 and AMOS 28.0 statistical package programs.

Results
Correlation Analysis Results

Pearson Correlation coefficients were calculated to examine the relationships between prospective teachers' 21st-century skills and perceptions of professional competence. The coefficients obtained are given in Table 2. The coefficients of the relations between prospective teachers' 21st-century skills and professional competence components took values between .05 and .31. Low and moderate relationships exist between 21st-century skills and professional competence components.

Table 2. Pearson Correlation Coefficients

	Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	Information and Technology Literacy Skills	1												
2.	Critical Thinking and Problem-Solving Skills	.58**	1											
3.	Entrepreneurship and Innovation Skills	.62**	.46**	1										
4.	Social Responsibility and Leadership Skills	.53**	.54**	.51**	1									
5.	Career Consciousness	.59**	.68**	.37**	.54**	1								
6.	21th Century Skills Scale (Total)	.90**	.74**	.83**	.71**	.71**	1							
7.	Personal and Professional Values	.18**	.31**	.05	.26**	.29**	.22**	1						
8.	Professional Development	.22**	.29**	.15**	.17**	.22**	.25**	.72**	1					
9.	Following and Assessing Teaching and Development	.26**	.29**	.18**	.20**	.23**	.28**	.69**	.68**	1				
10.	School Environment	.24**	.25**	.11*	.20**	.21**	.24**	.69**	.65**	.79**	1			
11.	School-Family Relations	.22**	.26**	.13**	.18**	.21**	.24**	.65**	.63**	.82**	.73**	1		
12.	Program and Content Knowledge	.28**	.25**	.18**	.16**	.23**	.28**	.64**	.65**	.83**	.78**	.76**	1	
13.	Professional Qualification Scale (Total)	.27**	.31**	.16**	.22**	.26**	.29**	.83**	.81**	.94**	.87**	.88**	.90**	1
	Mean	61.86	29.75	35.86	16.55	23.03	167.05	21.77	16.14	28.17	12.31	15.95	20.28	114.61
	Std. Deviation	8.55	3.24	7.34	2.61	2.65	19.89	3.73	3.31	6.09	2.55	3.78	4.51	21.09

**p<.01, *p<.05, N=380

Structural Equation Model Analysis Results

By applying the structural equation model analysis (SEM), the predictive effect of teacher candidates' 21st-century skills on their professional competence perceptions was examined. Research data were analyzed by SEM using the maximum likelihood method. The values of the tested relationship pattern are shown in Figure 2. Gender, class level, and income status were included in the model as control variables. Some goodness-of-fit index values are calculated in SEM to evaluate the model-data fit. The goodness of fit values must be acceptable to obtain valid results (Kline, 2011).

The goodness of fit indices and reference intervals used in SEM analyses are shown in Table 3. As it is demonstrated, the χ^2/df was found as 2.96 ($2 \leq \chi^2/df \leq 5$), RMSEA is .07 ($0 \leq$ RMSEA $\leq$ .08), SRMR is .04 ($0 \leq$ RMSEA $\leq$ .08), CFI is .96 (.90 $\leq$ CFI $\leq$ 1.0), IFI is .96 (.90 $\leq$ IFI $\leq$ 1.0) and TLI is .95 (.90 $\leq$ TLI $\leq$ 1.0). The values of the calculated goodness-of-fit indices have shown that the tested model is compatible at an acceptable level with the data. It has been confirmed that the tested model is valid.

Table 3. Recommended Values for Evaluation and the Obtained Values

Fit Measure	Acceptable Fit	Obtained Values	References
χ^2/df	$2 \leq \chi^2/df \leq 5$	2.96	Marsh and Hocevar (1985)
RMSEA	$0 \leq RMSEA \leq .08$	.07	Browne and Cudeck (1993)
SRMR	$0 \leq SRMR \leq .08$	.04	
CFI	$.90 \leq CFI \leq .95$	.96	Bentler (1990)
IFI	$.90 \leq IFI \leq .95$	.96	Bollen (1989)
TLI	$0,90 \leq TLI \leq 0,95$	.95	Bentler and Bonett (1980)

RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual; CFI=Comparative Fit Index; IFI=Incremental Fit Index, TLI = The Tucker-Lewis Coefficient
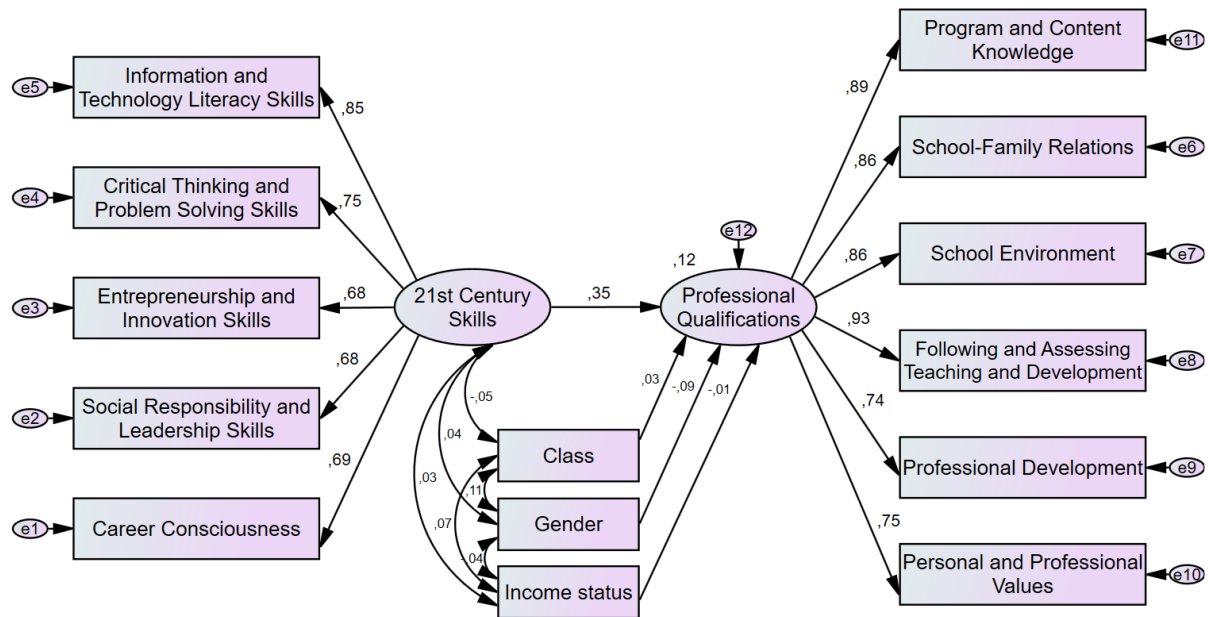

Figure 2. Structural Equation Model, χ^2=198.46, df= 67, p<.01

Table 4 shows the standardized estimate, standard errors, critical rate values, and 95% confidence intervals. There is no significant effect of the control variables such as grade level (β=.03, 95% CI [-.06, 1.12], p>.05), gender (β=-.09, 95% CI [-.18, .02], p>.05), and income level (β=-.01, 95% CI [-1.22, .09], p>.05) on the perception of teacher professional competencies. However, 21st-century skills have a positive effect on the perception of teachers' professional competencies (β=.35, 95% CI [.18, .48], p<.001). 21st-century skills account for 12% of the variation in the perception of teacher professional competencies. According to the results, the H_1 hypothesis is accepted. When gender, grade level, and income status are controlled, it is found that teacher candidates' 21st-century skills positively affect.

Table 4. Standardized Regression Weights

			β	SE	t	%95CI	
						LLCI	ULCI
Class	--->	Professional qualifications	.03	.20	.56[NS]	-.06	1.12
Gender	--->	Professional qualifications	-.09	.46	-1.83[NS]	-.18	.02
Income status	--->	Professional qualifications	-.01	.37	-.28[NS]	-1.22	.09
21st-century skills	--->	Professional qualifications	.35	.07	5.82[***]	.18	.48

[***]p<.001; NS= Not statistically significant, LLCI= Lower limit of confidence interval, ULCI= Upper limit of confidence interval

Discussion

With this study, correlational research was carried out on 380 pre-service teachers. The study aimed to determine the effect of teacher candidates' 21st-century skills on their professional competencies when gender, class level, and income status were controlled. The relationships between the variables were examined using the structural equation model analysis. When gender, class level, and income status were controlled, the 21st-century skills of teacher candidates positively affected their professional competencies.

The results obtained in this study indicate that teacher candidates with 21st-century skills can better understand the curriculum they apply, manage school-family relationships more effectively, communicate better with their students in the classroom, track their personal and professional development, better understand their students' learning processes, and bring out their students' potentials more effectively. Moreover, having 21st-century skills helps prospective teachers to improve their professional competence. For example, prospective teachers with digital literacy skills can teach students to use digital resources effectively. Those with critical thinking skills can help their students develop the skills of questioning, analyzing, and synthesizing information. Teachers with strong communication skills can communicate effectively with their students. In addition, teachers with collaborative skills can support cooperative learning environments in their classrooms. Teachers with problem-solving skills can help students develop the skills to identify and solve problems and implement solutions. Finally, creative and innovative teachers can encourage students to think creatively and help them generate new ideas. In conclusion, the findings of this study show the importance of focusing more on 21st-century skills in teacher candidates' education. This means that by developing these skills, prospective teachers can better respond to the needs of their students.

The studies carried out support the results obtained in this study. For example, Chen et al. (2018) examined the impact of 21st-century skills on teachers' teaching quality. Research shows that teachers with 21st-century skills offer their students more innovative and engaging lessons. This result reveals that teachers can provide students

with a more productive learning experience by gaining 21st-century skills. Bullock (2015) examined the effect of pre-service teachers' use of information technologies on their professional competencies. In his research, it has been shown that the use of technology improves pre-service teachers' teaching practices and increases student achievement. Voogt and Roblin (2012), on the other hand, showed the differences and similarities between the approaches of different countries on 21st-century skills and described the importance of these skills on a global scale. Researchers stated that educating teachers on 21st-century competencies will support their teaching strategies and effective use of technology. The study conducted by Williams et al. (2009) revealed that transforming pre-service teachers' attitudes and behaviors towards innovative technologies is essential for their preparation for 21st-century classrooms. For this reason, it was emphasized that education programs and technology should be integrated for pre-service teachers to acquire the necessary pedagogical skills and strategies.

A study by UNESCO (2015) emphasized the importance of 21st-century skills for the education system. This study stated that critical thinking, cooperation, communication, and creativity skills are vital for students' future success. In this context, it was stated that teachers should learn and teach these skills to their students. Teo et al. (2021) stated that 21st-century skills should be considered part of teacher training programs and that teacher candidates should be equipped with various tools and strategies to develop these skills. According to these researchers, teacher training institutions should offer training that emphasizes the importance of 21st-century skills and provide pre-service teachers with opportunities to develop skills such as collaboration, creativity, communication, problem-solving, critical thinking, and using technology.

As a result, it has been emphasized by many scientific studies that the 21st-century skills of teacher candidates positively affect their professional competence. Teaching these skills to teacher candidates is an essential requirement for education systems. The results of this study show that teaching 21st-century skills to prospective teachers can increase their professional competence. Therefore, teaching prospective teachers 21st-century skills should be one of the primary goals of education systems.

Conclusion

The findings obtained in this study revealed that the components that make up 21st-century skills significantly affect teacher candidates' professional qualifications. A positive and significant relationship exists between prospective teachers' 21st-century skills and professional competencies. As 21st-century skills have increased, the perception of professional competence has also increased. This result shows that 21st-century skills should also be considered in evaluating and developing pre-service teachers' professional competencies.

The results revealed that 21st-century skills such as information and technology literacy, critical thinking and problem-solving, entrepreneurship and innovation, social responsibility and leadership, and career awareness are essential for teacher candidates. It has been understood that these skills are the main factors that positively affect the professional qualifications of teacher candidates. Creating learning environments that offer ample opportunities for teacher candidates to learn and practice these skills is necessary. In line with this suggestion, it can be recommended to redesign and develop existing teacher training programs.

Recommendations

Various recommendations have been developed based on the findings of this study. First, it may be recommended to review and revise teacher training programs to prioritize the development of 21st-century skills. Curriculums should be designed in such a way as to enable pre-service teachers to develop their information and technology literacy, collaboration, critical thinking, problem-solving, and communication skills. In addition, it should be ensured that pre-service teachers gain practical experience through field studies and internship programs. Pre-service teachers should be encouraged to apply their 21st-century skills in real classroom settings. It is of great importance to ensure that pre-service teachers acquire these skills through practical experience.

Also, improving cooperation between teacher education institutions and schools is crucial to supporting the effective integration of 21st-century skills into classroom practice. Such collaborations can facilitate the alignment of teacher education programs with the demands of contemporary educational environments. In addition, in-service training programs should focus on developing 21st-century skills. These programs can be designed to provide teachers with continuous learning and skills development opportunities, ensuring their continuing proficiency in 21st-century skills throughout their careers.

However, this study has certain limitations. The cross-sectional research design used in this study provides limited information on establishing cause-effect relationships between variables. Future research using longitudinal research designs may be conducted to understand better the effects of 21st-century skills on teachers' professional competence. In addition, since this study was based on self-reported measurement tools, the findings are based on subjective assessments. To increase the validity of the findings, it is recommended that future studies include additional objective measures, such as classroom observations or performance appraisals, to supplement subjective data.

Furthermore, this study was conducted within a specific context, and contextual factors may influence the findings. Replicating the study in different educational settings and cultures would provide a more diverse perspective on the relationship between 21st-century skills and teachers' professional qualifications. Acknowledging these limitations, future research endeavors should address these gaps to enrich further our understanding of how 21st-century skills contribute to pre-teachers' professional qualifications and instructional practices. By doing so, we can ensure that educators are adequately prepared to meet the evolving demands of the 21st-century classroom.

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