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SELF-EFFICACY OF TEACHER TRAINEES TOWARD EDUCATIONAL SOFTWARE DEVELOPMENT

ABSTRACT

The aim of the study is to determine the self-efficacy perceptions of the teacher trainees, studying at the computer education and instructional technologies departments of education faculties, about the development of educational software. The education software self-efficacies of the teacher trainees were generally at the middle level. While, no significant differences were observed in project management and instructional design, graphic design, programming dimensions of education software development self-efficacies of the teacher trainees with respect to gender, a significant difference was found in the dimension of animation and sound-video design. The difference was in favor of male teacher trainees. Compared to those who do not have a computer, the teacher trainees having a computer appeared to have higher self-efficacies in all of the education software development dimensions. Since computer using skill requires a lot of practice, education faculties and other related organizations or institutions must provide maximum opportunity and support for teacher trainees to use computer.

Keywords: Self-Efficacy, Teacher Trainees, Software Development, Computer Education and Instructional Technologies

ÖĞRETMEN ADAYLARININ EĞİTİM YAZILIM GELİŞTİRMEDE ÖZ YETERLİLİĞİ

ÖZET

Araştırmanın amacı, eğitim fakültelerinin bilgisayar ve öğretim teknolojileri eğitimi bölümlerinde öğrenim gören öğretmen adaylarının eğitim yazılımı geliştirmeye yönelik öz-yeterliklerini belirlemektir. Öğretmen adaylarının eğitim yazılımı geliştirme öz-yeterlikleri genel olarak orta düzeydedir. Cinsiyet değişkenine göre öğretmen adaylarının eğitim yazılımı geliştirme öz-yeterliklerine bakıldığında proje yönetimi ve öğretim tasarımı, grafik tasarımı, programlama boyutlarında anlamlı bir farklılık görülmezken, animasyon ve ses-video tasarımı boyutunda anlamlı bir fark olduğu görülmüştür. Farklılık erkek öğretmen adayları lehinedir. Bilgisayara sahip olmayanlar ile karşılaştırıldığında sahip olanların tüm eğitim yazılımı geliştirme boyutlarında eğitim yazılımı geliştirme yeterliklerinin daha yüksek olduğu görülmüştür. Bilgisayar kullanma becerisi çok fazla uygulama gerektirdiği için eğitim fakültelerinin ve diğer ilgili kurum ya da kuruluşların öğretmen adaylarına bilgisayar kullanma konusunda mümkün olduğunca çok fırsat ve destek sağlaması gerekmektedir.

Anahtar Kelimeler: Öz-Yeterlık, Öğretmen Adayı, Yazılım Geliştirme, Bilgisayar ve Öğretim Teknolojileri Eğitimi

1. INTRODUCTION (GİRİŞ)

Self-efficacy perception is based on Bandura's social cognitive learning theory. One of the most important specialties of social cognitive learning theory is that it specifies that people have the capability to think, make judgments and reflections about themselves. According to this theory, individuals record their opinions about themselves and capabilities concerning performing activities and make judgments about the efficacy of their opinions [1]. With all these judgments, individuals form their opinions about the extent of their capabilities of performing any kind of task successfully. Bandura (2001) calls these judgments of individuals' about themselves self-efficacy. According to Bandura, self-efficacy is the belief that one is capable of performing in a certain manner or attaining certain goals [2]. It is a belief that one has the capabilities to execute the courses of actions required to manage prospective situations.

Self-efficacy perceptions influence the goals people set for themselves, the amount of effort they will spend to achieve these goals, and the exposure time they will be able to spend to achieve their goals in case of difficulties and their reactions to failures [3, 4]. An individual's perception regarding his self-efficacy may not reflect his real efficacy. However, the perceived efficacy has an important role in arranging his/her behaviours. Efficacy not only plays a key role in individuals' developing their lives, but also it determines the level of individuals' evaluating their skills and abilities and transferring them [2]. The assumption is that the beliefs that individuals create and develop and hold to be true about themselves form the very foundation of human agency and are vital forces in their success or failure in all endeavors [5].

In recent years, the studies made on self-efficacy have inclined toward determining self-efficacies in specific fields (e.g., science self-efficacy, computer self-efficacy, mathematics self-efficacy) as well. One of these fields is the teacher self-efficacy. Teacher self-efficacy is defined as teacher beliefs regarding their possibility of exhibiting necessary behaviours in order to perform their teaching function successfully [6].

Parallel to all these definitions, it can be stated that a teacher's realizing an effective and successful teaching-learning process depends on his own self-efficacy perception [7]. For as much as this perception of a teacher's is expected to ensure students' adopting specific attitudes by influencing both them and others, and finally these attitudes are expected to show themselves in the form of positive or negative behaviours. The environments in which this is most clearly observable are the classroom and school environments where the teacher-student interaction is the most intensive [8]. No matter how knowledgeable a teacher is in his field, he is not expected to become efficient in his lessons if he/she lacks self-efficacy. For this reason, it becomes rather important to determine teachers' self-efficacy perceptions.

Ashton denotes that since self-efficacy perceptions of teachers are closely related to their capacity to influence the student performance in teaching-learning process, no other teacher efficacy exhibits such a consistent relationship with student success [9].

According to Chambers and Hardy the academic performances of students of teachers with high self-efficacy perceptions appear to be higher compared to those of students of teachers with lower self-efficacy perception [10]. In addition to this, it was found that teachers with high self-efficacy perceptions are less critical of the errors that students make during in-class activities, spare more time for the students having learning difficulties, and have more

enthusiastic attitudes toward teaching [11]. On the other hand, it was determined that teachers with low self-efficacy perceptions spare less time on giving instructions to students, are not insistent that students shall accomplish a task, which is difficult for them, spend less effort on motivating their students toward the activity, and behave reluctantly during teaching [12].

Schmitz and Schwarzer specify that efficacy expectancy of a teacher is a protective factor against his professional stress and also explain that self-efficient teachers are more committed to their professions and have higher satisfaction levels [13]. Teachers' fulfilling the requirements of the teaching profession is directly related not only to their taking a good education but also to their belief that they can perform their teaching duty and fulfill the required responsibilities [14].

2. RESEARCH SIGNIFICATION (ÇALIŞMANIN ÖNEMİ)

Above researchers reported that teachers' beliefs of self efficacy affect their instructional activities, their orientation toward the educational process and their expectations from the students. On the other hand, the development of teacher efficacy beliefs among prospective teachers has generated a great deal of research interest because once efficacy beliefs are established; they appear to be somewhat resistant to change [15]. Therefore, studies to be made on this matter will also be an extremely important source of data in terms of curriculum development studies of teacher education programs. As Gerçek, Yılmaz, Köseoğlu ve Soran specified, based on the data to be obtained from these kinds of studies, that a prediction can be made regarding the performance that teacher trainees will exhibit and the level of effort they will spend in their professions in the future; and the education programs can be revised in a way that will include rearrangements concerning teacher development in this direction [16]. In this context, the aim of the present study is to determine the self-efficacy perceptions of the teacher trainees, studying at the Computer Education and Instructional Technologies Departments of Education Faculties, about the development of educational software. To reach this aim, answers were sought for the following questions;

- At what level are the self-efficacy perceptions of the teacher trainees about the development of education software?
- Do the self-efficacy perceptions of the teacher trainees about the development of education software show difference depending on gender?
- Do the self-efficacy perceptions of the teacher trainees about the development of education software show difference depending on having and not having a computer?

3. METHOD (YÖNTEM)

This is a descriptive study. These types of studies are actualized in order to describe existing situation the characteristics of the variables of interest in a situation [17]. In this respect, researchers tried to describe relevant aspects of the educational software development self-efficacy profiles of teacher trainees. In this part, the participants, materials and data analysis procedure were included.

3.1. Participants (Katılımcılar)

This study was carried out with 296 teacher trainees studying at the Computer Teaching and Technologies Departments of Education

Faculties of the universities located in 3 different geographical regions (Marmara, Mediterranean and Middle Anatolia) during the 2007–2008 academic year. 128 of the participants were female and 168 of them were male teacher trainees.

3.2. Materials (Materyal)

To assess the self-efficacy perceptions of the teacher trainees regarding the development of education software, the "Education Software Development Self-Efficacy Perception Scale" developed by Aşkar and Dönmez [18] and the "Student Information Collection Form" were administrated. The scale, developed to measure four dimensions of the education software development process. These dimensions as follows; project management and instructional design, graphic design, programming, animation and sound-video design. It is a five-point Likert-type scale and includes 22 items. The reliability coefficient of the scale calculated using Chronbach alpha was found to be .92.

The Student Information Collection Form includes the questions inquiring about the gender and grade levels of the students, the geographical regions they come from, whether they have a computer or not, and whether they have internet usage opportunities or not.

3.3. Data Analysis (Veri Analizi)

In the analyses of the data obtained from the study, frequency and percentages, arithmetic means, standard deviations, t-test and one way analysis of variance were used. To analyze the data, SPSS 11.0 program was used.

4. FINDINGS (BULGULAR)

- **The Self-Efficacy of the Teacher Trainees Regarding Education Software Development:**

In the study, first of all, an effort was spent to try to determine the level of education software development self-efficacies of the teacher trainees in four different dimensions. First of these dimensions was related to the "Project Management and Instructional Design". The results obtained from the measurement tool regarding the education software development self-efficacies of the teacher trainees toward project management and instructional design were given in Table 1.

In Table 1, the item "In an education software project, I can set the aims of the project and determine what pieces of information, ways, means, and materials I need to reach these aims" is the one that the students trust themselves most about the matter of education software development (X=60,25). The item that the students trust themselves least is the item "In an education software development project, I can make the materials to be prepared compatible with the standards (such as SCOM, AICC)" (X=41,99).

Table 1. The education software development self-efficacies of the teacher trainees toward project management and instructional design (Table 1. Öğretmen adaylarının proje yönetimi ve öğretim tasarımına yönelik eğitim yazılımı geliştirme yeterlikleri)

Items (n =296)	X	sd
1. I can plan all the stages of an education software project (analysis, design, development, application, evaluation).	54,85	31,75
2. In an education software project, I can determine the project team considering the aim and the requirements of the project and generate solutions regarding the duties and responsibilities of this team.	59,93	29,85
3. In an education software project, in case of any problem, I can solve it or lay down the action steps necessary to solve the problem.	54,42	30,79
4. In an education software project, I can set the aims of the project and determine what pieces of information, ways, means, and materials I need to reach these aims.	60,25	29,64
5. In an education software project, I can arrange the contents given to me in accordance with the learner characteristics and needs.	59,62	29,63
6. I can design the necessary information, skills, and attitudes in a teachable way.	59,25	29,57
7. In an education software project, I can form the scenario template and arrange the prepared contents according to this template.	56,84	30,16
8. In an education software development project, I can make the materials to be prepared compatible with the standards (such as SCOM, AICC).	41,99	30,46
9. In education software, I can determine the kinds of assessments to be used to test the success of it in the direction of learner characteristics (such as pre-post test, exercises).	58,72	29,86
10. In education software, I can determine the kind of the assessment to be used to test if the given contents are understood or not.	58,51	29,79
PMIDMEAN	56,38	30.15

According to these results, it appears that teacher trainees trust themselves more about what they need in education software development projects, but they do not trust themselves much about the matter of the compatibility of the materials to be developed in these projects with the standards. Moving from these results, it can be concluded that teacher trainees must acquire more knowledge and skills concerning the standards to be applied in material development.

In the study, secondly, the education software development self-efficacies of the teacher trainees were determined in accordance with the dimension of graphic design. The results obtained from the measurement tool regarding the education software development self-efficacies of the teacher trainees toward the dimension of graphic design were given in Table 2.

Table 2. The education software development self-efficacies of the teacher trainees toward graphic design
(Tablo 2. Öğretmen adaylarının grafik tasarımına yönelik eğitim yazılımı geliştirme yeterlikleri)

Items (n = 296)	x	Sd
11. In developing education software, I can design the screen interface in the direction of the instructions given to me.	56,72	33,51
12. In developing education software, I can design the side menu by using navigation information in the direction of the instructions given to me.	54,83	33,60
13. In education software project, I can draw any character approved by the team using any kind of graphic design program (such as Adobe Photoshop, Macromedia Fireworks).	50,94	34,82
GDMEAN	54,16	33,97

Table 2 shows the results regarding the education software development self-efficacy perceptions of the teacher trainees toward graphic design. According to these results, the item "In developing education software, I can design the screen interface in the direction of the instructions given to me" is the one that the students trust themselves most about the matter of education software development (X=56,72). However, the item that the students trust themselves least is the item "In education software project, I can draw any character approved by the team using any kind of graphic design program (such as Adobe Photoshop, Macromedia Fireworks) (X=50,94). From these results, regarding the education software projects, it appears that the teacher trainees trust themselves more in designing screen interface in the direction of the instructions given, but they do not trust themselves much in using the graphic design software programs. Moving from these results, it can be concluded that the teacher trainees must acquire more knowledge and skills in using graphic design software programs.

In the study, thirdly, the education software development self-efficacies of the teacher trainees were tried to be determined considering the dimension of animation and sound-video design. The results obtained from the collected data using the measurement tool regarding the education software development self-efficacies of the teacher trainees in relation to the dimension of animation and sound-video design were given in Table 3.

Table 3. The education software development self-efficacies of the teacher trainees in relation to the dimension of animation and sound-video design
(Tablo 3. Öğretmen adaylarının animasyon, ses-video boyutuna yönelik eğitim yazılımı geliştirme yeterlikleri)

Items (n = 296)	x	sd
14. The adjoining figure was extracted from an animation about car traffic under the guidance of a traffic policeman. I can animate a two-dimensional animation of the above-mentioned kind by using any kind of animation program (such as Macromedia Flash).	47,49	35,70
15. The adjoining mechanism was extracted from an animation explaining about an experiment on electric current passing. When the switch in "On" position, the bulb lights because the circuit is closed. When the switch is in "Off" position, the bulb does not light because the circuit is open. I can animate a two-dimensional animation of the above-mentioned kind by using any kind of animation program (such as Macromedia Flash).	52,48	36,96
16. The adjoining figure was extracted from a three-dimensional animation design. Firstly, the Earth rotates around itself together with the latitudes and longitudes shown on it. After this, the animation approaches to the geographical region where Turkey is located and then the latitudes and longitudes of Turkey are shown in the form of a three-dimensional animation. I can animate a three-dimensional animation of the above-mentioned kind by using any kind of animation program (such as 3D Max, Maya).	27,06	28,39
17. I can add or delete new sounds to a sound file using sound arrangement programs (such as SoundForge) and edit them in a required way.	45,89	35,73
18. I can take the required pictures with a video camera and then edit them and also I can add effects on the present and newly-taken pictures by using a video program (such as Adobe Premiere, Ulead VideoStudio).	44,63	35,91
19. I can convert a present picture file into various video files (such as Mpeg1, Mpeg2, Avi).	55,07	39,43
ASVDMEAN	45,33	35,35

Table 3 shows the results regarding the education software development self-efficacies of the teacher trainees in relation to the dimension of animation, sound-video design. According to these results, the item indicating that the teacher trainees trust themselves most in developing education software is the item "I can convert a present picture file into various video files (such as Mpeg1, Mpeg2, Avi)" (X=55,07). However, the item indicating that they trust themselves least is the item "I can animate a three-dimensional animation of the above-mentioned kind by using any kind of animation program (such as 3D Max, Maya" (X=27,06). From these results, it appears that the teacher trainees trust themselves more in converting

a picture file into various video files, but they do not trust themselves much in animating a three-dimensional animation by using software. Moving from these results, it can be concluded that the teacher trainees must acquire more knowledge and skills in using animation software.

In the study, fourthly, an effort was spent to determine the education software development self-efficacies of the teacher trainees in relation to the dimension of programming. The results obtained from the measurement tool concerning the education software development self-efficacies of the teacher trainees concerning the dimension of programming were given in Table 4.

Table 4. The education software development self-efficacies of the teacher trainees concerning the dimension of programming
(Tablo 4. Öğretmen adaylarının programlama boyutuna yönelik eğitim yazılımı geliştirme yeterlikleri)

Items (n = 296)	x	Sd
20. In an education software, using the given database, I can write codes regarding registrations like students' user registrations, and their performance levels in any programming language (such as Visual Basic, C++).	37,29	32,21
21. In an education software, using the database, I can write codes in any programming language (such as Visual Basic, C++) to learn about what subjects students can enter or can not enter.	34,41	31,03
22. In an education software, using any authoring language program (such as Macromedia Authorware, Macromedia Director), I can combine the text, sound, and animations formed by other units so as to be arranged in pages.	39,19	33,97
PMEAN	36,96	32.40

Table 4 shows the results concerning the education software development self-efficacies of the teacher trainees in relation to the dimension of programming. According to these results, regarding the education software development, the item indicating that teacher trainees trust themselves most is the item "In an education software, using any authoring language program (such as Macromedia Authorware, Macromedia Director), I can combine the text, sound, and animations formed by other units so as to be arranged in pages" (X=39,19). However, the item indicating that they trust themselves least is the item "In an education software, using the database, I can write codes in any programming language (such as Visual Basic, C++) to learn about what subjects students can enter or can not enter" (X=34,41). From these results, while it appears that the teacher trainees trust themselves more in using an authoring language, they do not trust themselves much in using database and in writing codes in any authoring language. Moving from these results, it can be concluded that teacher trainees must have more knowledge and skills in using the database while developing education software and in writing codes in any programming language.

- **The Education Software Development Self-Efficacies of the Teacher Trainees in respect to Gender:**

In this part of the study, it was investigated whether there was difference between the education software development self-efficacies of the teacher trainees with respect to gender variable and the obtained results were given in Table 5.

Table 5. Comparison of education software development self-efficacies of the teacher trainees with respect to gender variable
(Tablo 5. Öğretmen adaylarının cinsiyete değişkenine göre eğitim yazılımı geliştirme yeterliklerinin karşılaştırılması)

	GENDER	n	X	sd	t	P
PMIDMEAN	Female	128	53,94	28,65	-1,32	,181
	Male	168	58,25	26,45		
ASVMEAN	Female	128	37,90	29,03	-3,838	,000**
	Male	168	51,17	29,81		
GDMEAN	Female	128	50,82	31,91	-1,558	,120
	Male	168	56,70	32,41		
PMEAN	Female	128	33,47	28,43	-1,767	,078
	Male	168	39,62	30,53		

**p<0,01

Table 5 indicates the t-test and its results regarding the significant difference between the education software development self-efficacies of the teacher trainees with respect to gender variable. According to these results, there is a significant difference in terms of education software development between the self-efficacies of the female (X=37,90) and male (X=51,17) teacher trainees concerning the mean (t:-3,838; p<.000) in the dimension of animation and sound-video design. The difference is in favor of the male students. To put it differently, the male students trust themselves more than the female counterparts regarding this dimension. In the dimensions of project management and design, graphic design and programming, which are the other dimensions, there are no significant differences between the self-efficacies of the female and male students. It can be stated that the above-mentioned difference might have resulted from the fact that male and female students have different fields of interest and capabilities.

- **The Education Software Development Self-Efficacies of the Teacher Trainees with respect to the Variable 'having a computer or not':**

In this part of the study, it was investigated whether there was a difference between the education software development self-efficacies of the teacher trainees with respect to the variable 'I have a computer/ I do not have a computer' and the obtained results were given in Table 6.

Table 6. Comparison of education software development self-efficacies of the teacher trainees with respect to the variable "having a computer or not"
(Tablo 6. Öğretmen adaylarının bilgisayarlarının olup olmadığı değişkenine göre eğitim yazılımı geliştirme yeterliklerinin karşılaştırılması)

	Comp.	n	x	sd	t	P
PMIDMEAN	Yes	251	59,37	25,79	4,552	,000**
	No	45	39,77	30,69		
ASVMEAN	Yes	251	49,00	28,67	4,999	,000**
	No	45	25,53	30,78		
GDMEAN	Yes	251	58,00	31,00	5,039	,000**
	No	45	32,70	31,16		
PMEAN	Yes	251	39,82	29,16	3,997	,000**
	No	45	21,03	28,24		

**p<0,01

Table 6 indicates the t-test and its results regarding the significant difference between the education software development self-efficacies of the teacher trainees with respect to the variable 'I have a computer/ I do not have a computer'. According to these results, there is a significant difference between the self-efficacy perceptions of the teacher trainees with and without a computer in all the specified dimensions. In the dimension of project management and instructional design, the mean for those who have a computer was found to be 59, 37, and the mean for those who do not was found to be 39,77, and t-value was calculated to be 4,552 (p<.000). In the dimension of animation and sound-video design, the mean for those who have a computer was determined to be 49,00, and the mean for those who do not appeared as 25,5370, and t-value was 4,999 (p<.000). In the dimension of graphic design, the calculated mean for those who have a computer was 58,00 and for those who do not it was 32,70 with t-value calculated as 5,039 (p<.000). In the dimension of programming, the calculated mean for those who have a computer was 39,82, and for those who do not it was 21,03 with the t-value calculated as 3,997 (p<.000). The difference was in favor of the teacher trainees having a computer in all dimensions. To put it another way, teacher trainees having a computer trust themselves more than those who do not.

In addition to the above findings, it was observed that the standard deviation values in the tables are high. This situation may be related to the heterogeneity of the participants as stated previously they were from the 3 different geographical regions of Turkey. In other words, the variables such as instructional environment, physical conditions, and instructor's specialties may show differences in Computer Education and Instructional Technologies Departments of Education Faculties at different geographical regions. These variables could not control in this study.

5. DISCUSSION AND CONCLUSION (TARTIŞMA VE SONUÇ)

In the present study made to determine the self-efficacies of the teacher trainees toward education software development, the following results were reached.

- The education software self-efficacies of the teacher trainees were generally at the middle level. Teacher trainees, who are to train future individuals, are expected to become more efficient in developing education software that will be employed in

learning-teaching processes. Researches related to self-efficacy perception showed that the individuals who have higher computer self-efficacy are more successful in using computers than the others, they have higher self-esteem, and they are more motivated about taking responsibilities and successful in achieving these responsibilities [19, 20]. According to social cognitive theory personal experiences are the basic sources for self efficacy and the school life constitutes one of the most important sources for the personal experiences. In this respect, the number of the lessons and the number of the lesson hours of the present courses on developing education software must be increased in the programs of the teacher training institutions.

- When the education software development self-efficacies of the teacher trainees were examined in all four dimensions, in the project management and instructional design dimension it appeared that while the teacher trainees trust themselves in determining the knowledge, means and materials that they need in order to develop an education software, they do not trust themselves much in making the materials to be. prepared in developing an education software compatible with the standards Teacher trainees need more knowledge and skills in developing education software in accordance with the standards. For this purpose, they must be given education on this matter in relevant courses.
- In graphic design, the second dimension of the education software development self-efficacy instrument, while they trust themselves in designing screen interface in the development of education software, they do not trust themselves much in drawing a character for education software using any graphic design program. Teacher trainees need more knowledge and skills in using graphic design programs. It can be stated that computer graphic design courses must be included in the present programs.
- In animation and sound-video design dimension, while they trust themselves in converting a picture file into various video forms, they do not trust themselves much in making a three-dimensional animation using any animation software. The relevant courses that the teacher trainees take must include unit/units on using animation software.
- In the programming dimension, as the fourth dimension of the instrument, while they trust themselves in arranging pages using any authoring language program, they do not trust themselves much in writing codes using the database about monitoring of students in any programming language. In this case, it can be stated that teacher training institutions must include courses on database using and code writing in their programs.
- While project management and design, graphic design and programming dimensions there are no significant differences between the self-efficacies of the female and male students, a significant difference was found between their education software development self-efficacies in the dimension of animation and sound-video design with respect to gender. Difference was in favor of male teacher trainees. Moving from this, it can be stated that male teacher trainees trust themselves more in animation and sound-video design. The reason for the difference between female and male teacher trainees might be the fact that they have different fields of interest and capabilities. In related researches, it was stated that the male students have higher attitudes and self efficacies toward

computer than female students. However, in recent years female students are started to use computers as much as male students. Therefore, finding no significant difference with respect to gender can evaluated as natural result of this development.

- A significant difference was found between the education software development self-efficacies of the teacher trainees in respect to the variable 'having a computer or not'. Compared to those who do not have a computer, the teacher trainees having a computer appeared to have higher self-efficacies in terms of education software development in all of the education software development dimensions. Since computer using skill requires a lot of practice, the teacher trainees having a computer have an opportunity to make practice as much as they want. On account of this, not only teacher training institutions, but also both the official and private institutions and organizations should give support to teacher trainees so that they can have a computer.

NOTICE (NOT)

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