Education and Science tedmem

Vol 42 (2017) No 190 107-130

The Relationship Between Pre-Service Teachers' Use of 21st Century Learner Skills and 21st Century Teacher Skills *

Derya Orhan Göksün [1], Adile Aşkım Kurt [2]

Abstract

The main purpose of this study is to test the hypothesis as teachers teach the way learn within the scope of 21st century learner skills and 21st century teacher skills. For this purpose; single survey, causal-comparative and correlational survey research models were conducted with co-utilization. The participants of the study were 2506 preservice teachers who were selected via cluster sampling technique from 54624 preservice teachers in Turkey. With this context; 21st century learner skills use scale and 21st century teacher skills use scale were developed and utilized to collect the data. According to research findings, preservice teachers use of 21st century learner skills and its sub dimensions (cognitive, autonomous, collaboration and flexibility, and innovativeness skills), and 21st century teacher skills and its sub dimensions (administrative, technopedagogical, affirmative, flexible teaching, and generative skills) above midlevel. In addition to these, preservice teachers' use of 21st century learner skills and 21st century teacher skills differ regarding university, department, and university*department. It was found that use of all sub dimensions of 21st century learner skills use predicts 21st century teacher skills use.

Keywords

21st century learner skills
21st century teacher skills
Preservice teachers
Teacher education
MANOVA
SEM

Article Info

Received: 01.19.2017
Accepted: 04.05.2017
Online Published: 05.04.2017

DOI: 10.15390/EB.2017.7089

Introduction

Changing and advancing conditions in the world have caused transformations in learning & teaching environments as in several other areas. This transformation contains several elements from technological infrastructure of the schools to the teacher skills. Learners and teachers, who are the stakeholders of the learning & teaching system are the prominent actors of this transformation. Especially after the introduction of the concepts of digital native and digital immigrant, learner and teacher roles have started to be explained with the abovementioned (digital nativity or immigration) traits. According to Palfrey and Gasser (2008), digital natives mostly interact with their friends and families. Individuals who digital natives interact the most following their friends and family are their teachers, coaches and advisors. Thus, it could be argued that teacher – learner interaction is a process

* This study is the summary of the doctoral dissertation titled " The relationship between 21st century learner skills use and 21st century teacher skills use" written by Derya Orhan Göksün and supervised by Adile Aşkım Kurt.

[1] Adiyaman University, Faculty of Education, Department of Computer Education and Instructional Technologies, Turkey, dorhan@adiyaman.edu.tr

[2] Anadolu University, Faculty of Education, Department of Computer Education and Instructional Technologies, Turkey, aakurt@anadolu.edu.tr

that should be managed carefully in the 21st century. According to this model that stresses the significance of the interaction between digital natives and their teachers, coaches and advisors, 21st century learners, who use technology as a part of their lives, in other words, to fulfill their daily needs, should not be left alone in this process and they should be guided (Palfrey & Gasser, 2008).

To provide active guidance for the learning processes, teachers must primarily know the learner well and plan the instruction based on the learner's traits (Melvin, 2011). This situation creates a need for 21st century teachers, who could establish a healthy relationship with 21st century learners - digital natives, know them and their characteristics and could guide them in learning & teaching processes. Responsible institutions to fulfill this need in Turkey, in other words, to train 21st century teachers, are faculties of education. Education faculties are responsible with equipping pre-service teachers, who are 21st century learners themselves in today's conditions, with 21st century teacher skills.

Defining the characteristics of the target audience when planning an instruction is quite important (Callison & Lamb, 2004). Learner stakeholder of today's education system is made up of 21st century learners. Thus, recognizing 21st century learners and defining their skills would help in providing for the effectiveness of instructional processes. 21st century learner skills were mentioned the first time in Turkey in a study conducted by Turkish Industrialists' and Businessmen's Association (TÜSİAD, 1999) to determine career requirements of the new millennium. Aforementioned study aimed to help improve occupational education by determining the requirements of the professions of the future and mapping vocations of the future. The study by TUIBA (1999) carried the personal traits of the new millennium to the agenda in the literature. As a result of the conducted literature review on the subject, it was decided that it would be adequate to scrutinize the new millennium learner traits proposed by OECD (Organization for Economic Cooperation and Development), the standards defined by AASL (American Association of School Librarians), the skills categorized under three main topics by Trilling and Fadel (2009), and the skills categorized under seven groups by Wagner (2008) since they were up to date and they proposed views that are usable in Turkish education system. These characteristics and skills that would form the theoretical infrastructure of the 21st century learner skills section of the current study are detailed below.

OECD New Millennium Learners: OECD, the institution of which Turkey is a founding member and which organizes PISA (Programme for International Student Assessment), is conducted every three years, has arrived at different findings in studies which conducted on learner skills and learning in different periods. In a study conducted by OECD in 2012, the relationship between association and education was investigated. In that study, it was reported that social values and approaches, sense of entertainment and cognitive skills of learners have changed. The source of this change was determined as the condition of being continuously online due to technology, which is becoming a part of interpersonal connections and/or the life itself (OECD, 2012). However, despite revealing the current situation, this study by OECD (2012) was shaped around being connected and/or online. Thus, the emphasis on technology is quite obvious. Another study conducted in OECD countries, Ananiadou and Claro (2009) revealed the basic learner skills achieved in curriculum of each country. According to this study, primary and middle school curricula in Turkey result in learners to acquire critical thinking, creative thinking, communication, research, problem solving, decision making and information and communication technologies skills. However, these aformentioned skills do not reveal those used and utilized by the learners in learning processes, but those aimed to achieve by the curricula. In addition, in a project realized by OECD and aimed to scrutinize certain difficulties experienced due to the changes in education, Pedro (2006) organized the skills of the learners of the new millennium in three main topics. These were "alternative cognitive skills," "change in cultural practices and social values," and "expectations regarding teaching and learning." In addition to OECD, AASL, which started to conduct various studies on 21st century learners in 1996, came up with several judgments that could create a holistic perspective on 21st century learners.

AASL Standards: AASL standards take face to face information sharing into account in addition to technology. Within the context of AASL standards, four different skill, resource and tool usage fields of research were determined these are critical thinking and acquiring knowledge; determining the outcomes, decision making, adapting the knowledge to new situations and creating new knowledge; ethical and productive participation and sharing knowledge as a member of a democratic society; and personal and aesthetic development were determined. AASL (2007) also developed various performance indicators for each abovementioned area under the subtopics of skill use, going into action, and responsibility and self-assessment strategies.

The research includes critical thinking and acquiring knowledge topic, skills that separate the individual from others such as researching the accuracy of the resource before inferring any information, comparing the acquired information with resources that refute this information, questioning the truth behind the knowledge, using different strategies than others during research or utilizing the resources in a different way. The strategies that learners use when structuring the information such as analysis, synthesis, assessment and organization were utilized in determining outcomes, decision making, adapting knowledge to new situations and creating new information,. Ethical and productive participation as a member of a democratic society and sharing the knowledge skills were defined as sharing acquired information or inferences with group partners or other individuals which they consider that would be affected by this information and conducting these processes by confining to ethical standards. On the other hand, personal and aesthetic development reflects personal traits and skills that would carry their areas of interest forward such as learners' use of personal codes, interests, creativity and the acquired knowledge for their personal development or to acquire knowledge for personal development.

An examination of AASL standards would demonstrate that these standards focused on the methods and aims of 21st century learners in utilizing skills, resources and tools. However, 21st century learning entails more personal and special skills such as innovativeness, acquiring knowledge and creativity in addition to using tools and resources. Thus, it is necessary to focus personal skills in a study that would be conducted with 21st century learners. This theoretical requirement revealed within the context of the study was met by the 21st century skills proposed by Trilling and Fadel (2009) and Wagner (2008).

21st Century Skills: Trilling and Fadel (2009) examined 21st century learner skills that they shaped around the 21st century skills studies which were conducted within the framework of Partnership 21 (P21, 2015) under three main topics and each with different number of subtopics. These main topics were "learning and innovation skills," "digital literacy skills," and "career and life skills." Learning and innovation skills had two subtopics; knowledge and skill rainbow and learning innovation and learning.

Knowledge and innovation rainbow is more comprehensive than all other mentioned skills. This is mainly due to the facts that since it includes the 21st century learners' processes of accessing the knowledge and structuring the knowledge, it could explain both other skill topics and performance indicators. In brief, digital literacy skills were organized by Trilling and Fadel (2009) to express knowledge curiosity, fluency in media use, learning skills constructed with technology. Thus, digital literacy skills basically include three literacy skills of information, media, and information and technology literacy.

Information literacy, in short, includes the ability to access information effectively and productively, to assess information with a critical and holistic perspective and to use this information accurately and creatively. Media literacy skills reflect the skills of 21st century learners to use 21st century media and communication tools such as video, podcast, web pages, web 2.0 tools in the process of learning these tools. Information and communication technologies literacy on the other hand, expresses the skills of integrating and using digital tools such as computers, tablets, mobile devices in learning processes effectively.

Career and life skills are simply defined as readiness for the occupational life and considering career plans as a part of the professional life and paying attention to personal development (Trilling & Fadel, 2009). When the defined 21st century learner skills are considered, it could be observed that Trilling and Fadel (2009) did not suggest clearly separate topics, but proposed skill topics that explain and interact with each other. In fact, information and skill rainbow subtopic explains career and life skills subtopic and a certain part of the digital literacy subtopic. Although there are views in the literature that 21st century skills could not be clearly separated from each other, similar to this interwoven structure (Prensky, 2003, 2006; Trilling & Fadel, 2009), Wagner (2008) classified 21st century learner skills under seven topics.

Seven Survival Skills: Wagner (2008) used the expression "survival skills" for 21st century skills, stressing the significance of these skills and the vital importance they possess in 21st century. These seven skills were based on "No Child Left Behind (NCLB)" rule (Wagner, 2008). NCLB reflects all skills necessary for every child to be active and successful in learning, career and citizenship processes and every child to effectively apply all acquired skills in life (Bush, 2001; Rudalevige, 2003; Smeeding, 2002; Wright, Wright, & Heath, 2006). NCLB argues that there should be no child left who did not acquire these skills in the education process (Wright et al., 2006). Based on this principle, Wagner (2008) listed 21st century learner skills as critical thinking and problem solving, intersystem and interpersonal collaboration and leadership, an agile mind and adaptability, entrepreneurship and initiative, effective verbal and written communications, access to knowledge and analysis of the acquired knowledge, and curiosity and imagination.

Critical thinking and problem solving skills reflect the skills of testing the accuracy of the acquired information, questioning the usability of this information, and adequately using acquired knowledge or knowledge to be acquired in solving problems. Collaboration across networks and leading by influence refers to the adaptation of 21st century learners to the systems they work at, obtaining information from each other based on collaboration, acquiring knowledge about other cultures and adapting to these cultures as a result. Agility and adaptability skills explain the skills of learning or producing novel and creative solutions to everyday problems, adaptation to both learning and professional environments and cultural changes and self-renewal based on these changes (Wagner, 2008).

Initiative and entrepreneurialism means utilization of self-management and self-control strategies to resolve the problems faced in the processes of acquisition of knowledge and professional life and taking initiative to direct their learning and professional lives based on their interests. Effective oral and written communication skills express that students can use their skills regarding both daily and writing language on published or digital writings effectively. Accessing and analyzing of knowledge skills reflect the skills that students need to cope with the 21st century information overload. According to Wagner (2008), ability to select the adequate information that would provide solutions for the problems at hand or benefit the individual among the immense amount of information available, to connect these pieces of information and induce solutions using this information consist the 21st century access and analysis skills. In addition, Wagner (2008) stressed that personal curiosity and imagination were important for both access to knowledge and in the processes of analysis and synthesis in using this knowledge.

In 21st century teacher skills, the purpose was both to define national proficiencies and skills based on national capabilities and to reveal the use of internationally accepted proficiencies and skills in the literature. Thus, the study was shaped around general teacher proficiencies determined by Turkish Ministry of National Education (MEB), International Society for Technology (ISTE) standards for teachers, 49 active instruction techniques proposed by Lemov (2010) and teacher assessment standards suggested by Melvin (2011).

Ministry of National Education General Teacher Proficiencies: MEB commenced studies to determine teacher proficiencies of today in 2001 with the project title of "How a contemporary teacher should be?". In 2008, a book including several sections on teacher proficiencies was published and in the book, general teacher proficiencies and special proficiencies required in different teaching branches were defined. In the book, general teacher proficiencies were presented as six main proficiency areas: "personal and professional values – career development," "getting to know the student," "teaching and learning process," "monitoring and assessing learning and development," "school, family and society relationships," and "curriculum and content knowledge" (MEB, 2008). These six proficiency areas contained different number of sub-proficiency areas.

Personal and professional values reflect the respect and appreciation teachers show for the personal traits of the students in career development proficiency area. Teachers support personal development of the students by keeping their sociocultural differences and interests in mind. To resolve the problems that they encounter in this process, they seek the support of their colleagues, administrators and experts. MEB (2008) expects teachers to be aware of professional development needs in addition to their personal development needs.

The proficiency area of getting to know the student corresponds to knowing all personal traits of individual students. In addition to cultural, social, physical and environmental traits, teachers should know about learning styles, fields of interest and strengths and weaknesses of their students. The performance indicators related to the planning, implementation and administration of teaching – learning processes by the teacher are defined under the topic of teaching and learning process. Within the context of the proficiency area of monitoring and assessment of the development, teachers are expected to monitor and assess the development of students and and to get stduents to evaluate each other's work, namely do peer evalution. Furthermore, teachers are expected to share assessment results with the student, parents, administration and colleagues within the context of this proficiency area.

In school, family and social relationships proficiency area, teachers are expected to be aware of natural, economical and sociocultural characteristics of school environment. It is necessary for the teachers to contribute to the development process for the school and the environment within the context of these characteristics. Teachers are expected to know basic values and principles of Turkish National Education system within the realm of curriculum and content knowledge proficiency area. In addition, teachers should know and implement the approaches, purposes, methods, principles and techniques of the curriculum of their special fields. In addition to national proficiency area, there are also certain internationally accepted standards (Elmore, 2007; Zemelman, Daniels, Hyde, & Varner, 1998). One prominent standard under this category is ISTE standards for teachers.

ISTE Standards for Teachers: ISTE is an international association which first in 1993 commenced studies on establishing standards that defined the proficiencies which educational technology users should possess and finally in 2008, proposed education technology utilization standards in five different areas (student, teacher, administrator, coaches and computer science educators) divided further into various fields (Orhan, Kurt, Ozan, Som Vural, & Türkan, 2014). ISTE standards for teachers are the standards developed by the related organization in 2000 and revised in 2008 and they explain technology use proficiencies of the teachers. These standards were improved in 2008 within the context of a project that aimed to train the teachers of the future and they were published as National Educational Standards for Teachers (NETS-T) (ISTE Standards-T, 2008). However, in 2015, the name of these standards was amended and became "ISTE Standards for Teachers" (ISTE, 2015). Based on the proficiency areas available in the 2008 update of the standards (as cited in Orhan et al., 2014), in the proficiency area of facilitating students' learning and promoting their creativity, teachers are expected to be role models for the students, support and encourage them to promote their creative and innovative thinking, solving their problems in real life using technologies and achieving high level knowledge. In the proficiency area of digital age learning environments and design and development of assessment

activities, it was stated that teachers should use current technologies, and should not only consider knowledge, but also skills and attitudes when assessing their students. In being a role model in digital age work and learning proficiency area, teachers are expected to present their knowledge, skills and experiences using global and digital resources, in other words, transfer their experiences in using these resources by being a role model in this respect. Being a role model for digital citizenship entails the necessity of teachers being knowledgeable about cultural issues or problems that occur in digital environments and a role model for their students on these issues. On the other hand, participating in career development and leadership activities proficiency area stresses that teachers should be up-to-date when using digital resources and tools and should use lifelong learning skills when providing assistance to their colleagues in using these technologies (Orhan et al., 2014).

ISTE standards for teachers is generally accepted in international literature, proposed standards were shaped based on educational technologies consistent with the purpose of that institution. However, teacher skills, in addition to technology use, includes skills that are used in the classroom environment such as pedagogic skills and communication skills (Ainley & Luntley, 2007). Therefore, in this study resources from internationally renowned literature that propose additional skills for teachers' use of technology have been used. The first among these resources is the techniques proposed by Lemov (2010) for teachers to use in providing an active instruction.

49 Techniques of Active Instruction: In addition to general teaching proficiencies stipulated for teaching profession by MEB and ISTE standards for teachers, Lemov (2010) listed 49 techniques that could be used for good instruction under seven topics. These topics are; "setting high academic expectations," "planning that ensures academic achievement," "structuring and delivering your lessons," "engaging students in your lessons," "creating a strong classroom culture," "setting and maintaining high behavioral expectations," and "building character and trust." According to Lemov (2010), who claimed that academic expectations increased the achievement of students, even students who experienced failure in their past make an effort when they face high expectations.

Under the topic of planning for academic success, there are six techniques that could be perceived different to implement in classroom, yet play a significant role in the success of the remaining 43 techniques. The activities under the structuring and presenting the course topic are explained with a gradual system called "me/us/you." "Me" in this system reflects the activity of structuring or modeling the key concepts of instruction by the teacher. In the "us" stage following the "me" process, the teacher expands the key concepts in interaction with the students, enabling the participation of learners in the structuring process. At the final stage of "you," an opportunity is provided for the learners to apply the knowledge they structured.

Lemov (2010) proposed attracting the attention of the student to the course or the teacher using various games, questions, unusual stimuli, enabling the active participation of the student in the classroom. The topic of creating a strong class culture includes techniques proposed to transform the classroom into an environment where students worked very hard and exhibited their exemplary characters. Creating and maintaining high behavioral expectations topic reflects the processes in which the student would create and reinforce positive behavior that the student should exhibit in the class. In the first glance the topic of creating and sustaining high behavioral expectations may look similar to the academic expectations topic. While the techniques scrutinized under academic expectations topic finalize with success, in other words with the realization of the expectations, on the other hand, the techniques used under behavioral expectations finalize with sustainability of the behavior, in other words, reinforcement processes. Lemov (2010) argued that a good teacher should be self-oriented, well-read individual who could create a positive and emotionally safe environment in the class and could address the whole classroom. Lemov (2010) claimed that only then the teacher would be effective and productive.

How to Be a Good teacher?: Melvin (2011), who started to work to propose a new model that focuses on teacher performances and could be used in teacher assessments, developed a group of performance criteria for teachers. These criteria were listed as "organization of the environment for change," "organization of personal area and materials," "Reflective instruction model," "being a model as a leader," "performing applications in breaks between classes," "collaboration with parents," and "creating a citizenship culture". According to Melvin (2011), it is necessary to assess the extend to which teachers used the skills that were determined in the criteria listed in instructional activities. When a teacher uses these skills at a high level, it could be concluded that the teacher is a good teacher.

The current study aimed to reveal pre-service teachers' use of 21st century learner and teacher skills that are required to quide 21st century learners. The relationships between the use of the abovementioned skills were the main conundrum of the current study. Thus, since obtaining information on 21st century learner traits and skills and 21st century teacher traits and skills is significant in this context, these skills are scrutinized holistically below. As individuals, teachers are expected to plan instructional activities parallel to their own learning abilities. The main purpose of the current study is to identify the relationship between the use of 21st century learner skills by pre-service teachers as 21st century learners and prospective 21st century teachers, and their use of 21st century teacher skills. In this context, the current study seeks answers for the following research questions:

1. What is the level of pre-service teachers 21st century learner skills use?
2. What is the level of pre-service teachers 21st century teacher skills use?
3. Do utilization of 21st century learner and teacher skills by pre-service teachers differentiate based on
    a. gender,
    b. department,
    c. universities?
4. Is there a significant relationship between pre-service teachers' use of 21st century teacher skills and 21st century learner skills sub-dimensions? If there is, how does this relationship can be defined?

Method

In this section, information on the research design, population and sample, data collection tools, and processes of data collection and analysis are presented.

Research Design

The current study was conducted with co-utilization of single survey, causal-comparative and correlational survey research models. Single survey research models are research models that are conducted to identify the current status of individual variables as a type or amount (Karasar, 2003). The first and second research questions aim to reveal 21st century learner and 21st century teacher skills of pre-service teachers. Findings related to aforementioned research questions were attempted to be determined as types based on the factors and as amounts based on the levels. Thus, research questions were answered using single survey research model.

Causal-comparative research models are those that examine whether an experienced situation or a case was differentiated based on one or more variables (Sönmez & Alacapınar, 2013). In addition, causal-comparative research models aim to determine the reasons and results of differences between human groups without an intervention on conditions and participants (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel; 2013). The third research question was posed to test whether two dependent variables of the study (21st century learner and 21st century teacher skills uses) differentiated based on independent variables (gender, department and university). Since dependent variables would be grouped based on independent variables and the source of the difference would be investigated, causal-comparative research model was preferred.

The answer for the fourth research question was researched with correlational survey research model. This model is used to determine the relationship between several variables or to make estimations based on this relationship (Fraenkel, Wallen, & Hyun, 2012). For the fourth research question, the relationship between 21st century learner skills sub-dimensions and the use of 21st century teacher skills variables was investigated. Since a model was proposed for the literature based on these relationships, it was considered appropriate to use this research model in responding the research question.

Participants

During data collection stage from the population, cluster sampling technique, one of the random sampling methods, was adopted. The cluster of the current study included 65 state universities' graduated students in the 2014 – 2015 academic year. To determine the number of potential graduates from these 65 universities, 2011 Student Selection and Placement System (ÖSYS) Selection Guide (Center of Assessment Selection Placement [ÖSYM], 2011) was examined. After the examination, the number of potential senior students in faculties of education in 2014 – 2015 academic year was estimated. It was expected that there should be 54624 senior pre-service teachers in 65 different state universities. Education faculty of each university in that group was considered as a cluster and a random university selection was conducted. The selection was maintained until the number of pre-service teachers reached 20% of the population size. According to Arıkan (2004), if the number of units in the determined sample equals to 20% of the population, this could be used as an approach to determine the sample size. Since the total number of potential pre-service teacher graduates was 54624, selection was sustained until the sample size reached to 11180, beyond the 20% count of 10925. The ratio of the number of potential graduate pre-service teachers in the universities included in the sample to the number of total possible pre-service teacher graduates, in other words, the ratio of the number of units in the sample to the number of units in the population was over 20% (11180 / 54624 = 20.5%). Thus, it was concluded that the determined sample size represented the population and data collection phase was initiated. Data collection was on a voluntary basis. Data was collected from pre-services teachers that were accessible and voluntary during the data collection process. Distribution of participating pre-service teachers who responded to the data collection tools based on gender, department and universities are presented in Tables 1, 2 and 3, respectively.

Table 1. Distribution of Participating Pre-Service Teachers Based on Gender

Gender	*f*	%
Female	1581	63.1
Male	866	34.6
Undeclared	59	2.4
Total	2506	100

Table 2. Distribution of Participating Pre-Service Teachers Based on Their Departments

Department	*f*	%
Computer Education & Instructional Technology	249	9.9
Educational Sciences	580	23.1
Fine Arts Education	88	3.5
Primary Education	1188	47.4
Special Education	144	5.7
Foreign Languages	39	1.6
Other	130	5.2
Undeclared	88	3.5
Total	2506	100

Table 3. Distribution of Participating Pre-Service Teachers Based on Their Universities

University	***f***	**%**
Balıkesir	364	14.5
Necmettin Erbakan	338	13.5
Fırat	427	17.0
Kilis 7 Aralık	180	7.2
Uşak	292	11.7
Dicle	65	2.6
Ankara	150	6.0
Gazi	138	5.5
Ahi Evran	328	13.1
Mehmet Akif Ersoy	144	5.7
Hacettepe	80	3.2
Total	2506	100

Total participants in the data collection process in Turkey sample was 2506. Dataset was formed with the data obtained from these participants and the analysis process was initiated and whenever deemed necessary, extreme values were excluded from the dataset and the number of sample was reduced to 2473.

Data Collection Tools

21st century learner skills use scale and 21st century teacher skills use scale were utilized to collect the data. 21st century learner skills use scale was developed by Orhan and Kurt (2015) based on the resources by OECD, AASL (2007), Wagner (2008) and Trilling and Fadel (2009). The scale contains four factors of cognitive skills, autonomous skills, collaboration and flexibility skills, and innovation skills and 31 items. Total explained variance of the scale was calculated as 34.75% and the internal consistency coefficient was found as .892 (Orhan & Kurt, 2015). The main reason of total explained variance of this scale is conducting maximum likelihood method to enhance context validity (Kline, 1993). The established structure was confirmed using confirmatory factor analysis as well (χ^2 / df = 0.65; p = 1.00; RMSEA = 0.00). 21st century teacher skills use scale was also developed on the basis of MEB general teacher proficiencies, ISTE standards for teachers, and the resources by Lemov (2010) and Melvin (2011) (Orhan Göksün & Kurt, 2015). The scale includes 27 items grouped under five factors of administrative skills, technopedagogical skills, confirmative skills, flexible teaching skills and productive skills. Total explained variance of the scale was calculated as 40.33% and the internal consistency coefficient was found as .870 (Orhan & Kurt, 2015). The established structure was confirmed using confirmatory factor analysis as well (χ^2 / df = 0.87; p = 0.95; RMSEA = 0,00). Both data collection tools are in the form of five-point Likert-type scale that expresses the frequency of use. Total scores for the scales were calculated by totaling the points scored in each item and dividing this total by the number of items, in other words by taking the arithmetic mean. Thus, standard scores were obtained for all data collection tools and more valid and reliable statistical comparisons were obtained (Orhan Göksün, 2016).

Procedure

Necessary permissions were obtained to conduct data collection processes in ethical standards. Following the documents of ethical committee approvals from 11 universities where the data would be collected, data collection procedures were initiated. Both data collection tools were printed on one form and posted to 11 universities earmarked for collection of data from attending senior pre-service teachers. Thus, it was possible to collect responses from the same individual in both data collection tools. This fact facilitated to reach the model that was developed for 21st century learner skills use and 21st century teacher skills use, which was the main purpose of the study. Participation to the study was based on a voluntary basis. Associated with the ethical approvals, individuals that participated voluntarily completed the forms. Thus, although the possible number of participants were 11180, only 2506

participants completed the forms. Whenever necessary, the researchers visited the universities in the sample to administrate the data collection procedure. In other cases, a form, prepared by the researchers, that explained the issues that need to be considered during the data collection process was sent to the universities. Otherwise, data collectors were supported via e-mail and phone.

Results

There are some preconditions for MANOVA and structural equation modelling (SEM) which were conducted for answering research questions. These are (Pallant, 2007);

1. There have to be more cases each cell than dependent variables.
2. Withdrawing outliers from data set.
3. Data have to be distributed univariate and multivariate normally.
4. Multicollinearity and singularity.
5. Homogenity of varience-covarience matrices These preconditions were analyzed and it was seen that all these preconditions were met. The case number were 2473 after withdrawing data from data set and all analysis were conducted on this withdrawn set.

At which level pre-service teachers use 21st century learner skills?

Standardized total scores obtained in 21st century learner skills use scale were used to answer this research question. In addition to the total score obtained, the research question was responded by obtaining standardized total scores for each factor, in other words, for each sub-dimension as well. These standardized scores are displayed in Table 4.

Table 4. Scores Obtained From 21st Century Learner Skills Use Scale And Each Factor Therein

Score	n	$\bar{x}$	sd
Cognitive skills use	2473	4.23	.458
Innovation skills use	2473	4.02	.714
Collaboration and flexibility use	2473	3.81	.640
Autonomous skills use	2473	3.78	.608
Total score of 21st century learner skills use	2473	3.96	.483

Table 4 demonstrates that the scores of pre-service teachers on 21st century learner skills use scale were listed in descending order as cognitive skills, innovation skills, collaboration and flexibility skills, and autonomous skills. The reason behind the fact that cognitive skills were the most used skills was the higher rate of utilization of cognitive skills by students in the education system. However, the fact that autonomous skills were the least used skills among the learner skills could be seen as an indication of the pre-service teachers utilizing self-management skills less than other skills.

Since 21st century learner skills use score was standardized, it is known that a pre-service teacher could obtain 1 – 5 points. The fact that 21st century learner skills use score of pre-service teachers was higher than the midpoint 3 ($\bar{x}_{21stcenturylearnerskillsuse} = 3.96$) could be accepted as an indicator that pre-service teachers used 21st century learner skills at a level over the average. However, this average is not very close to the highest score of 5. Thus, it could be said that use of the related skills by the pre-service teachers was not at high levels.

At which level pre-service teachers use 21st century teacher skills?

21st century teacher skills use scores for pre-service teachers was calculated by the mean scores obtained from 21st century teacher skills use scale scores for five sub-factors and general use scores. To answer the research question, mean scores were compared. The related scores are presented in Table 5.

Table 5. Scores Obtained For Each Factor On 21st Century Teacher Skills Use Scale

Score	n	$\bar{x}$	sd
Confirmatory skills use	2473	4.57	.471
Administrative skills use	2473	4.18	.495
Productive skills use	2473	4.11	.710
Flexible teaching skills use	2473	3.90	.808
Technopedagogic skills use	2473	3.77	.464
Total score of 21st century teacher skills use	2473	4.11	.451

As shown in Table 5, the scores of pre-service teachers on 21st century teacher skills use scale were listed in descending order as confirmatory skills, administrative skills, productive skills, flexible teaching skills and technopedagogical skills. Confirmatory skills reflect the respect and reinforcement of the learner behavior. The fact that the highest score obtained in the scale came from that factor ($\bar{x}_{confirmatoryskilluse}$ = 4.57) could be considered as an indicator that future teachers had a confirmatory attitude towards the personal traits and positive behavior of the learners. However, the low scores obtained in the use of technopedagogical skills that are considered to increase the productivity of instruction process in the literature (Ceylan, 2015) could demonstrate that technopedagogical skills of pre-service teachers were at a lower level when compared to other skills, but it could also indicate that they did not use these skills as much as others in instruction processes. 21st century teacher skills use score ($\bar{x}_{21stcenturyteachingskillsuse}$= 4.11), which has a maximum point of five and a midpoint of 3, indicated that it was above the midpoint and even closer to the maximum score possible. This case demonstrated that pre-service teachers used 21st century teacher skills, which are scrutinized in the current study, in instruction processes.

Do 21st Century Learner and Teacher Skills Uses by Pre-Service Teachers Differentiate Based On Demographic Variables (Gender, Department, University)?

In answering this research question, MANOVA parametric test was conducted. The superiority of analysis of variance when compared to other comparative tests is its capacity to include the interaction between independent variable or variables in the analysis and reduce the margin of error in the final analysis (Akbulut, 2010; Huck, 2012; Tabachnick & Fidell, 2012). MANOVA is conducted in cases where there is more than one dependent variable and makes it possible to calculate the interaction between dependent variables in the analysis and is one of the most powerful analysis methods, reducing the margin of error considerably (Can, 2014). Since there was two dependent and three independent variables in the current study, data analysis was conducted with MANOVA to increase the reliability of findings and to reduce the margin of error. MANOVA findings are given in Table 6.

Table 6. Simultaneous Comparison of 21st Century Learner Skills Use And 21st Century Teacher Skills Use of Pre-Service Teachers Based on Demographical Variables

Source of the Variance	F	df	η^2	Power	p
University	3.106	20	.014	1.000	**.000**
Gender	4.018	2	.004	.719	**.018**
Department	2.764	12	.007	.988	**.001**
University * Gender	1.684	20	.007	.968	**.029**
University * Department	1.919	50	.021	1.000	**.000**
Gender * Department	.660	12	.002	.396	.791
University * Gender * Department	.822	48	.009	.926	.805

MANOVA findings displayed in Table 6 demonstrates that there was no significant difference when three independent variables were considered simultaneously ($F_{(university*gender*department)48} = .822$; $p > 0.05$). Furthermore, MANOVA result where gender and department variables were considered in conjunction was not significant either ($F_{12} = .660$; $p > 0.05$). When power ratings for the abovementioned analyses are considered, and since the power for the analysis where the three variables were considered simultaneously was above .80 ($Power_{(university*gender*department)} = .926$), it could be said that sample size was adequate (Cohen, 1988), however the power of the analysis where gender and department variables were compared simultaneously was quite low ($Power_{(gender*department)} = .396$) (Cohen, 1988). This fact indicated that a larger sample was required to compare gender and department variables simultaneously. Analysis of the other variables presented in the table showed that 21st century learner skills use and 21st century teacher skills use by pre-service teachers differentiated individually based on university, gender and department variables ($F_{(university)20} = 3.106$; $p < 0.05$), ($F_{(gender)2} = 4.018$; $p < 0.05$), ($F_{(department)12} = 2.764$; $p < 0.05$). However, it was also observed that the abovementioned dependent variables differentiated based on the MANOVA model where university and gender, and university and department variables were considered together ($F_{(university*gender)20} = 1.684$; $p < 0.05$), ($F_{(university*department)50} = 1.919$; $p < 0.05$). It was observed that the effect sizes were low (Cohen, 1988). When power of the same variables were examined, it was determined that adequate sample sizes were obtained for all variables ($Power_{(university)} = 1.000$; $Power_{(department)} = .988$; $Power_{(university*gender)} = .968$; $Power_{(university*department)} = 1.000$) except the gender variable ($Power_{(gender)} = .719$). However, since the calculated power rating for the gender was close to the value of .80, it could be argued that it was at an acceptable level (Cohen, 1988). All these findings demonstrated that the aforementioned differences between the dependent variables, in other words, 21st century learner skills use and 21st century teacher skills use, were statistically significant, sample size was adequate for the conducted analysis, however, there were other variables that caused the differences as well.

Path diagram that explains the relationship between the sub-dimensions of 21st century learner skills use and 21st century teacher skills use

Path analysis is a statistical method considered under SEM and used to model the explanatory relationships between variables that are interrelated and/or accepted in the literature (Çelik & Yılmaz, 2013). The views that teachers teach the way they learn (Burns & Sinfield, 2004; Minton, 2005; Tennant, McMullen, & Kaczynski, 2009), which form the general framework of the current study and the reason for the use of this method to answer the research questions, established the general theoretical framework of the path analysis. These views indicate that sub-dimensions of 21st century learner skills use are predictors of 21st century teacher skills use. Thus, it was considered appropriate to define paths from 21st century learner skills use sub-dimensions to 21st century teacher skills use in SEM.

Pintrich and DeGroot (1990) argued that self-oriented individuals used cognitive strategies in a more active manner. However, Pajares and Kranzler (1995) claimed that self-controlled students use their cognitive skills more actively as they use self-control mechanisms. When it is considered that autonomous skills, one of the dimensions proposed in the current study, explained autonomous learning skills that are realized as a result of integration of self-management, self-control skills and skills to work individually or within a group, it was proposed to define a path from 21st century learner skills sub-dimension autonomous skills to cognitive skills based on the study by Pajares and Kranzler (1995).

To develop cognitive skills of learners, it is necessary to include them in mutual learning techniques and collaborative activities by being a model for one another and guiding each other (Perkins & Salomon, 1989). Ryan and Pintrich (1997) claimed that students with low level social and cognitive skills have problems in asking the assistance of their peers, and thus, they fail in collaborative activities. Based on these resources, it was decided to define a path from 21st century learner skills sub-dimensions collaboration and flexibility skills to cognitive skills.

Self-control and self-management skills reflect personal skills and abilities (Leung, Siu, & Spector, 2000; Rotter, 1966; Yalçın, Tetik, & Açıkgöz, 2010). Similarly, innovativeness that implies adaptation of innovations before other individuals (Rogers, 2010) is a personal trait as well. However, collaboration skills require interpersonal communication ability (Slater & Ravid, 2010). Bearing in mind that self-control and self-management skills were considered within the context of autonomous skills in the current study and based on the information that collaboration implies interpersonal skills, and autonomous skills and innovativeness implies personal skills, making path definitions between autonomous skills and collaboration and flexibility skills, and between innovation skills and collaboration and flexibility skills was not possible. In addition, in a study, Tabak, Erkuş, and Meydan (2010) did not find a relationship between innovative individual behavior and locus of control, more clearly, having internal control or external control and innovative individual behavior. Thus, a path was not defined between innovative skills and autonomous skills.

To define paths in SEM in addition to the theoretical framework, at least an intermediary level relationship must exist between the variables (Çelik & Yılmaz, 2013). Variables within the scope of the current study are the scores obtained throughout the 21st century teacher skills use scale and in the sub-dimensions of the 21st century learner skills use scale. Abovementioned relationship was found using Pearson coefficient, since the variables were continuous and exhibited a normal distribution (Field, 2009). Obtained findings are presented in Table 7.

Table 7. Correlation Between 21st Century Teacher Skills And 21st Century Learner Skills Use Sub-Dimensions

n= 2473	**Cognitive learner skills**	**Autonomous learner skills**	**Collaboration and flexibility learner skills**	**Innovation learner skills**
Autonomous learner skills	.526**	-	-	-
Collaboration and flexibility learner skills	.593**	.556**	-	-
Innovation learner skills	.529**	.411**	.507**	-
21st century teacher skills	.699**	.407**	.559**	.455**

According to Büyüköztürk (2012), coefficients below 0.30 define low; coefficients between 0.30 and 0.70 define intermediate; and coefficients over 0.70 define high level of correlation when interpreting the correlation coefficients displayed in Table 7. Based on these ranges, it could be observed that there was an intermediary level correlation between all variables that were subjected to path analysis. Here, a path could be defined between each variable, however, since there was no correlation between autonomous skills and innovative skills as demonstrated in the literature, and no studies were found in the literature that scrutinized the relationships between autonomous skills and collaboration and flexibility skills, and innovation skills and collaboration and flexibility skills, path definitions between these dimensions were not conducted. The model is presented in Figure 1 below:

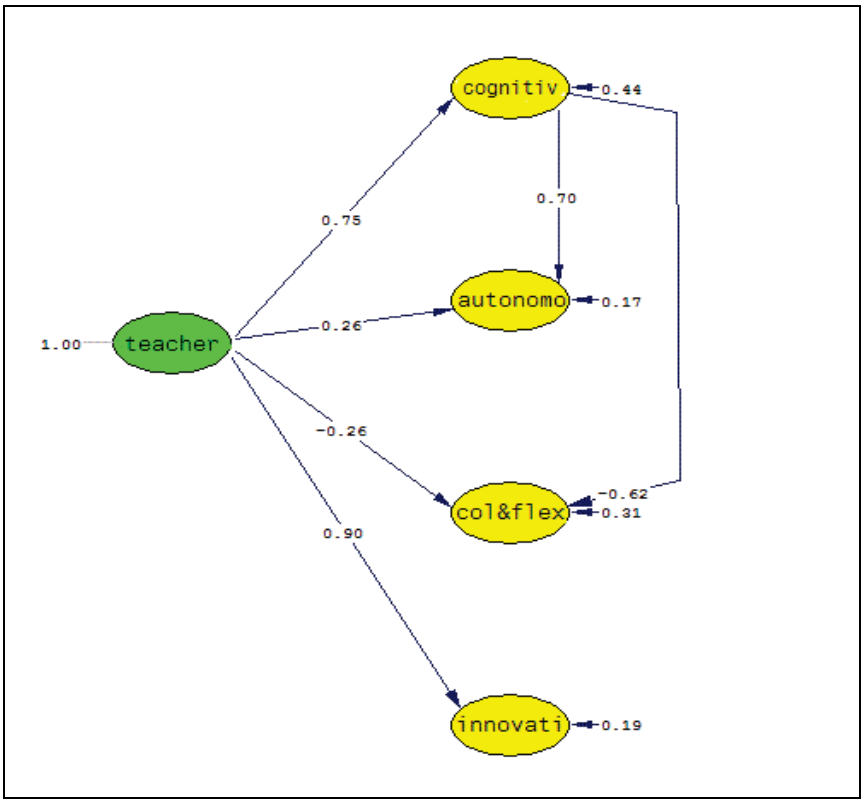

Figure 1. Structural Equation Model Created Based on 21st Century Teacher Skills Use And 21st Century Learner Skills Sub-Dimensions Use

Examination of the model displayed in Figure 1 shows that all defined paths were significant and adequate. In other words, all 21st century learner skills use sub-dimensions predicted 21st century teacher skills use and significant paths could be defined from all sub-dimensions to 21st century teacher skills use. Furthermore, 21st century learner skills use sub-dimensions autonomous skills and collaboration and flexibility skills predicted cognitive skill use by pre-service teachers. In addition to the form of the model, fit indexes of the model are important as well. Model indexes could be similarly analyzed using confirmatory factor analysis, one of the structural equation models. Fit indexes of the model are presented in Table 8.

Table 8. Structural Equation Model Fit Indexes Established Based on 21st Century Teacher Skills And 21st Century Learner Skills Sub-Dimensions

Fit Index	Best Fit Index	Observed Fit Index	Reference
χ^2/df	0≤ χ^2/df≤2	1.83	(Tabachnick & Fidell, 2012)
p value	.05≤p≤1.00	0.96	(Hoyle, 1995)
RMSEA	0≤RMSEA≤.06	0.05	(Schumacker & Lomax, 2004; Thompson, 2004)
SRMR	0≤SRMR≤.05	0.05	(Kenny, 2010)
NFI	.95≤NFI≤1	0.95	(Kenny, 2010)
NNFI	.95≤NNFI≤1	0.98	(Arbuckle, 2007)
CFI	.95≤CFI≤1	0.98	(Hu & Bentler, 1999)
GFI and AGFI	GFI>AGFI	0.85>0.83	(Blunch, 2008; MacCallum & Sehee, 1997)

χ^2=1011.05; df=554

As demonstrated in Table 8, fit indexes of the created model fit within the range of the best fit indexes. Thus, it could be stated that there was a significant relationship between 21st century teacher skills use and cognitive, autonomous, collaboration and flexibility and innovativeness learner skills. Furthermore, the relationships defined between cognitive learner skills and autonomous and collaboration and flexibility skills were significant as well.

Discussion, Conclusion and Suggestions

Within the framework of the purposes of the study, 21st century learner skills use and 21st century teacher skills use of pre-service teachers were examined under four dimensions of;

- Cognitive skills
- Autonomous skills
- Collaboration and flexibility skills, and
- Innovation skills.

21st century teacher skills were analyzed in five dimensions of;

- Administrative skills
- Technopedagogic skills
- Confirmative skills
- Flexible learning skills, and
- Productive skills.

Obtained use scores are interpreted bearing in mind the facts that the highest score that could be obtained in the scales and sub-dimensions of the scales was five, mean was three, and the minimum score was one. Thus, the analysis of pre-service teachers' use of 21st century learner skills and its sub-dimensions, over-the-mean levels use scores were observed for all items ($\bar{x}_{cognitiveskills} = 4.23$, $\bar{x}_{innovationskills} = 4.02$, $\bar{x}_{collaborationandflexibilityskills} = 3.81$, $\bar{x}_{autonomousskills} = 3.78$, $\bar{x}_{21stcenturylearnerskillsuse} = 3.96$). Over the midpoint use score could be an indicator of the fact that the related skill was used over the mid level. Use rates of abovmentioned skills by pre-service teachers indicate that cognitive skills were the most widely used skills, whereas autonomous skills were the lowest used.

According to Young (2012), instructional activities designed by teachers who experience generation conflict with their learners could only activate cognitive processes. For these activities to use other skills of the learners as well, initially the teachers should know learners and then design the instructional activities accordingly. The fact that the findings of the current study, which indicate cognitive skills were the most frequently used skills, could be interpreted as the generation conflict that today's students experience with their teachers. Furthermore, PISA results demonstrated that Turkey was behind the desired level despite recent investments in education. PISA is not designed to measure how far the students comprehend the course content, but how much they were able to use the knowledge they acquired in classes in the real life and/or in solving the problems they encounter (Anıl, Özer Özkan, & Demir, 2015). Turkey was unable to reach a desired level in the list created with the country results obtained in this exam. Thus, it could be stated that high level use of cognitive skills by the students was not sufficient to solve the problems of the contemporary life. In the current study, it was observed that pre-service teachers used cognitive skills at a high level, however, their use of skills that are used to resolve real-life problems such as autonomous skills, collaboration and flexibility skills was close to the intermediate level. The finding that pre-service teachers mostly used the 21st century learner cognitive skills is consistent with PISA results. When it is considered that PISA is an assessment of whether students could transfer what they have learned to other and real-life problems and issues, the fact that students predominantly use their cognitive skills could explain that Turkey falls behind of

other OECD countries in this test (Anıl et al., 2015; Çelen, Çelik, & Seferoğlu; 2011). One of the theoretical pillars of the 21st century teacher skills scale, developed for the current study, was the OECD standards. The reason behind the consistency between the data obtained on 21st century learner skills use and the PISA results could be the fact that the scale was based on the OECD standards.

Curriculum for teacher training undergraduate programs designed in the workshops conducted in 2006 has been implemented in faculties of education since 2006 – 2007 academic year. Albeit flexible, this curriculum generally includes 50% field knowledge and skills, 30% teaching occupation knowledge and skills, and 20% general knowledge courses (Council of High Education [YÖK], 2007). Another reason for the higher level of cognitive skill use than the other skills by pre-service teachers studying in the current teacher training programs could be the high concentration of field knowledge courses and low number of general knowledge courses that they could transfer the knowledge acquired in the field courses in the training program.

Instructional design processes start with the phase of audience analysis (Fer, 2009; Gagne, Wager, Golas, Keller, & Russell, 2005; Şimşek, 2009). For pre-service teachers to conduct effective target audience analysis, their use of 21st century learner skills should be developed. In other words, pre-service teachers who are more aware of their own learning and skills could conduct more effective audience analysis and it is a requirement to improve these skills beyond the current level.

It was observed that 21st century teacher skills use and sub-dimension scale scores of pre-service teachers were $\bar{x}_{confirmativeskills} = 4.57$, $\bar{x}_{administrativeskills} = 4.18$, $\bar{x}_{productiveskills} = 4.11$, $\bar{x}_{flexibleteachingskills} = 3.90$, $\bar{x}_{technopedagogicskills} = 3.77$, $\bar{x}_{21stcenturyteacherskillsuse} = 4.11$. Parallel to their use of 21st century learner skills, it was determined that pre-service teachers used 21st century teacher skills above the intermediate level as well. Findings of a study by Brun and Hinostroza (2014) demonstrated that teachers-in office had occupational development needs. In addition, the finding by Bunker (2012) that pedagogical approaches used by today's teachers could not fulfill the requirements of 21st century learners reveals the significance of the level of 21st century teacher skills use. When it is considered that the teacher skills measured within the context of the current study were shaped within the framework of 21st century pedagogy, it could be argued that over the intermediate level 21st century teacher skills use of pre-service teachers, who are the future teachers, would facilitate their career lives.

It was observed that pre-service teachers mostly used confirmative skills among the abovementioned skills. Miller and Pedro (2006) proposed that the most important behavior that the teachers should perform to create an emotionally safe classroom was an attitude that matches the learner behavior and approves the correct behavior. When it is considered that confirmative skills mean an attitude that approves the correct behavior of the learners within the context of this study, it could be observed that the findings of this study are consistent with the suggestions by Miller and Pedro (2006). However, it is also known that teachers have the tendency of reinforcing positive behavior due to the once-applied behaviorist approach in Turkish education system. When it is considered that participating pre-service teachers had such an experience in their previous academic experiences, it is the view of these authors that their tendencies to reinforce positive behavior occurred naturally as a result of that process. Furthermore, due to the transformation of the educational philosophies in our education system, the same generation experienced the transformation to constructivism approach as well and developed an awareness for confirming learner behavior by respecting individual differences. It was an expected finding that our pre-service teachers, who have the tendency to confirm learner behavior by respecting individual differences similar to the reinforcement behavior, would have high levels of confirmative skills utilization.

It was observed in the current study that technopedagogical skills were the least used skill dimension by pre-service teachers. Contrary to this finding, Adıgüzel and Yüksel (2012) stated that teachers did not individually use the technology in the classroom, however used the technology at an acceptable level by supporting it with their pedagogical skills. Interviews with teachers conducted in the study demonstrated that they had good levels of utilizing available technologies in the classroom together with the pedagogical approaches. However, the study by Adıgüzel and Yüksel (2012) was a qualitative study conducted with teachers who were on duty. Hence, the differences between the findings of these two studies could have driven by the effective use of pedagogical skills by the experienced teachers in the study group and the contextual characteristics of qualitative research findings.

A review of teacher training programs revealed that technology knowledge courses were limited to Computer I and Computer II courses with the sole exception of Computer Education and Instructional Technology department curriculum (YÖK, 2007). Furthermore, despite the fact that an evolution is being experienced in the profession of teaching towards technopedagogic content knowledge (Turkish Association of Education [TED], 2009), no technopedagogic or technopedagogical content knowledge courses were encountered in the teacher training curriculum. Teacher training program could be considered as one of the reasons why pre-service teachers, who were trained with an outdated curriculum when compared to current standards, used technopedagogical skills at the lowest level. Şad, Açıkgül, & Delican (2015) measured the perceptions of pre-service teachers on technopedagogic content knowledge. Their findings demonstrated that pre-service teachers expressed that their technopedagocial knowledge levels were good. Contrary to the findings by Şad et al. (2015), the current study aimed to reveal the pre-service teachers' usage levels of these skills, in other words, the data was collected using more application oriented items. It was thus considered that the findings of the two studies differed on that basis.

It is considered that the main reason behind the low level of technopedagogic skills use revealed in the current study when compared to other skills could be the lack of adequate technology training. To prepare the learners for the world of 21st century, it is quite important to teach the innovations with innovations and to enrich old instructional methods with technology use (Klopfer, Osterweil, Groff, & Haas, 2009). Clark (2008) argued that the most significant factors that affect the use of technological tools by teachers were the lack of professional development activities towards the use of these tools. Supporting this finding, Karadeniz and Vatanartıran (2015) stated that teachers who did not receive technology training perceived themselves less proficient in technopedagogical knowledge when compared to teachers who received technology training in their study. Garba, Byabazaire, and Busthami (2015) argued that technopedagogical content knowledge proficiencies of teachers were low and these proficiencies should be developed primarily to improve 21st century learning environments. Koh, Chai, Benjamin, and Hong (2015) stressed that teachers should be proficient in all technological pedagogical content knowledge (TPACK) dimensions in the educational processes provided for 21st century learners. Thus, it could be argued that it is necessary for pre-service teachers to take a step toward achieving better in these skills than their current situation. Parallel to the findings of the current study, studies in the literature that scrutinized the development of technopedagogic skills of teachers and pre-service teachers (Ersoy, Kabakçı Yurdakul, & Ceylan, 2016; İşigüzel, 2014; Karadeniz & Vatanartıran, 2015; Klopfer et al., 2009; Şimşek, Demir, Bağçeci, & Kinay, 2013) expressed that 21st century teachers used these skills insufficiently and they should develop these skills. It could be stated that the main reasons behind that fact were insufficient number of faculty members, physical utilities and technological infrastructure, and inability to train teachers who could adopt the transformation of the pedagogical system from behaviorist approach to TPACK.

MANOVA was used in responding to another research question in the current study, "does utilization of 21st century learner and teacher skills by pre-service teachers significantly differ based on gender, university and department variables?" . Analyses demonstrated that dependent variables (21st century learner skills use * 21st century teacher skills use) differed with university and department

variables in addition to the interaction of university and department. Pre-service teachers are placed in higher education with SSPS. Both base points and point types of the universities and departments they select and placed differ (ÖSYM, 2011). Thus, it could be argued that pre-service teachers differentiate during the process of their placement in the universities and departments based on their achievements, and the difference occurring in dependent variables basically derived from the aforementioned differentiation. Furthermore, learning experiences that pre-service teachers have in their universities differ based on the differences between faculty members and content of the departments as well. These different learning experiences could have affected both 21st century learner skills use and 21st century teacher skills use by pre-service teachers. There was no study in the literature that addressed 21st century learnings skills use and 21st century teacher skills use or compared these based on independent variables. Thus, another reason behind our finding could the interaction between the dependent variables.

In addition, the "teachers teach the way they learn" hypothesis tested in the current study was confirmed. According to SEM, it can be said that all 21st century skills use sub-dimensions predicted 21st century teacher skills use. This finding was consistent with the resources (Burns & Sinfield, 2004; Minton, 2005; Tennant et al., 2009) that proposed the abovementioned hypothesis. Learning takes place as a result of the communication between teachers and learners. In this process, teacher shapes the learning processes by structuring the content or making it available for the structuring by the learner. The hypotehesis as "teachers teach the way they learns" means that they would structure instructional activities and content based on the best way they know how to learn. This situation implies that coding and decoding in learning processes would be conducted consistent with the schemes of the teacher.

In the current study, significant and positive correlations between 21st century learner skills use sub-dimensions and 21st century teacher skills were revealed within the context of the proposed model. This finding reflects the fact that as pre-service teachers' 21st century learner skills use increased, their 21st century teacher skills use increased as well, and as 21st century learner skills use decreased, their 21st century teacher skills use decreased as well. Thus, it is observed that the defined correlations could affect learning environments in two directions, namely positively or negatively. For instance, a pre-service teacher who expects the diversification of the activities in learning processes is expected to provide his/her own students with a variety of activities in his/her own teaching processes in the future. On the other hand, when the condition of not being self-controlled, which could be considered as a negative situation with respect to 21st century learner skills, is considered, it could be argued that a teacher who forms the learning process with externally dependent learning activities would likely to demonstrate the same behavior when planning the instructional activities, and thus, would affect the learning of 21st century students negatively. These results demonstrated that confirmation of the hypothesis that proposed that teachers teach the they learn could be a significant finding for faculties of education, which are teacher training institutions, to train successful teachers of the future. This finding demonstrates that good teachers are good students at the same time. It could further be argued that faculties of education also need to develop learner skills of pre-service teachers in addition to training pre-service teachers to achieve teaching skills.

In addition to these results, correlations between learner skills uses were also scrutinized. Within the model, pre-service teachers' use of autonomous skills and collaboration and flexibility skills predicted their use of cognitive skills. This finding was consistent with the studies that were the theoretical resources for SEM (Leung et al., 2000; Pajares & Kranzler, 1995; Perkins & Salomon, 1989; Pintrich & DeGroot, 1990; Rogers, 2010; Rotter, 1966; Ryan & Pintrich, 1997; Slater & Ravid, 2010; Tabak et al., 2010; Yalçın et al., 2010). In other words, cognitive skill use revealed in the current study is affected by autonomous skill use and collaboration and flexibility skills use. When the paths between pre-service teachers' 21st century learner skills sub-dimensions are scrutinized based on the significant and positive correlation between the abovementioned skills, it could be observed that as autonomous skills use increased, cognitive skills use increased as well. Thus, it could be stated that high self-control and autonomous skills use of pre-service teachers facilitates their utilization of cognitive skills in learning

processes or caused them to use cognitive skills. Similarly, based on the correlation between collaboration and flexibility skills use and cognitive skills use, it could be argued that individuals who could guide learning processes with collaborative activities and render their learning independent from the environment use cognitive skills more in learning processes.

Cognitive skills could resolve several learning problems encountered in educational environments and could be transferred to skill areas such as collaboration, self-management or self-confidence (Billing, 2007). This information serves as another evidence for the significance of the paths defined between the abovementioned skill uses. However, autonomous skills and collaboration and flexibility skills are separate skills by nature. As is known, autonomous skills indicate autonomous behavior in learning processes based on personal skills. Collaboration is a required skill to work within a group. This case is the prime reason why no path was constructed between autonomous skills and collaboration and flexibility skills.

A significant path was defined between innovation skills and 21st century learner skills use, but it was not possible to define significant paths between the other sub-dimensions of 21st century learner skills use. Thus, it could be argued that innovation skills were related to 21st century teacher skills, but they were not related to other 21st century learner skills. Similarly, Brun and Hinostroza (2014) emphasized in their study that teachers who could actively use new technologies should be trained for active use of technologies presented to educational environments. Since the concept of innovation in the current study reflects the skills to use new technologies, the finding that pre-service teachers who used innovation skills at a higher level could use 21st century teacher skills actively as well was consistent with the findings by Brun and Hinostroza (2014). On the other hand, Mardis and Dickinson (2009) explained the significance of skills such as school culture, communication processes, self-control skills for learning processes based on the views communicated about the AASL standards. Another finding of this study was the opinion that AASL could find a common ground for the learners since it does not stress technology like NETS. Thus, it could be argued that skills of using new technologies could discriminate learners. Therefore, it could be stated that the main reason why it was not possible to define a path between innovation skills and other 21st century learner skills in the model proposed in the current study was this discriminative factor.

Current study was limited participated preservice teachers, used data collection tools and variables. The sample of the study was determined as preservice teachers. Moreover, via 21st century teacher skills use scale, the data may be collected from teacher-in-duty. Thanks to this, their use of this skills may be revealed and compared with regard to seniority, duty stage etc.. Comparision analysis may be conducted by changing and extending independent variables. Similar with 21st century teacher skills use, via 21st century learner skills use scale, the data may be collected from K-12 students and revealed their use of these skills. In this study, the predictability of 21st century learner skills' sub dimensions to 21st century teacher skills was analyzed via SEM. In addition to this, the predictability of some skills such as different literacy skills and their sub dimensisons may be searched. Additionally, action researches may be designed to raise preservice teachers use of both 21st century learner skills and 21st century learner skills.

Acknowledgements

This PhD dissertation summary study supported by Anadolu University Scientific Research Project, numbered as 1503E096 and TUBITAK 2211 BIDEB.

References

Adıgüzel, A., & Yüksel, İ. (2012). Öğretmenlerin öğretim teknolojileri entegrasyon becerilerinin değerlendirilmesi: Yenipedagojik yaklaşımlar için nitel bir gereksinim analizi. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, *6*(1), 265-286.

Ainley, J., & Luntley, M. (2007). Towards an articulation of expert classroom practice. *Teaching and Teacher Education*, *23*(7), 1127-1138.

Akbulut, Y. (2010). *Sosyal bilimlerde SPSS uygulamaları: Sık kullanılan istatistiksel analizler ve açıklamalı SPSS çözümleri*. İstanbul: İdeal Kültür Yayıncılık.

American Association of School Librarians. (2007). *Standards for the 21st century learner*. Retrieved January 5, 2015 from http://www.ala.org/aasl/sites/ala.org.aasl/files/content/guidelinesandstandards/learningstandards/AASL_LearningStandards.pdf

Ananiadou, K., & Claro, M. (2009). *21st century skills and competences for new millennium learners in OECD countries*. OECD Education Working Papers: OECD Publishing. Retrieved January 29, 2016 from http://www.oecd-ilibrary.org/education/21st-century-skills-and-competences-for-new-millennium-learners-in-oecd-countries_218525261154.

Anıl, D., Özer Özkan, Y., & Demir, E. (2015). *PISA 2012 araştırması ulusal nihai raporu*. Ankara: İşkur Matbaacılık.

Arbuckle, L. J. (2007). *AMOS user's guide.* USA: Amos Development Corporation.

Arıkan, R. (2004). *Araştırma teknikleri ve rapor hazırlama.* Ankara: Asil Yayın.

Billing, D. (2007). Teaching for transfer of core/key skills in higher education: Cognitive skills. *Higher Education*, *53*(4), 483-516.

Blunch, N. J. (2008). *Introduction to structural equation modelling: Using SPSS and AMOS*. Los Angeles: Sage Publications.

Brun, M., & Hinostroza, J. E. (2014). Learning to become a teacher in the 21st century: ICT integration in initial teacher education in Chile. *Journal of Educational Technology & Society*, *17*(3), 222-238.

Bunker, D. H. (2012). *Teachers' orientation to teaching and their perceived readiness for 21st century learners* (Unpublished doctoral dissertation). The University of Texas at Arlington.

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

Bush, G. W. (2001). *No child left behind.* Education Publication Center.

Büyüköztürk, Ş. (2012). *Sosyal bilimler için veri analizi el kitabı: İstatistik, araştırma deseni SPSS uygulamaları ve yorum* (15th ed.). Ankara: Pegem A Yayıncılık.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2013). *Bilimsel araştırma yöntemleri* (15th ed.). Ankara: Pegem Akademi.

Callison, D., & Lamb, A. (2004). Key words in instruction. Audience analysis. *School Library Media Activities Monthly*, *21*(1), 34-39.

Can, A. (2014). *SPSS ile bilimsel araştırma sürecinde nicel veri analizi* (2nd ed.). Ankara: Pegem Akademi Yayıncılık.

Center of Assessment Selection Placement. (2011). *Tablo 4 merkezi yerleştirme ile öğrenci alan yükseköğretim lisans programları.* Retrieved February 2, 2015 from http://www.osym.gov.tr/dosya/1-57952/h/2011tablo4-2172011.pdf

Ceylan, B. (2015). *Öğrenme nesnelerinin öğretmen adaylarının teknolojik pedagojik içerik bilgisi becerilerine etkisinin değerlendirilmesi*. (Unpublished doctoral dissertation). Anadolu University, Institute of Educational Sciences, Eskişehir.

Clark, D. D. (2008). *A study of West Virginia teachers: Using 21st century tools to teach in a 21st century context* (Unpublished doctoral dissertation). Marshall University, West Virginia.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hilldfale, NJ: Erlbaum.

Council of High Education. (2007). *Eğitim fakültesi öğretmen yetiştirme lisans programları.* Retrieved January 19, 2016 from http://www.yok.gov.tr/documents/10279/30217/E%C4%9E%C4%B0T%C4%B0M+FAK%C3%9CLTES%C4%B0%20%C3%96%C4%9ERETMEN+YET%C4%B0%C5%9ET%C4%B0RME+L%C4%B0SANS+PROGRAMLARI.pdf/054dfc9e-a753-42e6-a8ad-674180d6e382

Çelen, F. K., Çelik, A. ve Seferoğlu, S. S. (2011). *Türk eğitim sistemi ve PISA sonuçları*. Paper presented at XIII. Akademik Bilişim Konferansı, İnönü University, Malatya.

Çelik, H. E., & Yılmaz, V. (2013). *LISREL 9.1 ile yapısal eşitlik modellemesi: Temel kavramlar- uygulamalar-programlama* (Renewed 2nd ed.). Ankara: Anı Yayıncılık.

Elmore, R. F. (2007). *School reform from the inside out: Policy, practice, and performance*. Cambridge, MA: Harvard Education Press.

Ersoy, M., Kabakçı Yurdakul, I., & Ceylan, B. (2016). Öğretmen adaylarının BİT becerileri ışığında teknopedagojik içerik bilgisine ilişkin yeterliklerinin incelenmesi: Deneysel bir araştırma. *Eğitim ve Bilim*, *41*(186), 119-135.

Fer, S. (2009). *Öğretim tasarımı*. Anı Yayıncılık.

Field, A. (2009). *Discovering statistics using SPSS.* (3rd ed.). Sage Publications.

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

Gagne, R. M., Wager, W. W., Golas, K. C., Keller, J. M., & Russell, J. D. (2005). Principles of instructional design. *Performance Improvement, 44*(2), 44-46.

Garba, S. A., Byabazaire, Y., & Busthami, A. H. (2015). Toward the use of 21 st century teaching-learning approaches: The trend of development in Malaysian schools within the context of Asia Pacific. *International Journal of Emerging Technologies in Learning*, *10*(4), 72-29.

Hoyle, R. H. (1995). *Structural equation modeling: Concepts, issues, and applications*. London: Sage Publications.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Huck, S. W. (2012). *Reading statistics and research* (6th ed.). Boston, MA: Pearson Education.

International Society for Technology in Education. (2015). *About ISTE.* Retrieved November 11, 2015 from http://www.iste.org/about

ISTE Standards-T. (2008). *ISTE standards: Teachers.* Retrieved November 9, 2015 from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf

İşigüzel, B. (2014). Almanca öğretmen adaylarının teknopedagojik eğitime yönelik yeterlik düzeylerinin incelenmesi. *Journal of International Social Research*, *7*(34), 768-778.

Karadeniz, Ş., & Vatanartiran, S. (2015). Primary school teachers' technological pedagogical content knowledge. *Elementary Education Online, 14*(3), 1017-1028.

Karasar, N. (2003). *Sosyal bilimlerde araştırma yöntemleri*. Ankara: Seçkin Yayınları.

Kenny, D. A. (2010). *Measuring model fit*. Retrieved January 14, 2014 from http://davidakenny.net/cm/fit.htm

Kline, P. (1993). *An easy guide to factor analysis.* Routledge.

Klopfer, E., Osterweil, S., Groff, J., & Haas, J. (2009). Using the technology of today in the classroom today: The instructional power of digital games, social networking, simulations and how teachers can leverage them. *The Education Arcade*, 1-20.

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*(3), 535-543.

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

Leung, T. W., Siu, O. L., & Spector, P. E. (2000). Faculty stressors, job satisfaction, and psychological distress among university teachers in Hong Kong: The role of locus of control. *International Journal of Stress Management*, *7*(2), 121-138.

MacCallum, R. C., & Sehee, H. (1997*).* Power analysis in covarience structure modeling using GFI and AGFI. *Multivariate Behavioral Research, 2*(32), 193-210.

Mardis, M. A., & Dickinson, G. K. (2009). Far away, so close: Preservices school library media specialists' perceptions of AASL's "Standards for the 21st-century learner". *School Library Media Research*, *12*.

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

Miller, R., & Pedro, J. (2006). Creating respectful classroom environments. *Early Childhood Education Journal*, *33*(5), 293-299.

Ministry of National Education. (2008). *Öğretmen yeterlikleri: Öğretmenlik mesleği genel ve özel alan yeterlikleri 2. parça.* Ankara: Devlet Kitapları. Retrieved January 28, 2015 from http://otmg.MNE.gov.tr/belgeler/ogretmen_yeterlikleri_kitabi/%C3%96%C4%9Fretmen_Yeterlikleri_Kitab%C4%B1_genel_yeterlikler_par%C3%A7a_2.pdf

Minton, D. (2005). *Teaching skills in further and adult education* (3rd ed.). Thomson Learning.

OECD. (2012). *Connected minds: Technology and today's learners, educational research and innovation.* OECD Publishing. Retrieved January 29, 2016 from http://www.oecd-ilibrary.org/education/connected-minds_9789264111011-en

Orhan Göksün, D. (2016). *Öğretmen adaylarının 21.yy. öğrenen becerileri ve 21. yy. öğreten becerileri arasındaki ilişki* (Unpublished doctoral dissertation). Anadolu University, Institute of Educational Sciences, Eskişehir, Turkey.

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.

Orhan, D., & Kurt, A. A. (2015). An Inventory for Determining 21st Century Learner Skills Usage: Validity and Reliability Study. In D. Rutledge, & D. Slykhuis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2015* (pp. 3522-3524). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Orhan, D., Kurt, A. A., Ozan, Ş., Som Vural, S., & Türkan, F. (2014). Ulusal eğitim teknolojileri standartlarına genel bir bakış. *Karaelmas Journal of Educational Science, 2*(1), 65-79.

Pajares, F., & Kranzler, J. (1995). Self-efficacy beliefs and general mental ability in mathematical problem-solving. *Contemporary Educational Psychology, 20*, 426-443.

Palfrey, J., & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives*. Basic Books.

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows.* (3rd ed.). Maidenhead, PA: Open University Press.

Partnership21. (2015). *P21 framework definitions.* Retrieved November 13, 2015 from http://www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf

Pedro, F. (2006). *The new millennium learners: Challenging our views on ICT and learning*. Retrieved February 3, 2015 from http://www.oecd.org/edu/ceri/38358359.pdf

Perkins, D. N., & Salomon, G. (1989). Are cognitive skills context-bound?. *Educational Researcher*, *18*(1), 16-25.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33-40.

Prensky, M. (2003). *Has growing up digital and extensive video game playing affected younger military personnel's skill sets?*. The oral presentation, which was presented at I/ITSEC 2003.

Prensky, M. (2006). *Don't bother me, mom, I'm learning!: How computer and video games are preparing your kids for 21st century success and how you can help!*. New York: Paragon house.

Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, *80*(1), 1-28.

Rudalevige, A. (2003). *No child left behind*. Retrieved November 10, 2015 from http://media.hoover.org/sites/default/files/documents/ednext20034_62.pdf

Ryan, A. M., & Pintrich, R. P. (1997). "Should I ask for help?" The role of motivation and attitudes in adolescents' help seeking in math class. *Journal of Educational Psychology, 89*, 329-341.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. (2nd ed.). New Jersey: Lawrence Erlbaum Associates, Publishers.

Slater, J. J., & Ravid, R. (2010). *Collaboration in education*. Routledge.

Smeeding, T. M. (2002). No Child Left Behind?. *Indicators*, *1*(3), 6-30.

Sönmez, V., & Alacapınar, F. G. (2013). *Örneklendirilmiş bilimsel araştırma yöntemleri* (2nd ed.). Ankara: Anı Yayıncılık.

Şad, S. N., Açıkgül, K., & Delican, K. (2015). Senior preservice teachers' senses of efficacy on their technological pedagogical content knowledge (TPACK). *Journal of Theoretical Educational Science*, *8*(2), 204-235.

Şimşek, A. (2009). *Öğretim tasarımı*. Nobel Yayın Dağıtım.

Şimşek, Ö., Demir, S., Bağçeci, B., & Kinay, İ. (2013). Öğretim elemanlarının teknopedagojik eğitim yeterliliklerinin çeşitli değişkenler açısından incelenmesi. *Ege Eğitim Dergisi*, *14*(1), 1-23.

Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics*. (6th ed.). Pearson.

Tabak, A., Erkuş, A., & Meydan, C. H. (2010). Denetim odağı ve yenilikçi birey davranışları arasındaki ilişkiler: Belirsizliğe tolerans ve risk almanın aracılık etkisi. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, *10*(1), 159-176.

Tennant, M., McMullen, C., & Kaczynski, D. (2009). *Teaching, learning and research in higher education: A critical approach*. Routledge.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications.* Washington DC: American Psychological Association.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times: learning for life in our times*. John Wiley & Sons.

Turkish Association of Education. (2009). *Öğretmen yeterlikleri: Özet rapor: "Öğretmene yatırım, geleceğe yatırım"*. Retrieved January 19, 2016 from http://portal.tEditionorg.tr/genel/yayinlar/Ogretmen_Yeterlik_Kitap_Ozet_rapor.pdf

Turkish Industrialists' and Businessmen's Association. (1999). *Türkiye'de mesleki ve teknik eğitimin yeniden yapılandırılması.* Lebib Yalkın Yayımları ve Basım İşleri A.Ş. Retrieved January 29, 2016 from http://www.tusiad.org.tr/__rsc/shared/file/meslekiegitim.pdf

Wagner, T. (2008). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need-and what we can do about it.* Basic Books.

Wright, P. W., Wright, P. D., & Heath, S. W. (2006). *No child left behind*. Harbor House Law Press.

Yalçın, B., Tetik, S., & Açıkgöz, A. (2010). Yüksekokul öğrencilerinin problem çözme becerisi algıları ile control odağı düzeylerinin belirlenmesine yönelik bir araştırma. *Organizasyon ve Yönetim Bilimleri Dergisi*, *2*(2), 19-27.

Young, J. S. (2012). Linking learning: Connecting traditional and media literacies in 21st century learning. *Journal of Media Literacy Education*, *4*(1), 70-81.

Zemelman, S., Daniels, H., Hyde, A. A., & Varner, W. (1998). *Best practice: New standards for teaching and learning in America's schools*. Heinemann Educational Publishers.