



Are teacher candidates able to use educational technologies effectively? A case study in terms of standards¹

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Abstract

The present study aims at investigating the educational technology use of teacher candidates attending education faculties in Turkey in terms of NETS*T standards. The study employed 2.566 senior teacher candidates from 7 different universities in Turkey. As a result of the study, it was revealed that the teacher candidates considered themselves to have a high level of self-efficacy with respect to educational technology standards as a whole. Considering the factors, teacher candidates reported the highest level of self-efficacy for the factor of productivity and professional practices and the lowest level of self-efficacy for the factor of social, ethical, legal and human issues. Gender caused differences for certain factors. In addition, the department being attended was another variable that resulted in difference when the departments of the teacher candidates were taken into consideration.

Keywords: Educational technology, standards; teacher education/development; student teaching; national technology standards for teachers.

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Introduction

The question of “does the purchase of a technology mean the inclusion of that technology into the educational environment?” could be answered depending on long-time experience. Today, studies on technology planning of any kind prepared by anyone and on strategy planning involve not only the purchase of a technology but the individuals that will use that technology as well (UNESCO, 2002). The biggest responsibility for the use of educational technologies falls on the teachers, who constitute a part of the educational process. In order to increase the technology use of teachers, standards were determined by a number of countries. There are different approaches to the development of these standards like countries’ developing their own standards or like their adopting the standards of other countries. However, although intensive trainings on educational technologies are given to teachers in some countries, there are no approved standards. One of these countries is Turkey. This study was carried out in order to compare these intensive trainings with the world standards. For this comparison, the self-efficacies of teacher candidates were examined with the help of a scale developed through NETS*T standards.

Why did we choose NETS Standards?

In this study, NETS*T (National Educational Technology Standards for Teachers) standards were used. There were several factors that made the researchers of this study choose NETS, a project executed by International Society for Technology in Education (ISTE). Some of these factors were as follows:

- NETS defines such duties better as Student (NETS*S), Administrator (NETS*A) and Teacher (NETS*T),
- Developed for the first time in 1993, NETS was updated parallel to the developing technology (in 1997 and 2000) (NETS, 2006),
- NETS was adapted to the different states in USA due to the federal structure in the country and thus has a flexible structure to be approved by all countries in the world.
- Thanks to its flexible structure, NETS constitutes the basis of educational technology standards of numerous countries like Australia, China, Ireland, Latin America and England (UNESCO, 2002),

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- Teacher training education in Turkey has a structure parallel to NETS*T standards.

Depending on all these factors, NETS*T standards with 6 sub-categories and 23 sub-indicators were used in this study (NETS, 2006). These categories are shown in Table 1.

Table 1.

The ISTE National Educational Technology Standards for Teachers (NETS, 2006)

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- I. Technology Operations and Concepts
 - II. Planning and Designing Learning Environments and Experiences
 - III. Teaching, Learning, and the Curriculum
 - IV. Assessment and Evaluation
 - V. Productivity and Professional Practice
 - VI. Social, Ethical, Legal, and Human Issues
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(*) for a detailed version of the table, visit the web-site of <http://cnets.iste.org/Teachers/pdf/page09.pdf>

Trainings Given on Educational Technologies in Teacher Training Programs

Although teacher training programs were executed by different institutions in Turkey, education faculties of universities were made the only authority by law in 1982. The Council of Higher Education (YOK) was authorized as the only center for the inspection and organization of education faculties. Furthermore, this situation was stressed in the report of “Rearrangement of Teacher Training Programs in Education Faculties” published in 1998, and the qualities that teachers should have and the courses that they should give are determined (YOK, 1998). In this respect, all teacher candidates in Turkey should take education in three different areas such as knowledge of the teaching profession, general knowledge about other areas and as field knowledge. Depending on their departments, teacher candidates in education faculties are supposed to achieve a 140-credit training program including 80-credit field knowledge, 35-credit professional knowledge and 25-credit general knowledge (YOK, 1998).

Especially the trainings given on teaching profession and general knowledge in other areas can be said to provide teacher candidates with the NETS*T standards seen in Table 1. For instance, the courses regarding the teaching profession training include Introduction to Educational Sciences, Guidance, Sociology, Class Management, Instructional Planning and Evaluation, Measurement and Assessment, and Special Teaching Methods. Furthermore, among the general knowledge courses are Computer I and Computer II. These courses

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significantly help teacher candidates acquire the basic skills regarding Information and Communication Technologies (Şumuer, Doğusoy&Yıldırım, 2006).

Instructional Technologies and Material Development, a teacher training course given to third-grade students, is of special importance. In this course, teacher candidates are taught how to use educational technologies during their teaching profession. This is explained in the Teacher Training Programs of Education Faculties as follows (YOK, 1998);

A compulsory computer course is included in all teacher training programs. The goal of this course is to help teacher candidates gain the basic skills in computer use and know more about information technologies. Instructional Technologies and Material Development, one of the courses in the teacher training program, is like the extension of the basic computer course and includes the application of developing technologies into the teaching environment... With the help of these courses that promote the use of developing information technologies in schools and the development of various instructional materials, teacher candidates are intended to learn about such technologies as computers, the internet, multi-media, television and video sets, and projectors and to use them in teaching. In this way, future teachers are expected to know more about technology and to do their job effectively.

It is clear that teacher candidates learn a lot about teaching with the help of the general knowledge and teaching profession courses before they take the course of Instructional Technologies and Material Development. With this course, teacher candidates find the opportunity to gather all the information they have obtained so that they can use technology effectively (Gunduz and Odabaşı, 2004). At the end of their education (4th grade), with the course of School Practicum, teacher candidates have the opportunity to apply their knowledge into the class environment.

As summarized above, in the process of university education of teacher candidates in Turkey, it can be stated that the courses they take help them meet the education technology standards.

Purpose

The basic purpose of this study is to determine the self-efficacies of teacher candidates from education faculties regarding education technology standards.

Depending on this basic purpose, the present study sought answers to the following research questions:

1. What is the distribution of the self-efficacies of teacher candidates with respect to education technology standards and factors?

2. Is there a significant difference between the self-efficacies of teacher candidates and their genders and departments regarding education technology standards?

Method

The study was based upon the general survey method and examined the self-efficacies of teacher candidates with respect to education technology standards considering different variables.

Population and the sample

The population of the study includes senior teacher candidates attending Education Faculties in the academic year of 2007-2008. Due to the big size of the universe of the study, two-phase stage sampling approach, a probability sampling method, was run. While determining the sample, the university-entrance score types of students as the first selection criterion and the departments with the biggest number of students according to the score types as the second criterion were taken into consideration in the study. Also, the department of Computer and Instructional Technologies, expected to reveal a difference, was included in the study. Hence, the study was carried out in 8 important universities that included the departments of Computer and Instructional Technologies, English Language Teaching, Mathematics Teacher Training with a Minor in Turkish, Arts and Crafts Education, Elementary School Teacher Training, Social Studies with a Minor in Turkish. One university (Selcuk University) was used for the scale development, the research data were collected from the other 7 universities. The data obtained from a sample of 2.566 teacher candidates were analyzed. Table 2 presents the demographic background of the participants.

Table 2.

Demographic Background of the Teacher Candidates Participating in the Study

		Frequency	Percentage (%)
Gender	Male	1.070	41.7
	Female	1.496	58.3
	Total	2.566	100
Department	Computer and Instructional Technologies	277	10.8
	English Language Teaching	579	22.6

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	Mathematics Teacher Training with a Minor in Turkish	470	18.3
	Arts and Crafts Education	271	10.6
	Elementary School Teacher Training	582	22.7
	Social Studies with a Minor in Turkish	387	15.1
	Total	2.566	100
University	Atatürk University	322	12.5
	Anadolu University	393	15.3
	Dokuz Eylül University	466	18.2
	Gazi University	323	12.6
	İnönü University	269	10.5
	Marmara University	407	15.9
	Ondokuz Mayıs University	386	15.0
	Total	2.566	100

The Data Collection Tool and Data Collection

In the study, the Educational Technology Standards Scale for teachers (ETSS) developed with the use of NETS*T standards by the researcher in the scope of the study. For the development of the scale, ISTE, NETS*T standards and the indicators of these standards were used. ETSS was formed as a 5-item Likert scale. (Strongly Disagree=1, Disagree=2, Neutral=3, Agree=4, and Strongly Agree=5). In the development of the scale, the following steps were taken into consideration in general: An item-pool was formed in line with the related literature; this item-pool was submitted to those who were expert in the fields of educational technology, education programs, measurement and evaluation, professional development and ethics, and scale and questionnaire development; Following the expert-opinion process, the scale was piloted. With the help of the data collected, factor analysis was run to test the structural validity of the scale. The scale developed with 460 teacher candidates attending the Education Faculty of Selcuk University includes 6 factors and 41 items. The Cronbach Alpha internal consistency coefficient of the scale was calculated as ($\alpha=0.957$). The factors found in the ETSS scale developed from NETS*T standards are as follows:

Table 3.

The Factors in ETSS Scale Developed from NETS*T Standards

I. Technology Operations and Concepts ($\alpha=0.834$)
II. Planning and Designing Learning Environments and Experiences ($\alpha=0.886$)
III. Assessment and Evaluation ($\alpha=0.833$)
IV. Productivity and Professional Practice ($\alpha=0.919$)
V. Social, Ethical, Legal, and Human Issues ($\alpha=0.843$)
VI. Planning of Teaching According to Individual Differences and Special Needs ($\alpha=0.801$)

As can be seen in Table 3, 5 of the NETS*T standards were included in the scale, while 1 factor was not. Instead of this excluded factor, a new factor was included in the scale. “Planning of Teaching According to Individual Differences and Special Needs” (New Factor), does not exist in NETS*T (NETS, 2006). This new factor included items related to the planning of special education activities for students who need physically special attention and those related to equal use of technology. The basic education law for teachers also requires teachers to provide students with equal educational opportunities and to be responsible for students who are in need of special education (MEB, 1973). Furthermore, teachers are also given education on these issues during their university education (YOK, 1998). Although the items of the third factor of NETS*T, which was “Teaching, Learning, and the Curriculum” (NETS III), were included in the ETSS scale, these items were excluded from the scale following factor analysis. This is quite a significant finding. Among the items of this factor was the planning of technology-enhanced experiences including student-related and content-related technology standards; and the development of students’ upper-level thinking skills and their creativity with the help of educational software. However, the participants of the scale did not receive any education that covers these items (YOK, 1998). Therefore, it is quite natural that the items that consist of this factor do not exist in the scale.

Analysis of the Data

For the analysis of the data, descriptive techniques were used. Frequency and percentage helped reveal the general situation. In addition, One-Way ANOVA was run to determine if the self-efficacies of teacher candidates regarding educational technology standards differed with respect to their departments. In order to see whether there was any difference in terms of gender, Independent-Samples t Test was applied (Field, 2000). For the

analysis of the data, SPSS 15.0 package software was used, and .05 was taken as the significance level in the study.

Findings and Discussion

In this part, the results regarding the findings obtained from the statistical analyses of the data collected are presented and interpreted.

Self-Efficacies of Teacher Candidates Revealed by the Educational Technology Standards Scale

In order to determine the self-efficacies of the teacher candidates according to the educational technology standards scale in general and to the sub-factors of the scale, the values of frequency (f) and percentage (%) and of the mean (\bar{X}) and the standard deviation (Ss) were found (Table 4).

Table 4.

Descriptive Statistics of the Self-Efficacies of the Teacher Candidates Regarding the Educational Technology Standards Scale and the Factors

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	\bar{X}	Ss	
1	Technology Operations and Concepts	f	36	160	631	1225	514	3.78	.664
		%	1.4	6.2	24.6	47.7	20.1		
2	Planning and Designing Learning Environments and Experiences	f	29	91	326	1386	734	4.05	.604
		%	1.2	3.5	12.7	54.1	28.5		
3	Assessment and Evaluation	f	33	160	574	1313	486	3.80	.637
		%	1.3	6.2	22.3	51.2	19.0		
4	Productivity and Professional Practice	f	42	88	262	1224	950	4.14	.613
		%	1.7	3.5	10.3	47.8	37		
5	Social, Ethical, Legal, and Human Issues	f	71	295	878	1015	307	3.46	.740
		%	3.0	12.3	35.7	37.6	11.4		
6	Planning of Teaching According to Individual Differences and Special Needs	f	37	142	620	1288	479	3.79	.706
		%	1.5	5.53	24.1	50.2	18.9		
Overall Mean		f	41	156	549	1242	578	3.90	.535
		%	1.6	6.2	21.7	48.1	22.4		

As can be seen in Table 4, the mean of the self-efficacy scores obtained from the educational technology standards scale in general was calculated as ($\bar{X}=3.90$). In addition, for the scale in general, among all the teacher candidates, 1.6% of them reported “Strongly Disagree”, 6.2% “Disagree”, 21.7% “Neutral”, 48.1% “Agree”, and 22.4% reported “Strongly Agree”. Since the teacher candidates responded as “Agree” and “Strongly Agree” with a total rate of 70.5%, it could be stated that teacher candidates meet the educational technology standards for teachers to a large extent.

When the scores obtained from the scale used to determine the educational technology standards of teachers were examined in terms of factors the teacher candidates had the highest mean for the factor of productivity and professional practice with $\bar{X}=4.14$ and the lowest for the factor of social, ethical, legal and human issues with $\bar{X}=3.46$. Moreover, the teacher candidates had a high level of educational technology standards for all the factors including the factor of social, ethical, legal and human issues, for which they had the lowest mean. The mean self-efficacy scores for the other factors are planning and designing learning environments and experiences ($\bar{X}=4.05$), assessment and evaluation ($\bar{X}=3.80$), planning of teaching according to individual differences and special needs ($\bar{X}=3.79$) and technology operations and concepts ($\bar{X}=3.78$), respectively. Especially for the last three factors, the closeness of the means to each other is striking. Therefore, for these three factors, teacher candidates could be said to use technology at an equally high level.

This finding of the study is consistent with the finding of Oh and French (2005) – who studied on whether teacher candidates meet the NETS*T standards - that “as a result of the course of Preparatory Level Educational Technology, teacher candidates, to a large extent, have educational technology standards efficacies” and with the finding of Hofer (2003) – who studied with students taking the courses of educational technology standards given in 7 different universities - that “65.1% of teacher candidates have a high level of NETS*T standards in general,” while the present finding of the study does not support the finding of a study carried out by Song et.al. (2005) in China that “teachers in China have a fairly limited level of efficacy.” The difference could be explained with the factors revealed by researchers that “although the course of computer literacy and a teaching certificate are given during the five-year teacher training, teacher candidates are not taught how to integrate technology into the teaching and learning process” and that “In USA, while there is one

computer for 5 students, in China, there is one for 99 students.” Therefore, it could be stated that the way of educational practices and the present opportunities are effective factors in the acquisition of educational technology standards for candidate teachers.

To sum up, depending on the self-efficacy scores of teacher candidates obtained from the scale developed to determine the educational technology standards of teachers, it could be stated that teacher candidates have a high level of educational technology standards; that the factor in which they consider themselves the most proficient is the factor of productivity and professional practice; and that the factor of social, ethical, legal and human issues is the one in which they consider themselves as the least proficient yet at a high level.

The Relationship between the Educational Technology Scale Self-Efficacies and Gender

In line with the sub-goals of the present study, the self-efficacy scores of teacher candidates obtained from the educational technology standards scale were examined to see if they differed with respect to gender. The results of the analysis are shown in Table 5.

Table 5.

T Test Results of the Relationship between Educational Technology Standards Scale Self-Efficacies and Gender

	Gender	N	\bar{X}	Sd	df	t	p
Technology Operations and Concepts	Male	1070	3.88	.684	2564	6.148	.001
	Female	1496	3.71	.642			
Planning and Designing Learning Environments and Experiences	Male	1070	4.02	.650	2564	1.954	.051
	Female	1496	4.07	.568			
Assessment and Evaluation	Male	1070	3.81	.672	2564	.678	.498
	Female	1496	3.79	.612			
Productivity and Professional Practice	Male	1070	4.11	.664	2564	2.718	.007
	Female	1496	4.17	.573			
Social, Ethical, Legal, and Human Issues	Male	1070	3.56	.734	2564	6.033	.001
	Female	1496	3.39	.735			
Planning of Teaching According to Individual Differences and Special Needs	Male	1070	3.79	.735	2564	.481	.631
	Female	1496	3.78	.685			
Overall	Male	1070	3.92	.576	2564	0.913	.361
	Female	1496	3.90	.504			

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As can be seen Table 5, the level of teacher candidates' educational technology standards did not differ significantly with respect to gender [$t(2564)=.913$, $p<.05$]. The values of the self-efficacies of male students obtained from the educational technology standards scale ($\bar{X}=3.92$) did not significantly differ from the values of the self-efficacies of female students obtained from the educational technology standards scale ($\bar{X}=3.90$). Based on this finding, it could be stated that the level of educational technology standards was the same for both male and female students.

In summary, the educational technology standards of teacher candidates did not differ with respect to their gender. When the educational technology standards of teacher candidates were examined in terms of the factors found in the scale, it was revealed that there was a significant difference in terms of the factors of technology operations and concepts, productivity and professional practice, and social, ethical, legal and human issues, while no significant difference was observed for the factors of planning and designing learning environments and experiences, assessment and evaluation, and planning of teaching according to individual differences and special needs.

The Relationship between Educational Technology Standards Scale Self-Efficacies and the Department Being Attended

The relationship between the self-efficacy scores of teacher candidates obtained from the educational technology standards scale and the department of teacher candidates was examined. The results are shown in Table 6.

Table 6.

Descriptive Statistics Regarding the Relationship of Educational Technology Standards Scale Self-Efficacies with Departments

Departments	N	\bar{X}	Sd	Standard Error
A-Computer & Instructional Technologies	277	4.04	.637	.038
B- English Language Teaching	579	3.91	.472	.019
C- Mathematics Teacher Training with a Minor in Turkish	470	3.79	.530	.024
D- Arts and Crafts Education	271	3.95	.567	.034
E- Elementary School Teacher Training	582	3.91	.505	.020
F- Social Sciences with a Minor in Turkish	387	3.88	.546	.027

As can be seen in Table 6, the teacher candidates attending the department of Computer and Instructional Technologies had the highest level of educational technology standards self-efficacies, while those attending the department of Mathematics Teacher Training with a Minor in Turkish had the lowest level of educational technology standards self-efficacies.

Table 7 shows the results of the analysis carried out to reveal the difference in educational technology standards self-efficacies of teacher candidates with respect to the departments they were attending.

Table 7.

The Results of the Analysis Regarding the Relationship between Educational Technology Standards Self-Efficacies and the Department Being Attended

The Source of the Variance	Sum of Squares	df	Mean Square	F	p	Significant Difference
Between Groups	11.842	5	2.368	8.377	.001	A-B, A-C,
Within Groups	723.800	2560	.283			A-E, A-F,
Total	735.642	2565				C-B, C-D, C-E

It is seen in Table 7 that there was a statistically significant difference between the self-efficacy scores of the teacher candidates obtained for the educational technology standards scale and the departments the teacher candidates were attending [$F_{(5-2560)}=8.377$, $p<.05$].

According to the results of Scheffe test applied to reveal which group caused the difference, there was a significant difference between the department of Computer and Instructional Technologies and the departments of English Language Teaching, Mathematics Teacher Training with a Minor in Turkish, Elementary School Teacher Training and Social Studies with a Minor in Turkish. The difference was found to be in favor of the department of Computer and Instructional Technologies. In other words, the teacher candidates attending the department of Computer and Instructional Technologies considered themselves as to have a higher level of self-efficacies than most of those attending the other departments. In addition, a significant difference - found in favor of the department of English Language Teaching – existed between the department of English Language Teaching and the department of Mathematics Teacher Training with a Minor in Turkish. Furthermore, there was a significant difference – found in favor of the departments of Elementary School

Teacher Training and Arts and Crafts Education - between the department of Mathematics Teacher Training with a Minor in Turkish and the departments of Arts and Crafts Education and Elementary School Teacher Training.

The finding that educational technology standards self-efficacies of teacher candidates differed with respect to the departments they were attending is consistent with the findings of other studies on NETS*T standards that educational technology standards differ depending on the department being attended (Haderlie 2001; Oh and French, 2005). The basic reason for the difference could be said to be the perceptions of departments about technology and their state of technology use. Kabakçı and Tanyeri (2006), in their studies, reported that depending on their departments, teacher candidates have different needs in educational tools. Therefore, the researchers suggested that the course of Educational Technologies and Material Development be taught in a different way based on the program. Alobiedat (2005) stated that in the department of special education rather than in other departments, especially such technologies as tape-recorders are preferred more than new technologies and reported this preference to be a normal situation. In this respect, it could be stated that it is quite natural for technology use to differ with respect to departments.

In summary, the department being attended plays a role in the acquisition of educational technology standards by teacher candidates. The viewpoints of departments about technology are considered to be an important factor for this difference to occur.

Conclusion

As a result of the present study carried out with 2.566 teacher candidates attending education faculties in 7 different universities in Turkey, it is seen that the teacher candidates considered themselves to have a high level of educational technology standards; that they were able to use technology well in the teaching process; that they had a good level of self-efficacy in the use of common technologies which could be called especially basic-level technologies; and that they had a moderately high level of self-efficacy in such subjects as educational softwares that require top-level skills. It is also clear that while the teacher candidates benefitted from technology especially for traditional assessment-evaluation services, they did not use technology for performance-based assessment-evaluation services. The teacher candidates were found to be most proficient in the factor of productivity and professional practices, which mostly require the use of the internet, while the factor of social,

ethical, legal and human issues – in any one of which the teacher candidates did not take any education - was the one for which the teacher candidates considered themselves as the least proficient. In addition, though teacher candidates did not take any education on the factor of planning of teaching according to individual differences and special needs, they reported that they considered themselves to be at a high level in line with their empathic tendencies.

Furthermore, it could be stated that gender was not significant in terms of the educational technology standards scale in general. In addition, gender was not a significant factor with respect to planning and designing learning environments and experiences, assessment and evaluation, and planning of teaching according to individual differences and special needs. On the other hand, male teacher candidates considered themselves as more proficient for the factor of technology operations and concepts and for the factor of social, ethical, legal and human issues, while female teacher candidates considered themselves more proficient for the factor of productivity and professional practices. In addition, educational technology standards self-efficacies differed with respect to the departments the teacher candidates were attending. In this respect, it is seen that the department of Computer and Instructional Technologies caused a significant difference. Due to its low self-efficacy score, the department of Mathematics Teacher Training with a Minor in Turkish was among the important factors that caused the difference.

Suggestions

Based on the results of the present study, the following suggestions could be proposed for application and for future research considering the variables of especially gender and departments.

- There are no standards for how to use educational technology in Turkey, yet. Standards for top-level educational technology use should be determined, and for this purpose, NETS standards could be adapted as many countries have done.
- The teacher candidates considered themselves basically proficient. In addition, teacher candidates should gain the skills in top-level technology use. These skills will also be effective in all aspects of the standards.
- Teacher candidates have the least self-efficacies for the factor of social, ethical, legal and human issues. The reason for this, no education is given to teacher candidates on

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such subjects as computer health and ethical use of computer in education faculties.

Teacher candidates should be given trainings on such subjects.

- There are models for the appropriate use of educational technology standards (Hall, 2006; Judgea and O'Bannon, 2004). According to these models, new courses should be organized in education faculties, and in these courses, teacher candidates should be taught how to use technology in the whole educational process rather than being taught only the skills in technology use.
- Departments have different needs of educational technology use. Considering these differences and standards together, NETS*T standards should be restructured at least according to the departments that have similar structures.

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