Turkish Primary School Teachers' Self-Efficacy Perceptions for 21st Century Skills, Use of Teaching Skills and of Educational Technology: A SEM Approach

Beril CEYLAN[1], Alev ATES COBANOGLU[2], Şengül Saime ANAGUN[3], Belgin ARSLAN CANSEVER[4], Pınar CAVAS[5]

The Present cross-sectional survey study aims to examine, through a SEM approach, the relationship among self-efficacy perceptions for 21st century skills, teaching skills use and educational technology use of teachers. 438 Turkish primary school teachers participated in the study. A SEM approach revealed that Educational technology use (ETUS) is a significant predictor of 21st century teaching skills (TS) and self-efficacy perceptions of teachers for 21st century skills (SEP). Also, 21st century teaching skills are a significant predictor of self-efficacy perceptions for 21st century skills. It is considered that the results can contribute to studies regarding 21st century skills of primary school teachers and use of instructional technology.

INTRODUCTION

In the 21st century, the developments in the field of information systems and technologies manifested human power qualified in all areas. Educational institutions should prepare students to live in the information age, to use today's technology and discover new things. Students should be able to make conscious decisions so that they can develop expertise and learn continuously for lifelong (Suwono, Mahmudah & Maulidiah, 2017). Physical infrastructure of educational environment, technological infrastructure, content of the curricula and similar factors are directly or indirectly related to the quality of the education delivered. In educational process, it can be said that teacher qualification is very important (Leigh & Mead, 2005), and the knowledge and skills of teachers is the most important factor supporting students' development. According to Shihab (2008), in rapidly growing and changing global economy of our day, individuals need to have certain skills to achieve competitiveness and success. One of the most important skills among these is probably the 21st century skills. 21st century skills require students to use their skills in all areas of life by being creative, learning collaboratively and being part of learning communities.

When current reports of business world and educators are reviewed, it is seen that 21st century skills are highlighted, and many countries develop their educational curricula based on these skills. In literature, it is emphasized that content-based approaches are handing it over to skills day by day and skill-based purposes are getting to the foreground (Ravitch, 2009). However, to teach 21st century skills and to achieve the outcomes aimed for, improved curricula, teacing practices and assessment elements should be run to work in accordance (Rotherham & Willingham, 2010). Teachers must teach 21st century skills to students in unique contexts by providing interesting learning opportunities and integrate them into the present curricula (Larson & Northern Miller, 2011 as cited in Karahan, 2021). In this respect, Saavedra and Opfer (2012) express that most of the scientists' suggestions related to how students can learn 21st century skills and how their needs can be pedagogically met focus on concepts of information transfer, metacognition, teamwork, technology, and creativity. Besides, in the report related to how 21st century skills can be developed, Windschitl (2009) stated that professional development which can support science teachers' perceptions and practices should focus on scientific content, practice and active learning opportunities based on databased evidence (Karahan, 2021).

The issue of learners' developing 21st century skills has brought up teachers' integrating their technological knowledge with pedagogical content knowledge. Combining technology with the conceptual framework of pedagogical content knowledge was first put into practice by Pierson (1999, 2001) in the beginning of 2000s. In this model, by adding technological knowledge to pedagogical content knowledge model, "technological pedagogical content knowledge" concept was used for the first time. In the same years, affected by Shulman, 1987; Margerum-Lays & Marx (2002) used the term "PCK of educational technology". Although many researchers developed various models related to this subject, Koh et al. (2015) suggested a course design model

[1] Ege University, beril.ceylan@ege.edu.tr, https://orcid.org/0000-0002-2440-0434
[2] Ege University, alev.ates@ege.edu.tr, https://orcid.org/0000-0002-8319-9822
[3] Eskisehir Osmangazi University, ssanagun@gmail.com, https://orcid.org/0000-0002-8011-0730
[4] Ege University, bacansever@gmail.com, https://orcid.org/0000-0002-0720-8096
[5] Ege University, pinar.cavas@gmail.com, https://orcid.org/0000-0001-9492-9002

related to how 21st century teachers can integrate their TPACK competencies into their courses.   The basic model of this design is illustrated in Figure 1.
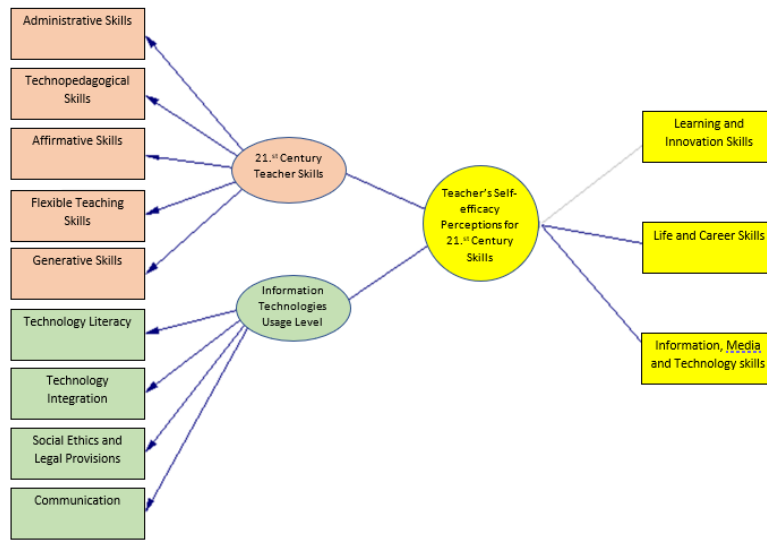

Figure 1. Latent and Observed Variables of Basic Model

In Figure 1, 21st century skills are integrated with cognitive, metacognitive, sociocultural, productivity and technology dimensions. As for the course design, it consists of steps of determining content, designing course materials, applying and reflection. To make teachers develop their TPACK-21st century teacher competencies, it is necessary to get them to apply the courses they integrated with technology and test their results (Doering, Veletsianos, Scharber & Miller, 2009). Research results showed that when teachers design technology supported courses and do practices, their self-efficacies improve (Lambert & Gong, 2010; Mouza & Karchmer-Klein, 2015). In this study, focusing on teacher qualities and use of technology during courses, the conceptual framework of 21st century skills that teachers have to posess is examined according to dependent and independent variables within the framework of the model developed by Koh and his colleagues (2015).

Theoretical Framework

To be able to meet the expectations of today's learners, who are called digital natives, besides having certain standards, as being the most important factor in planning and applying the educational process in an environment where students with high-level skills are present, it is inevitable for teachers to posess some skills that they need to provide quality education.

21st century skills and teachers' 21st century skills self-efficacy perceptions

Today's teachers are expected to raise world citizens students who are donated with 21st century skills. In parallel with the increasing interest in the skills that students should have in the 21st century necessitated the development of a framework for these skills. There are five major frameworks that stand out among many different classifications (Partnership for 21st Century Skills (2002), AASL (2007), ISTE (2000), North Central Regional Educational Laboratory (Lemke, 2002) and National Research Council (Hilton, 2008). In the framework developed by P21, the skills that students should have in order to be ready to work in the global economy in the 21st century and to be more competitive in the international arena have been determined. According to the P21 (2009) 21st Century skills listed as life and career skills, learning and innovation skills, information, media, and technology skills (Partnership for 21st Century Skills, 2009). Teacher plays an important role in students' gaining 21st century skills. This situation also requires the change of the qualities teachers have. In fact, Day, Kington, Stobart, and Sammons (2006) emphasize that the key concepts that constitute teacher identity are self-efficacy, motivation, professional satisfaction, effectiveness and commitment. Among these variables, self-efficacy appears to be one of the important factors in teachers' achieving success in their practices.

Self-efficacy is defined by Bandura (1986, 1997) as "the judgments of individuals regarding their ability to organize and execute the necessary actions in order to achieve certain performances". In other words, self-efficacy can be expressed as individuals' personal beliefs about planning and performing actions (Martin & Mulvihill, 2019). According to the Social Cognitive Theory, the concept of teacher self-efficacy refers to teachers' beliefs about their ability to successfully continue the teaching process. There are many studies examining the effect of teachers' beliefs on teaching practices in the classroom (Canrinus, Helms-Lorenz,

Beijaard, Buitink, & Hofman, 2012; Elkatmış, Demirbaş & Ertuğrul, 2013; Ghasembolanda & Hashimb, 2013; İlgör, 2019). There are also research about TSE which has been linked to desirable outcomes like the use of diverse teaching strategies (Chan, 2008), a better classroom climate (Aslan, 2015) and student performance (Mojavezi &Tavis, 2012). Fackler, Malmber & Sammons (2021) examined teacher self-efficacy in terms of teacher, class, school and administrator variables, based on TALIS data. The results of the research revealed that in all the variables, the most related to teacher self-efficacy is the class variable. In this respect, teachers must believe that they can do this job in order to play their critical role properly in implementing educational processes and getting their students to gain 21st century skills.

21st century teacher qualities/skills

International Society for Technology in Education-ISTE updated teacher standards in 2017. By gathering these standards under two main headings named as professionalism (first three areas) and learner supporter (four areas), seven competency areas were identified in total. Learner expresses teachers' improving themselves professionally. Teachers follow studies in their field on a local and global scale by renewing themselves in technological and pedagogical respect. Leader expresses teachers' providing students opportunities to be successful in educational process. It involves being a model for their colleagues in making use of technology and using digital contents according to students' needs. Digital citizen expresses teachers' encouraging students to contribute as digital citizens. Teachers help students to be safe, legal, and ethical in digital enviroments, participate in online environments and create a learning culture here. Collaborator indicates teachers' sharing with their colleagues as well as their students. Teachers add on to their experiences by getting help from technology in problem solving, they collaborate on global and cultural levels by including their students and families. Designer expresses teachers' producing unique learner-based activities. Teachers make use of technological devices, use digital environments for individual and innovative experiences. Facilitator emphasizes teachers' supporting learning process with technology. Teachers support learners' creativity, use of technology, skills for individual and group work, knowledge, and operational thinking in learning process. Problem solver expresses students' achieving their goal with teachers' assessment data. At this stage, teachers want students to show their technological proficiencies. Teachers give students feedback, make use of technology in formative and final assessments. They cooperate with other stakeholders in students' development.

It is seen that the teacher competencies stated above give various roles to teachers in educational process. Today's teachers are no longer individuals to pass on information to their students but are required to undertake a designer's mission by transforming their practices with technology. Besides the purpose of using teaching technologies in learning environment to make learning easy, it should also serve the purpose of enriching teaching and facilitating individual learning. With this perspective, teacher competencies in using technology emerge as a variable with a growing importance.

Teachers' Information and Communication Technologies (ICT) Usage Levels

In the 21st century, it is essential to provide educational environments integrated with technology for individuals so that they can achieve the the competencies expected from them. In this respect, as teachers play a very important role in raising qualified individuals, their technology competencies have an important place in integrating their students and educational environment with technology. The outcomes and principles of educational curricula in Turkey were prepared in compliance with the European Qualifications Framework and organized according to the Turkish Qualifications Framework (MoNE, 2016). Also, by including 21st century skills in educational curricula, an important step was taken towards getting individuals to gain these skills. Furthermore, it is obvious that it cannot be expected to get students to gain these skills unless teachers, who are one of the most important components of teaching-learning process, are equipped with the competencies in this field (Darling-Hammond, 2006; Schleicher, 2016; Özyurt, 2020).

The technology use in education gives support within the scientific dimension and the framework of educational policies (Fraillon, Ainley, Schulz, Duckworth & Friedman 2019; OECD, 2015). In the scientific discussions related to education, the necessity of technology integration into education as well as its contribution to improving teaching and learning processes to get students to gain 21st century skills are emphasized.

Studies conducted with teachers include topics such as teachers' use of technology (Brun & Hinostroza, 2014; Ertmer & Ottenbreit-Leftwich, 2010; Türel & Johnson, 2012), and technology integration processes (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012; Keengwe, Onchwari & Wachira, 2008; Kim, Kim, Lee,

Spector & DeMeester, 2013). As there are studies explaining the obstacles standing in front of technology integration with poor infrastructure (Drossel et al., 2017), studies which show that teachers' beliefs in this field cause restriction also take place in literature (Backfisch, Lachner, Hische, Loose, & Scheiter, 2020; Scherer, Siddiq, & Tondeur, 2019; Taimalu & Luik, 2019). However, the relationships between teachers' motivational beliefs (in other words; self-efficacy, perceived benefit) and technology integration are not made clear yet. For example, the classic motivational belief models (e.g., expectancy value theory; Eccles & Wigfield, 2002) assume a concurrent mechanism with direct effects of self-efficacy and benefit-value on technology integration (Taimalu & Luik, 2019). As an alternative, technology acceptance models (TAM) (Al-Azawei and et all, 2017; Scherer and et all, 2019; Marangunić & Granić, 2015) suggest a gradual model. Whatever their perspectives are, both models assumed that teachers' self-efficacy perceptions and technology integration are related to each other. The purpose of O'Neal, Gibson & Cotton's (2017) study was to explore teachers' beliefs surrounding the role of technology in teaching and learning skills suitable for modern-day opportunity and employment. Their research findings suggested that, while teachers in the study saw the importance of incorporating technology into teaching and learning.

There is a relationship between teachers' teaching skills and their self-efficacy perceptions about teaching 21st century skills. Studies on 21st century skills focus on the effects of different teaching strategies on gaining 21st century skills (Korkmaz, 2019; Nouri, Zhang, Manila & Norén, 2020; Pana & Escarlos, 2017) and professional development (Sharif & Cho, 2015). In Turkey, studies conducted with teachers related to 21st century skills are limited with studies aimed at determining views and efficacy perceptions (Karadeniz & Vatanartıran, 2015; Orhan Göksün, 2016; Gürültü, Aslan & Alcı, 2018; Aydın, 2019; Cemaloğlu, Arslangilay, Üstündağ & Bilasa, 2019; Çelebi & Sevinç, 2019; Eğmir & Çengelci, 2020). In literature, there are studies which consider the conceptual framework of 21st century skills with respect to teacher self-efficacy (Wilborn, 2013; Uyar & Çiçek 2021; Coşanay & Karalı 2022) as well as studies which examine teachers' self efficacy with their self-efficacy about their skill teaching (Wilborn 2013; Uyar & Çiçek 2021; Coşanay & Karalı 2022). Also, Kuloğlu & Karabekmez (2022) searched the relationship between 21st century teacher skills and critical thinking skills of the classroom teachers. Çimen (2022) examined the relationship between the general self-efficacy levels of physical education and sports teachers and their efficacy perception of skill teaching. Research results revealed that there was a moderate positive correlation between the self-efficacy and efficacy perceptions for skill teaching of physical education and sports teachers.

In all the studies mentioned above, it is seen that teacher is an important element in educational processes, it is essential for teachers to have 21st century skills and to have a high self-efficacy in teaching skills, and use of technology in education is an important factor in 21st century skills teaching. However, when studies in literature were examined, no research related to the relationship between teachers' 21st century skills self-efficacy perceptions, 21st century teacher qualities and teachers' technology use was found.

Applying structural equation model which holds the variables mentioned within the scope of the study is important as it reveals the interaction between the variables and its predictive power for the dependent variable. It is considered that the results of this study will make unique contributions to the literature of education sciences especially in the subject area of teachers' 21st century skills and teaching technologies. Setting off from this theoretical framework, the structured model illustrated in Figure 2 was constructed. According to the model, teachers' use of 21st century teacher skills and educational technologies are independent variables, teachers' self-efficacy perceptions towards 21st century skills teaching is treated as dependent variable.
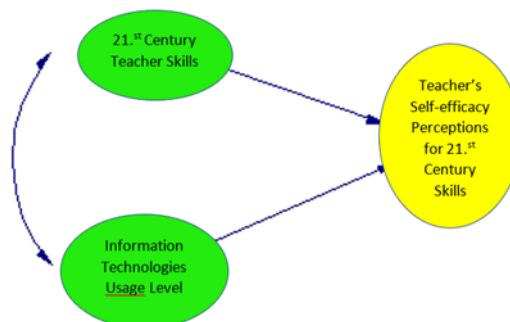

Figure 2. The Hypothetical Model

Objectives of the Study

This study aims to test and build a holistic model, through a SEM approach, for the variables as self-efficacy perceptions for 21st century skills, teaching skills use and educational technology use of Turkish primary school teachers. The results of the present study have the potential to contribute to the literature regarding 21st century skills of primary school teachers and use of educational technology. The predicted structural model of the study is that direct relations exist among self-efficacy perceptions for 21st century skills, teaching skills use and educational technology use of primary school teachers. The hypotheses for the current study have been identifed as follows:

H1: 21st century teaching skills (TS) is a direct affect on self-efficacy perceptions for 21st century skills (SEP) as a significant predictor.

H2: Educational technology use (ETUS) is a direct afect a self-efficacy perceptions for 21st century skills (TEP) as a significant predictor.

H3: Educational technology use (ETUS) and 21st century teaching skills (TS) are significant predictors of self-efficacy perceptions for 21st century skills (SEP).

METHOD

Research Design

The authors employed the correlational survey research design to examine the relations among self-efficacy perceptions for 21st century skills, teaching skills use and educational technology use of teachers. Survey research involves studying relationships among variables and their directions (Fraenkel, Wallen & Hyun, 2012). In this study, educational technology use and 21st century teaching skills are the independent variables whereas self-efficacy perceptions for 21st century skills are the dependent variable of the study.

Population and Sample

The target population is all primary school teachers in Turkiye, and the accessible population is all primary school teachers in the city of Izmir, a western city of Turkiye. According to the data of İzmir Provincial Directorate of National Education (2020) records, the number of primary schools in Izmir is 651 whilst the number of primary school teachers is 13281. Considering the reliability of 95% confidence interval, the required number of teachers for the sample is 373. And the authors administered the scales to 490 teachers. When the data set was cleaned from the missign data, the sample included a total of 438 Turkish primary school teachers. The demographics of the teachers are displayed in Table 1.

Table 1. The demographic background of the sample

Gender	f	%	Work experience	f	%
Female	354	80.82	Above 20 years	142	32.42
Male	84	19.18	10-14 years	89	20.32
Level of education	f	%	5-9 years	74	16.89
PhD	1	0.23	15-19 years	70	15.97
Master	70	15.98	1-5 years	63	15.38
Undergraduate	367	83.79	**School location**	f	%
Graduation	f	%	City center	202	46.12
Faculty of Education	356	81.28	District	164	37.44
Faculty of science and literature	30	6.85	Town	17	3.88
Other	20	4.57	Village	49	11.19
Institute of Education	18	4.11	Neighborhood	4	0.91
Teacher High School	14	3.19	not working currently	2	0.46
Age	f	%	**Which grade are you teaching?**	f	%
30-39	160	36.53	1st grade	115	26.26
40-49	106	24.20	3rd grade	108	24.66
20-29	92	21.00	2nd grade	107	24.43
Above 50	80	18.27	4th grade	99	22.60
			Multi-age classroom	9	2.05

Data Collection Tools

The scale of self-efficacy perceptions for 21st century skills (SEP)

SEP was developed by Anagün, Atalay, Kılıç and Yaşar (2016) with 42 items and a three-factor structure. The factors of SEP included (1) learning and innovation skills, (2) life and career skills and (3) information, media, and technology skills. The correlations among factors vary between 0.28-0.50 and they are significant at .01 level. EFA results revealed that the three-factor and approximate total explained variance of SEP was 51.30%. Whereas CFA analysis revealed acceptable goodness-of-fit values (Kline, 2015) $\chi2/df$=2.00, RMSEA=.055, CFI= .93, IFI= .93. The Spearman Brown value of the scale is 0.731 while the Guttman Split- Half value is 0.731.

The Cronbach alpha (α) value of the whole scale is 0.89. Alpha value for the factors are as follows: 0.845 for the Factor 1, 0.826 for the Factor 2 and 0.810 for the Factor 3. In addition, considering that the item-total correlations of the scale varied between .152 and .499, it has been understood that the scale had a consistent structure based on items (Anagün et al., 2016).

The scale of 21st century teacher skills use (TS)

Orhan Göksün and Kurt (2015) developed the TS based on general teacher competencies of the Turkish Ministry of National Education, ISTE for teachers, Lemov (2010), and Melvin (2011). The total variance explained in the scale is 40.33% and the internal consistency score is 0.87. Final version of that five-point scale has five factors and 27 items. Namely, administrative skills, techno-pedagogical skills, confirmative skills, flexible teaching skills and productive skills are the factors of the scale. The structure was also confirmed using confirmatory factor analysis ($\chi2 / df$ = 0.87; p = 0.95; RMSEA = 0,00).

The Level of Teachers' Educational Technology Usage Scale (ETUS)

The ETUS was developed by Bayraktar (2015). This five-point scale consists of 38 items with four factors. It was reported that these factors together explain 62,90% of the total variance. Namely, the factors of the scale are Technology Literacy (19 items), Technology Integration into the Subject (9 items), Social Ethical and Legal Provisions (6 items) and Communication (4 items). Kaiser-Meyer-Olkin (KMO) value of the scale is 0.975. And the Cronbach Alpha internal consistency score is 0.975.

Data Analysis

Structural Equation Modeling (SEM) approach was used to test the research hypotheses. The term structural equation modeling (SEM) does not designate a single statistical technique but instead refers to a family of related procedures (Kline, 2015). Pearl (2012) defines SEM as a causal inference method that is a set of hypotheses based on theory and a set of logical implications of the model that may not directly correspond to a specific parameter but that still can be tested in the data. The point of SEM is to test a theory by specifying a model that represents predictions of that theory among plausible constructs measured with appropriate observed variables (Hayduk, Cummings, Boadu, Pazderka-Robinson, & Boulianne 2007 cited in Kline, 2015). In this research, before starting structural equation modeling (SEM) analysis, model SEM assumptions were tested. First, preliminary analysis such as outlier, univariate, multivariate normality, and multicollinearity were tested. Then, the data were analyzed with two stage SEM.

At the beginning of the data analysis stage, the Structural Equation Modeling (SEM) assumptions were tested by performing a preliminary analysis. These assumptions include outlier, univariate, multivariate normality, and multicollinearity before starting the Structural Equation Modeling (SEM) analysis (Kline, 2015). Outlier analysis was performed to ensure normality and the outliers Mahalanobis distance was calculated (Uzun & Çokluk-Bökeoğlu, 2019). Mahalanobis distance maximum value is 12,370. This distance maximum value is 13.816 at the 0.001 significance level. This means that there are not any outliers. After, skewness and kurtosis values were examined for checking normality as shown in Table 2. Since these values are between -2 and +2 as suggested (Hair, Black, Babin ve Anderson 2010) this assumption was provided.

Table 2. Variables Correlation and Normality Values

Variables	$\overline{X}$	*Sd*	SEP	TS	ETUS
Self-efficacy perceptions for 21st century skills (SEP)	4.270	.314	-	.657	.456
21st century teaching skills (TS)	4.214	.328	.657	-	.478
Educational technology use (ETUS)	3.961	.562	.456	.478	-
Skewness			.151	.031	-.201
Kurtosis			-.479	-.896	-.416
VIF				1.296	1.296
TI				.771	.771

Second, the correlations among variables (see Table 2), tolerance, VIF values were examined for checking multicollinearity assumption (Anagün et al., 2016; Uzun & Çokluk-Bökeoğlu, 2019). And it was observed that none of the correlations among variables are greater than .80 and the tolerance values are above 0.1 as suggested by Uzun & Çokluk-Bökeoğlu (2019) which indicates no problem with multicollinearity. The correlation values are between .657 and .478. It is acceptable that VIF values are smaller than 10 (Alpar, 2022). The VIF value is 1,296 and similar among independent variables.

FINDINGS

The linear regression analysis shows the prediction on self-efficacy perceptions for 21st century skills (SEP) using 21st century teaching skills (TS) and educational technology use (ETUS).

The linear regression model is significant ($F_{(2,435)}$=183.66, p<.001). The variance in the dependent variable was explained by independent variables at %46 ($R^2_{adjusted}$= .46). In this research all the hypothesis (H1, H2 and H3) are accepted. The regression model equation is in the following: SEP= 1.57 + .54 * TS + .10 * ETUS. The values are shown at Table 3.

Table 3. Linear Regression Values

Variable	Non-Coefficients		Standard Coefficients	R	R^2	t	p
	B	S.E	β				
Constant	1.571	.143		.677	.458	10.988	.000
TS	.544	.038	.569			14.163	.000
ETUS	.103	.022	.184			4.571	.000

21st century teaching skills (TS) are positive and significant predictors of self-efficacy perceptions for 21st century skills (SEP). β=.57, $t_{(435)}$=14.16, p<.001), pr²= .32. These values show, H1 acceptence. And also, H2 is accepted. Educational technology use (ETUS) is positive and significant predictor of self-efficacy perceptions for 21st century skills (SEP). β=.18, $t_{(435)}$ = 4.57, p<.001), pr²= .05

Educational technology use (ETUS) and 21st century teaching skills (TS) are positive and significant predictors of self-efficacy perceptions for 21st century skills (SEP). For answering this hypothesis, a SEM was created. The Structional model is in the following: SEP= 0.75* TS + 0.14* ETUS, Errorvar.=0.028, R^2 =0.72. This means that TS and ETUP variables are together explain the variability (difference) on SEP %72. The factor loadings were as shown in table 4.

Table 4. The Factor Loadings of the Variables

Latent variable	Observed variable	Standardized factor load	P	R^2	Error variance
SEP	Learning and Innovation Skills	0.711	.000	0.506	0.494
	Life and Career Skills	0.760	.000	0.577	0.423
	Information, Media, and Technology Skills	0.638	.000	0.407	0.593
TS	Administrative Skills	0.895	.000	0.800	0.200
	Technopedagogical Skills	0.696	.000	0.484	0.516
	Affirmative Skills	0.601	.000	0.361	0.639
	Flexible Teaching Skills	0.361	.000	0.130	0.870
	Generative Skills	0.567	.000	0.322	0.678
ETUS	Technology Literacy	0.752	.000	0.566	0.434
	Technology Integration	0.917	.000	0.841	0.159
	Social Ethics and Legal Provisions	0.585	.000	0.342	0.658
	Communication	0.602	.000	0.363	0.637

As seen in Table 4 the latent variables of measurement model standardized factor load on the observed variables (ranged from .36 to .91, $p < .001$) are related. As a result, the observed variables in the present study are significantly explained by the latent variables to which they depend. The measurement model is shown in Figure 4 indicates the T-values. Also, the results of the equation for the model is given below.

Self-efficacy skils= 0.71* Teacher skills + 0.13* ICT usage, Errorvar. =0.061, R^2 =0.91
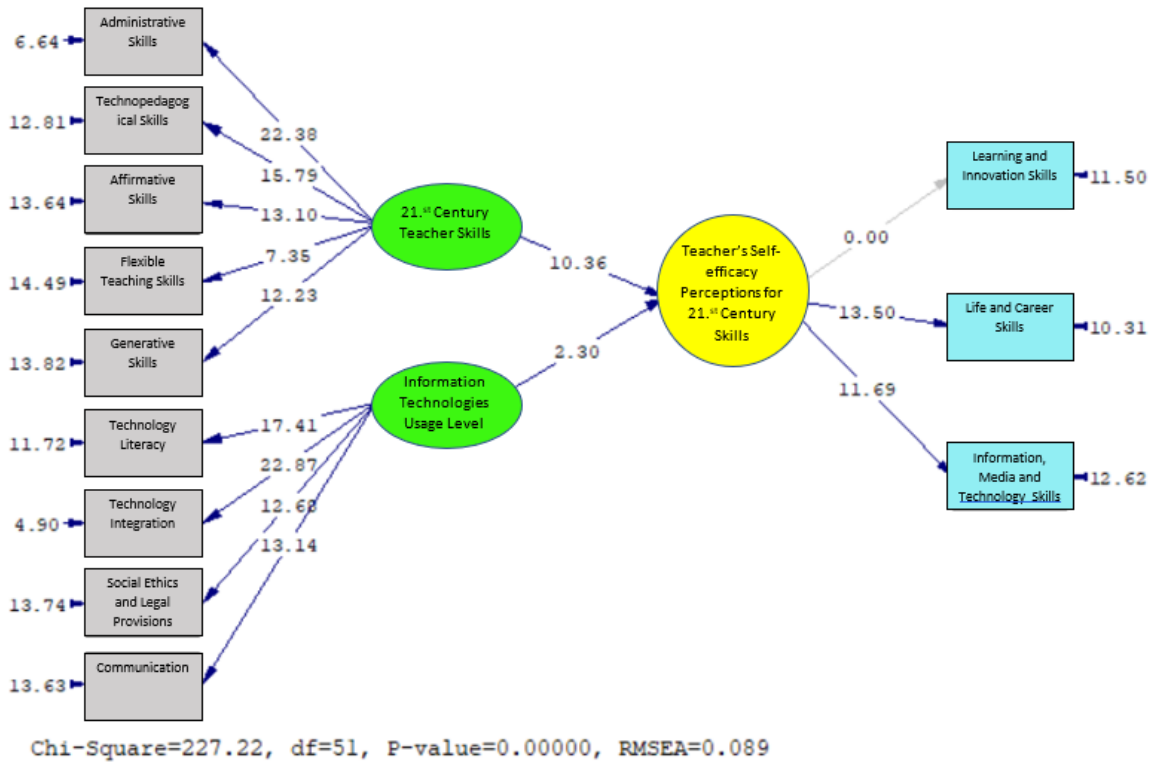

Figure 4. Measurement model T-value diagram

Table 5. The findings of the measurement model and the rationale for the criteria

Value	Criteria	Measurement model	Rationale
X^2	N/A	227.220	Bollen (1989)
df	N/A	51	Ayyıldız, Cengiz & Ustasüleyman (2006)
X^2/df	≤ 5 Acceptable ≤ 3 Excellent	4.455	Hooper, Coughan & Mullen (2008) Marsh & Hocevar (1988)
CFI	0.90 ≤ CFI ≤ 1.00 Acceptable	0.960	Şimşek (2007); Tabachnick & Fidell (2001)
GFI	0.90 ≤ GFI ≤ 1.00 Acceptable	0.920	Schermelleh-Engel &Moosbrugger (2003); Tabachnick & Fidell (2001)
AGFI	0.90 ≤ CFI ≤ 1.00 Acceptable	0.878	Schermelleh-Engel &Moosbrugger (2003)
SRMR	0 ≤ SRMR ≤ 0.10 Acceptable	0.065	Şimşek (2007); Brown (2006)
RMSEA	0 ≤ SRMR ≤ 0.08 Acceptable	0.089	Hooper, Coughan & Mullen (2008)

The Goodness of Fit indices are the criteria for accepting or declining the model which was tested by SEM. As shown in Table 5, the statistical results for the proposed model suggested that the CFI=0.96 and the GFI=0.92 values indicated the perfect fit and the AGFI=0.878 value inficated acceptable fit. Also, the SRMR value was calculated as 0.065 while the RMSEA was 0.089. These values also indicated acceptable goodness of fit.

Moreover, X^2/df value of the model was 4.455. As a result, it is concluded that the proposed model has a valid and reliable structure.

DISCUSSION AND CONCLUSION

This study aimed to test and build a holistic model, through a SEM approach, for the variables as self-efficacy perceptions for 21st century skills, teaching skills use and educational technology use of Turkish primary school teachers. The results of the study indicated that the measurement model is eligible for structural equation analysis. According to the results, the level of educational technology use of elementary school teachers and their 21st century teaching skills are significant predictors of their self-efficacy perceptions for 21st century skills. Therefore, it is concluded that there is positive correlation between the level of educational technology use of elementary school teachers, their 21st century teaching skills and self-efficacy perceptions for 21st century skills. Also, it was revealed that the 91% of the variance regarding primary school teachers' self-efficacy skills of 21st century skills were explained by their educational technology use and 21st century teaching skills.

According to Taimalu and Luik (2019), expectancy value theory (Eccles & Wigfield, 2002) assume a concurrent mechanism with direct effects of self-efficacy and benefit-value on technology integration. As an alternative to the expectancy value theory, technology acceptance models (TAM) (Al-Azawei et all, 2017; Marangunić & Granić, 2015; Scherer et all, 2019) suggest a gradual model. Both models assume that there is a relationship between teachers' self-efficacy perceptions and technology integration. Research results support these opinions. Similarly, Arslan-Cansever et al. (2021) came up with similar results in their study. They examined the correlation and predictive power between the 21st century teaching skills of primary school teachers and their 21st century skills efficacy perception levels. Results of their research indicated that utilization of 21st century teacher skills increase as does 21st century teacher skills efficacy perceptions. Similarly, Kara et al. (2022) reached the conclusion in their study that teachers' professional Studies in the literature support this result. Wilborn's study (2013) which examines teachers' self-efficacy within the framework of 21st century skills revealed that if teachers' perceptions of 21st century skills they have are positive; this is also reflected in their practices. Self-efficacy significantly predicts teachers' perceptions of their 21st century skills competence. Even though teachers in Turkey consider themselves capable to develop 21st century skills, centralized national education system in Turkey may bring about those teachers having problems in reflecting these competencies in their teaching practices. In fact, research on the effective use of information and communication technologies and Web 2.0 tools in classrooms, which is one of the basic requirements of teaching 21st century skills, has shown that these applications are rather insufficient (Şengür, 2020; Yaşar, 2021).

In sum, the authors would like to conclude that present age in which we live in, involves technology which is considered as one of the most crucial elements for teaching 21st century skills. Teaching students to effectively use an then how to produce technology affect both their academic and professional life experiences. It is indicated that the use of technology in learning environments improves deep learning, research and inquiry skills. And also technology supports self-directed learning; proliferates vital and professional skills of learners (Boyraz, 2008; Rashid & Asghar, 2016). Teachers are considered to have key roles for the success of educational reform and innovations (Butler and Schnellert, 2012). For helping students to build twenty-first century skills, positive perceptions of the teachers for the twenty-first century learning is crucial at first. Therefore, current study intended to test and build a holistic model, through a SEM approach, for the variables as self-efficacy perceptions for 21st century skills, teaching skills use and Educational technology use of Turkish primary school teachers. Although it is limited with primary school teachers in Turkey and the results are limited to the responses of the teachers in the study group, it is considered that the results fill the gap in professional development studies regarding primary school teachers' self-efficacy skills of 21st century. Finally, the authors argued following implications for further studies: To improve primary school teachers' self-efficacy skills of 21st century skills, relevant professional development courses can be designed, developed, and implemented particularly at nation-wide in Turkey. In such professional development programs, learning goals can cover primary school teachers' educational technology use and teacher skills for successful and need-supportive models. On the other hand, some courses including the issue of being a 21st century teacher can be added to the curriculum of education faculties. Also, it is suggested researchers to conduct this study with the teachers from other disciplines as well.

Declarations

Conflict of Interest

No potential conflicts of interest were disclosed by the authors with respect to the research, authorship, or publication of this article.

Ethics Approval

The formal ethics approval was granted by the Social And Humanities Scientific Research and Publication Ethics Committee of Ege University. We conducted the study in accordance with the Helsinki Declaration in 1975.

Funding

No specific grant was given to this research by funding organizations in the public, commercial, or not-for-profit sectors.

Research and Publication Ethics Statement

The study was approved by the research team's university ethics committee of the Ege University (Approval Number/ID: 02.2021/06. Hereby, we as the authors consciously assure that for the manuscript " Turkish Primary School Teachers' Self-Efficacy Perceptions for 21st Century Skills, Use of Teaching Skills and of Educational Technology: A SEM Approach " the following is fulfilled:

- This material is the authors' own original work, which has not been previously published elsewhere.
- The paper reflects the authors' own research and analysis in a truthful and complete manner.
- The results are appropriately placed in the context of prior and existing research.
- All sources used are properly disclosed.

Contribution Rates of Authors to the Article

The authors provide equal contribution to this work.

REFERENCES

Al-Azawei, A., Parslow, P., & Lundqvist, K. (2017). Investigating the effect of learning styles in a blended e-learning system: An extension of the technology acceptance model (TAM). *Australasian Journal of Educational Technology, 33*(2). https://doi.org/10.14742/ajet.2741

Alpar, C. R. (2016). Spor sağlık ve eğitim bilimlerinden örneklerle uygulamalı istatistik ve geçerlik güvenirlik [Applied statistics and validity and reliability with examples from sports, health and education sciences]. Detay Yayıncılık.

American Association of School Librarians [AASL]. (2007). Standards for the 21st–Century learner.

Anagün, Ş. S., 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 Education, 40*(40), 160-175. http://dx.doi.org/10.9779/PUJE768

Arslan-Cansever, B., Ceylan, B., Çavaş, P., Ateş-Çobanoğlu, A., & Anagün, Ş.S. (2021). Self-efficacy and teaching skills perceptions of primary school teachers: A predictive study. *Shanlax International Journal of Education, 9*(4), 236-246. Doi: 10.34293/education.v9i4.4142

Aslan, B. (2015). A comparative study on the teaching profession in Turkey and South Korea: Secondary analysis of TALIS 2008 data in relation to teacher selfefficacy. *Eurasian Journal of Educational Research, 61*, 1-22. http://dx.doi.org/10.14689/ejer.2015.61.1

Aydın, A. (2019). *İngilizce öğretmen adaylarının görüşleri çerçevesinde öğretmen eğitiminde 21. yüzyıl becerilerinin incelenmesi [The examination of 21st century skills in teacher education within the framework of English pre-service teachers' views]*. Master Thesis, Hacettepe University, Ankara.

Backfisch, I., Lachner, A., Hische, C., Loose, F., & Scheiter, K. (2020). Professional knowledge or motivation? Investigating the role of teachers' expertise on the quality of technology-enhanced lesson plans. *Learning and Instruction, 66*, Article 101300. https://doi.org/10.1016/j.learninstruc.2019.101300

Bandura, A. (1986). Social foundations of thought & action: A social cognitive theory. Upper Saddle River, NJ: Pearson Education.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bayraktar, R. (2015). Öğretmenlerin eğitim teknolojileri kullanım düzeylerinin belirlenmesi: Ölçek geliştirme çalışması [Determination of level of teachers' educational technology usage: A study of a scale development]. Master Thesis, Karadeniz Teknik University, Trabzon.

Bollen, K.A. (1989). *Structural equations with latent variables*. New York: John Wiley & Sons.

Boyraz, Z. (2008). *Türk eğitim sisteminde eğitim teknolojisinin eğitim-öğretim kalitesine etki*si [*The effect of education technology in education-teaching quality in Turkish education system*]. Master Thesis, Beykent University, İstanbul.

Brun, M., & Hinostroza, J. (2014). Learning to become a teacher in the 21 st century: ICT integration in initial teacher education in Chile. *Educational Technology & Society. 17*. 222-238.

Butler, D. L., & Schnellert, L. (2012). Collaborative inquiry in teacher professional development. *Teaching and Teacher Education, 28*, 1206–1220.

Canrinus, E. T., Helms-Lorenz, M., Beijaard, D., Buitink, J., & Hofman, A. (2012). Self efficacy, job satisfaction, motivation, and commitment: Exploring the relationships between indicators of teachers' professional identity. *European Journal of Psychology of Education, 27*(1), 115-132. Doi:10.1007/s10212-011-0069-2

Cemaloğlu, N., Arslangilay, A.S., Üstündağ, M.T., & Bilasa, P. (2019). Meslek lisesi öğretmenlerinin 21. yüzyıl becerileri özyeterlik algıları [21st Century Skills Self-Efficacy Perceptions of Vocational High School Teachers]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 20*, 845-874. doi:10.29299/kefad.2019.20.02.010

Chan, D. W. (2008). Emotional intelligence, self-efficacy, and coping among Chinese prospective and in-service teachers in Hong Kong. *Educational Psychology, 28*(4), 397–408. https://doi.org/10.1080/01443410701668372

Coşanay, G., & Karalı, Y. (2022). Examination of classroom teachers' 21st century teaching skills. *International Online Journal of Education and Teaching (IOJET), 9*(1), 432-448.

Çelebi, M., & Sevinç, Ş. (2019). Öğretmenlerin 21. yüzyıl becerilerine ilişkin yeterlik algılarının ve bu becerileri kullanım düzeylerinin belirlenmesi [Determining teachers' perceptions of efficacy regarding 21st century skills and their level of use of these skills]. 6. Uluslararası Multidisipliner Çalışmaları Kongresi (s.157-172). Retrieved from https://drive.google.com/file/d/1MjWKEurbEcBCzeB7ItMTC8zlDr_kHpi3/view

Çimen, E. (2022). The relationshıp between general self-efficacy and efficacy perceptıon for skıll teachıng: a study on physıcal educatıon and sports teachers (sample of the Mediterranean region)," *Revista On Line De Politica E Gestao Educacional,.26*(1).

Darling-Hammond, L. (2006). Securing the right to learn: Policy and practice for powerful teaching and learning. *Educational Researcher, 35*(7), 13–24. https://doi.org/10.3102/0013189x035007013

Day, C., Kington, A., Stobart, G., & Sammons, P. (2006). The personal and professional selves of teachers: Stable and unstable identities. *British Educational Research Journal, 32*(4), 601–616. http://dx.doi.org/10.1080/01411920600775316

Doering, A., Veletsianos, G., Scharber, C., & Miller, C. (2009). Using the technological, pedagogical, and content knowledge framework to design online learning environments and professional development. *Journal of Educational Computing Research, 41*(3), 319-346.

Drossel, K., Eickelmann, B., & Gerick, J. (2017). Predictors of teachers' use of ICT in school – the relevance of school characteristics, teachers' attitudes and teacher collaboration. *Education and Information Technologies, 22*. 10.1007/s10639-016-9476-y.

Eğmir, E., & Çengelli, S. (2020). Öğretmenlerin 21. yüzyıl öğretim becerilerinin yansıtıcı düşünmeyi uygulama becerilerini yordama gücü [The predictive power of teachers' 21st century teaching skills to apply reflective thinking]. *Tarih Okulu Dergisi, 45*, 1045-1077. doi: 10.29228/Joh41513

Elkatmış, M., Demirbaş, M., & Ertuğrul, N. (2013). Eğitim fakültesi öğrencileri ile formasyon eğitimi alan fen edebiyat fakültesi öğrencilerinin öğretmenlik mesleğine yönelik öz yeterlik inançları [Self-efficacy beliefs of students who take the pedagogic training program in the faculty of arts and sciences and students in the education faculty towards teaching profession]. *Pegem Eğitim ve Öğretim Dergisi, 3*(3), 41-50.

Ertmer, P., & Ottenbreit-Leftwich, A. (2010). Teacher technology change: How knowledge, beliefs, and culture intersect. *Journal of Research on Technology in Education. 42*. 255-284. 10.1080/15391523.2010.10782551.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadık, O., Sendurur, E., & Sendurur, P. (2012). Teacher Beliefs and Technology Integration Practices: A Critical Relationship. *Computers and Education, 59*, 423-435. https://doi.org/10.1016/j.compedu.2012.02.001

Fackler, S., Malmberg, L. E., & Sammons, P. (2021). An international perspective on Teacher self-efficacy: Investigating personal, cultural, structural and environmental factors. *Teaching and Teacher Education, 99*, 1e26. https://doi.org/ 10.1016/j.tate.2020.103255

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). How to design and evaluate research in education (8th ed.). New York: Mc Graw Hill.

Fraillon, J., Ainley, J., Schulz, W., Duckworth, D., & Friedman, T. (2019). IEA international computer and information literacy study 2018 assessment framework (p. 74). Springer, Cham, Switzerland. Retvieved form https://link.springer.com/book/10.1007/978-3-030-19389-8 ,13.02.2022.

Ghasembolanda, F., & Hashimb, F. B. (2013). Teachers' self-efficacy beliefs and their English language proficiency: A study of nonnative EFL teachers in selected language centers. *Procedia – Social and Behavioral Sciences, 103*, 890 – 89.

Gürültü, E., Aslan, M., & Alcı, B. (2019). Ortaöğretim öğretmenlerinin 21. yüzyıl becerileri kullanım yeterlikleri [Secondary School Teachers' Competencies in the Use of 21st Century Skills]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 35*(4), 780-798 doi:10.16986/HUJE.2019051590

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate data analysis*. 7th edition, Pearson, New York.

Hilton, M. (2018). *National Research Council Research on Future Skill Demands: A Workshop Summary*. The National Academies Press, Washington, DC.

İlgör, B. (2019). The Relationship Between English Teachers' Professional Identity Perceptions and Self-efficacy Beliefs. Master Thesis, Uludağ University, Bursa.

International Society for Technology in Education [ISTE]. (2000) National educational technology standards and performance indicators for teachers. Retrieved from http://www.iste.org/Content/NavigationMenu/NETS/ForTeachers/2000Standards/NETS_for_Teachers_2000.htm

Kara, A., Anagün, Ş. S., Boyacı, Ş. D., & Yaşar, S. (2022). Investigating the link between teachers' perceptions of 21st century skills efficiency and students' perceptions of learning experience: Mediating role of teacher's self-efficacy. *Journal of Pedagogical Research*, 6(4), 50-65.

Karadeniz, Ş., & Vatanartıran, S. (2015). Sınıf öğretmenlerinin teknolojik pedagojik alan bilgilerinin incelenmesi [Primary School Teachers' Technological Pedagogical Content Knowledge]. *İlköğretim Online, 14*, 1017-1028. doi:10.17051/io.2015.12578

Karahan, E. (2021). Fen eğitimi ve 21. yüzyıl becerileri. In Çavaş, P and Anagün, S. S. (Eds) 21. Yüzyılda Fen Bilimleri Öğretimi, pp.17-36, Ankara: Anı Yayıncılık.

Keengwe, J., Onchwari, G., & Wachira, P. (2008). Computer technology integration and student learning: barriers and promise. *Journal of Science Education Technology 17*, 560–565. https://doi.org/10.1007/s10956-008-9123-5

Kim, C., Kim, M., Lee, C., Spector, & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and Teacher Education. 29*. 76–85. 10.1016/j.tate.2012.08.005.

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.

Koh, J. H. L., Chai, C. S., Benjamin, W., & Hong, H. Y. (2015). Technological pedagogical content knowledge (TPACK) and design thinking: A framework to support ICT lesson design for 21st century learning. *The Asia-Pacific Education Researcher, 24*, 535-543.

Korkmaz, H. (2019). The effect of argumentation based science learning approach to 7th grade students' scientific epistemological beliefs and 21st century skills. Master thesis, Muğla Sıtkı Koçman University, Muğla.

Kuloğlu, A., & Karabekmez, V. (2022). The relationship between 21st-century teacher skills and critical thinking skills of classroom teacher. *International Journal of Psychology and Educational Studies, 9*(1), 91-101. https://dx.doi.org/10.52380/ijpes.2022.9.1.551

Lambert, J., & Gong, Y. (2010). 21st century paradigms for pre-service teacher technology preparation. *Computers in the Schools, 27*(1), 54-70.

Leigh, A., & Mead, S. (2005). Lifting teacher performance: Policy Report, Progressive Policy Institute, Retrieved from http://www.ppionline.org

Lemov, D. (2010). Teach like a champion: 49 techniques that put students on the path to college (K-12). Jo Wiley & Sons.

Marangunić, N., & Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. *Universal Access in the Information Society, 14*, 81-95.

Margerum-Lays J., & Marx R.W. (2002). Teacher knowledge of educational technology: a case study of student/mentor teacher pairs. In What Should Teachers Know About Technology? In Y. Zhao (Ed.), Perspectives and Practices (pp. 123–159). Information Age Publishing, Greenwich, CO.

Martin, L. E., & Mulvihill, T. M. (2019). Voices in education: Teacher self-efficacy in education. *The Teacher Educator, 54*(3), 195-205.

Ministry of National Education. (MoNE). (2016). Öğretmenlik mesleği genel yeterlikleri [General competencies of the teaching profession.]. Ankara: Öğretmen Yetiştirme ve Geliştirme Genel Müdürlüğü

Melvin, L. (2011). How to keep good teachers and principals: practical solutions to today's classroom problems. R&L Education.

Mojavezi, A., & Tamiz, M. P. (2012). The impact of teacher self-efficacy on the students' motivation and achievement. *Theory and Practice in Language Studies, 2*, 483-491. https://doi.org/10.4304/tpls.2.3.483-491

Mouza, C., & Karchmer-Klein, R. (2015). Designing effective technology preparation opportunities for preservice teachers. In: Angeli, C. and Valanides, N. (Eds.), Technological pedagogical content knowledge (pp. 115-136). Boston, MA: Springer. Retrieved from https://doi.org/10.1007/978-1-4899-8080-9_6

Nouri, J., Zhang, L., Mannila, L., & Norén, E. (2020). Development of computational thinking, digital competence and 21st century skills when learning programming in K-9. *Education Inquiry, 11*(1), 1-17. https://doi.org/10.1080/20004508.2019.1627844

OECD (2015). Education policy outlook 2015: Making reforms happen. Paris: OECD Publishing. Retrieved form https://www.oecd.org/education/EPO%202015_Highlights.pdf, 22.02.2023.

O'Neal, L.J.; Gibson, P.,& Cotton, S.r. (2017). Elementary school teachers' beliefs about the role of technology in 21st-century teaching and learning. *Computers in the Schools, 24*(3) 192-206. https://doi.org/10.1080/07380569.2017.1347443

Orhan Göksün, D. (2016). Öğretmen adaylarının 21. yüzyıl öğrenen becerileri ve 21. yüzyıl öğreten becerileri arasındaki ilişki [The relationship between 21st century learner skills use and 21st century teacher skills use]. Doctoral dissertation, Anadolu University, Eskişehir.

Orhan Göksün, D., & Kurt, A. A. (2015, 21-25 October). 21st century teacher skills using level inventory: Validity and reliability study in a sample of student teachers. Paper presented at The Seventh Asian Conference on Education (ACE), Kobe, Japan.

Özyurt, M. (2020). 21. yüzyıl becerileri öğretimi ölçeğinin Türk kültürüne uyarlanması: Geçerlik güvenirlik çalışması. *OPUS–Uluslararası Toplum Araştırmaları Dergisi, 16*(30), 2568-2594. http://dx.doi.org/10.26466/opus.725042

Pana, G. U., & Escarlos, G. S. (2017). Contemporary teaching strategies on students' attitude, academic performance and acquisition of the 21st century skills. *International Journal of Scientific & Technology Research, 8*(6), 332-337.

Partnership for 21st Century Skills [P21] (2009). A. framework for 21st century learning. Tucson: AZ: P21.

Pearl, J. (2012). The causal foundations of structural equation modeling. In R. H. Hoyle (Ed.), Handbook of structural equation modeling (pp. 68–91). The Guilford Press.

Pierson, M. E. (1999). Technology integration practice as a function of pedagogical expertise (Order No. 9924200). Available from ProQuest Dissertations & Theses Global. (304502093). Retrieved from https://www.proquest.com/dissertations-theses/technology-integration-practice-as-function/docview/304502093/se-2 at 22.02.2023

Pierson, M.E. (2001). Technology integration practice as a function of pedagogical expertise. *Journal of Research on Computing in Education, 33*(4), 413-429.

Rashid, T., & Asghar, H. M. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior, 63*, 604-612.

Ravitch, D. (2009). 21st century skills: An old familiar song. Retrieved from http://www.projo.com/opinion/contributors/content/CT_ravitch10_10-10-09_LDFO9TM_v10.3f8ee5e.html

Rotherham, A. J., & Willingham, D. T. (2010). 21st-century skills. *American Educator, 34*, 17- 20.

Saavedra, A., & Opfer, V. (2012). Teaching and learning 21st century skills: Lessons from the learning sciences. A Global Cities Education Network Report, New York: Asia Society. Retrieved from http://asiasociety.org/files/rand-0512report.pdf

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education, 128*, 13-35.

Sharif, A., & Cho, S. (2015). 21st-century instructional designers: bridging the perceptual gaps between identity, practice, impact and professional development. *RUSC. Universities and Knowledge Society Journal, 12*(3), 72-85. doi http://dx.doi.org/10.7238/rusc.v12i3.2176

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Shihab, M. M. (2008). Web 2.0 tools improve teaching and collaboration in high school English language classes. Doctoral dissertation, Nova Southeastern University, Florida.

Şengür, S. (2020). *Sınıf öğretmenlerinin bilişim teknolojilerini kullanım düzeyleri ve eğitimde Web 2.0 uygulamalarının kullanımına ilişkin görüşleri [Information technology usage levels of primary school teachers and teacher' views on the use of Web 2.0 applications in education].* Master Thesis, Eskişehir Osmangazi Üniversitesi, Eskişehir.

Schleicher, A. (2016). Teaching excellence through professional learning and policy reform: Lessons from around the world. Paris: International Summit on the Teaching Profession; OECD Publishing. https://doi.org/10.1787/9789264252059-en

Suwono, H., Mahmudah, A., & Maulidiah, L. (2017). Scientific literacy of a third year biology student teachers: Exploration study. *KnE Social Sciences*, 269-278. Retrieved from http://dx.doi.org/10.18502/kss.v1i3.747

Taimalu, M., & Luik, P. (2019). The impact of beliefs and knowledge on the integration of technology among teacher educators: A path analysis. *Teaching and Teacher Education, 79*, 101–110. https://doi.org/10.1016/j.tate.2018.12.012

Türel, Y. K., & Johnson, T. E. (2012). Teachers' belief and use of interactive whiteboards for teaching and learning. *Educational Technology & Society, 15*(1), 381–394.

Uyar, A., & Çiçek, B. (2021). 21st Century Skills of Different Field Teachers. *IBAD Journal of Social Sciences, 9,* 1-11.

Uzun, G., & Çokluk-Bökeoğlu, Ö. (2019). Investigation of relation between academic achievement and school, family and student's characteristics with multilevel structural equation modelling. *Ankara University Journal of Faculty of Educational Sciences, 52*(3), 655-684, DOI: 10.30964/auebfd.525770

Wilborn, J.W. (2013). Teacher self-efficacy: common core state standards within a 21st century skills framework. Doctoral dissertation, Liberty University, Lynchburg, VA.

Windschitl M. (2009). Cultivating 21st century skills in science learners: How systems of teacher preparation and professional development will have to evolve. National Research Council. Retrieved from http://www7.nationalacademies.org/bose/WindschitlPresentation.pdf

Yaşar, S. (2021). İlkokul dördüncü sınıf öğrencilerinin 21. yüzyıl öğrenme deneyimlerine yönelik algılarının incelenmesi [*Investigation of primary school fourth grade students' perceptions about 21st century learning practices*]. Doctoral dissertation, Anadolu University, Eskişehir.