SELF-EFFICACY BELIEFS, ACHIEVEMENT MOTIVATION AND GENDER AS RELATED TO EDUCATIONAL SOFTWARE DEVELOPMENT

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ABSTRACT

This study aims to investigate preservice computer teachers' self-efficacy beliefs and achievement motivation levels for educational software development before and after the "Educational Software Design, Development and Evaluation (ESDDE)" course. A pretest and post test design without a control group was employed. In 2008, 46 senior students (25 male and 21 female) who were enrolled at Computer Education and Instructional Technology department participated in this study.

The data were collected by the scale of self-efficacy beliefs towards Educational Software Development (ESD), achievement motivation scale besides student demographics form. Positively, the results revealed that the students' self efficacy beliefs towards educational software development significantly improved after ESDDE course. Before the course, the students' self-efficacy beliefs were significantly different according to perceived level of programming competency and gender in favor of male, however after the course there was no significant difference in self-efficacy beliefs regarding gender and perceived level of programming competency. Hence, achievement motivation levels after the course were significantly higher than before while gender and perceived level of programming competency had no significant effect on achievement motivation for ESD. The study is considered to contribute studies investigating gender and computer related self efficacy beliefs in IT education.

Keywords: **Educational software development; multi-media software development; gender; IT education; self-efficacy; achievement motivation.**

INTRODUCTION

The concepts "motivation" and "self efficacy" are considered as among the factors which have a great impact on teaching and learning processes. As Hastings (1997) implied motivation is a key factor for successful teaching as well as learning. Marshall (1998) defined achievement motivation as "the need to perform well or the striving for success, and evidenced by persistence and effort in the face of difficulties, achievement motivation is regarded as a central human motivation".

It is a reason for why some students study voluntarily while others do not and why some of them make efforts to improve themselves and others do not (Çakmak & Ercan, 2006). The relations among motivation and other psychological and educational variables such as self-esteem, exam anxiety, achievement, efficacy belief and attribution styles are under investigation in many studies as Bozanoglu (2004) cited.

Borich (2007) adressed that cognitive psychologists have proposed three distinct yet overlapping theories of academic motivation which are attribution theory, self-efficacy theory and goal theory. Among these, self-efficacy theory holds academic motivation hinges on learners' beliefs that they can succeed at school tasks.

People's beliefs about their capabilities are considered to have a central role among the mechanisms of personal agency to control over events that affect their lives (Bandura, 1989).

Perceived self-efficacy is defined by Bandura (1994), the originator of self-efficacy theory, as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives". Self-efficacy beliefs determine how people feel, think, behave and function as an important set of proximal determinants of human affect and action.

As cited by Ortaçtepe (2006), Bandura noted that people's beliefs in their efficacy influence them in various ways, such as the actions they take, the choices they make, how much effort they put in their struggles, how long they will persist against obstacles and failures, their flexibility for adversity, how much stress and depression they experience in coping with environmental demands, and the level of accomplishments they ultimately achieve. As Bandura and Locke (2003) addressed, individuals' self efficacy beliefs contribute significantly to the level of their motivation and performance as well. Therefore, self efficacy beliefs need to be investigated as a key determinant in education (Aşkar & Dönmez, 2004; Aşkar & Umay, 2001; Kurbanoğlu, 2003). Highlighting the relations between gender and computer self-efficacy, Vekiri & Chronaki (2008) examined relations between outside school computer experiences, perceived social support for using computers, and self-efficacy and value beliefs about computer learning for 340 Greek elementary school boys and girls. Among their findings, they noted that the boys reported more perceived support from their parents and peers to use computers and more positive computer self-efficacy and value beliefs than girls. Meelissen & Drent (2008) also indicated that female students are likely to have less positive perceptions of their computer competence.

Another study investigating 100 preservice computer teachers' self-efficacy for educational software development in Turkey, Demirer, Özdinç & Şahin (2009) found that although male students have higher self-efficacy beliefs than female, the difference is insignificant. On the contrary, surveying 605 Turkish pre-service science and mathematics teachers' computer related self-efficacies, attitudes, and the relationship between these variables, Pamuk & Peker (2009) reported that a participant's gender was not a significant factor on his/her computer self-efficacy and computer attitude scores (CAS) except for the computer liking sub-scale of the CAS.

In the context of computer teacher education, self efficacy and gender issues were investigated by İmer & Özkılıç (2009). They examined 296 preservice computer teachers' educational software self efficacy beliefs. According to their findings, the students' self efficacy beliefs are at moderate level. While, no significant differences were observed in project management and instructional design, graphic design, programming dimensions of educational software development self-efficacies of the preservice computer teachers with respect to gender, a significant difference was found in the dimension of animation and sound-video design. Difference was in favor of male teacher trainees. This study also examines the relations among preservice computer teachers' gender, self-efficacy and achievement motivation for educational software development.

In order to bring up the need for conducting this study, it is considered that the goals of the computer teacher education program in Turkey should be mentioned.One of the goals of the Computer Education and Instructional Technology (CEIT) departments in Turkish educational faculties is to provide preservice computer teachers skills in developing computer and/or Web based instructional materials and educational software. Demirer et al. (2009) defined self efficacy beliefs for educational software development as the individuals' self confidence levels and personal judgments about educational software development process. To prepare educationally effective software, preservice computer teachers need to be well equipped with both pedagogical and technical knowledge. In order to help achieving this goal, it is considered that investigating their self efficacy beliefs and achievements motivation levels before and after training can contribute development of CEIT programs.

PURPOSE OF THE STUDY

This paper aims to investigate self-efficacy beliefs of students towards educational software development and their achievement motivation levels for the "Educational Software Design, Development and Evaluation (ESDDE)" course before and after the course. ESDDE is one of the eighth semester course of Computer Education and Instructional Technologies (CEIT) program at faculty of education. The key research inquiries are:

- **What are the levels of self-efficacy beliefs towards educational software development before and after ESDDE course considering following dimensions?**
- **Project management and instructional design,**
- **Animation and sound-video design,**
- **Graphics design,**
- **Programming**
- **Is there any significant difference between students' self-efficacy beliefs towards educational software development before and after ESDDE course?**
- **Is there any significant difference between students' self-efficacy beliefs towards educational software development before and after ESDDE course regarding gender?**
- **Is there any significant difference between students' self-efficacy beliefs towards educational software development before and after ESDDE course regarding their perceived level of programming competency?**
- **Is there any significant difference between students' achievement motivation levels for educational software development before and after ESDDE course?**
- **Is there any significant difference between students' achievement motivation levels for educational software development before and after ESDDE course regarding gender?**
- **Is there any significant difference between students' achievement motivation levels for educational software development before and after ESDDE course regarding their perceived level of programming competency?**

METHOD

Research design of this study is one-group Pre-Test/Post-Test Design. The study was limited with one sample without a control group; therefore the findings obtained cannot generallize to a broader population.

Delimitations for this study include the use of a purposive sample of preservice computer teachers enrolled in one CEIT program in Turkey. However, by filling a gap in this era, the study is considered to provide valuable contributions for investigating self efficacy beliefs for educational software development and achievement motivation level of preservice IT teachers before and after the ESDDE course.

Participants

The sample of the study is of 46 senior students (25 male and 21 female) at Computer Education and Instructional Technologies department of faculty of education at Ege University, Izmir, Turkey. Demographic data of the participants are summarized in Table: 1.

Table: 1
Demographics of the sample

Demographics		f	%
Gender	Male	25	*54.3*
	Female	21	45.7
Type of high school they graduated	- Computer Science intensive vocational)	17	37.0
	- Anatolian/Science	19	*41.3*
	- Public	6	13.0
	- Intensive English	4	8.7
Their perceived level of programming competency	1- Very low	2	4.3
	2 - Low	2	4.3
	3 - Moderate	21	*45.7*
	4 - Good	16	34.8
	5 – Very good	5	10.9
Total		46	100

Content of the"Educational Software Design, Development and Evaluation" (ESDDE) course

ESDDE was one of the eighth semester courses of the Computer Education and Instructional Technologies Program which aims the students excel at computer teaching and become well-equipped instructional technologists. However, with the new program for educational faculties, this course is excluded. In ESDDE course in this study, the students are asked to follow the educational software development process in a defined schedule including 14 weeks as follows:

- **Choosing a partner student (or may study individually) and selecting a course topic from the list given,**
- **Making interviews with a subject expert and a group of target level of students, and report what their teaching and learning needs are (Needs Assessment),**
- **Preparing the educational goals of their software and review them after lecturer's feedback,**
- **Examining and criticizing available educational software programs that prepared for same topics of theirs with the lecturer,**
- **Reviewing principles and suggestions for educational material design (interface design, usability issues. etc.)**
- **Starting to design the interface elements of the software and review them after lecturer's feedback,**

- **Getting help from experts about resources and forming content of the software,**
- **Making audio and other visuals such as video, graphics, animations or simulations, (the students are required to use multi-media options for the content)**
- **Integrating all components of the educational software through guidance of the lecturer,**
- **Debugging and finalizing the software,**
- **Piloting the software in a target group of students and get feedback from students and their teachers as well.**
- **Reporting feedback for the software and make suggested changes in the program,**
- **Exhibiting software to his/her peers, lecturers and other people who are interested.**

For developing software, Adobe Flash program is suggested since they studied with Flash in previous term. Barretto, Piazzalunga, Ribeiro, Dalla and Filho (2003) implied that Flash has a user-friendly and comprehensive online tutorial with plenty of examples and explanations available.

Flash enables users to create attractive animations, to apply several visual effects, and to make use of MP3 audio format, which adds to sound quality and reduced file size and has many advantages such as generating vectorized images and vectorizing images imported from other software. As Flash has limited possibilities of programming, there is a reduced potential for promoting interactivity between user and software.

Data Collection

Two data collection tools are made use of in this study which is as follows:

- **Personal information form: This form includes eight questions regarding gender, type of high school they graduated, their perceived level of programming competency, difficulties they face during educational software development and their possible reasons for these difficulties.**
- **Scale of self-efficacy beliefs towards Educational Software Development (ESD): This scale was developed by Aşkar & Dönmez (2004), including 22 items for assessing the level of their self-confidence in their competency at the given task about educational software development process ranging from 0 (no confidence) to 100 (full confidence). The final version of the scale was administered to 283 junior and senior students studying at Computer Education and Instructional Technologies departments of Hacettepe, Ankara, Orta Doğu Teknik and Gazi University in Turkey. Principal components factor analysis rotated to varimax rotation was used for the purpose of obtaining evidence for validity estimates, yielded four factors, namely,**

    - **Project management and instructional design,**
    - **Animation and sound-video design,**
    - **Graphics design,**
    - **Programming.**

The estimated reliability of the scale scores by using Cronbach's was .92 (Askar & Dönmez, 2004). The maximum score for the scale was 2200 while the minimum was 0.Scale of achievement motivation.

This scale was developed by Umay (2002) and conducted to total 229 students who started the program recently every year since 1998 and scale was readministered to the first group completed the program at 2002. The scale includes two sections; the first section aims to reveal the student's perception of achievement, definition of achievement and the factors effecting his/her achievement motivation. This section includes 7 items and scored as 0/1 (Bernoulli experiment) (Umay, 2002).

The second section which includes 14 items is three point Likert type for assessing the level of achievement motivation according to several learning theories. Considering the second section, the reliability of the scale scores by using Cronbach · was .75. Since achivement motivation is not regarded as constant, · coefficient of the scale is found to be relatively high (Umay, 2002).

Data Analysis

The data were analyzed by a statistical packaging program using descriptive statistics, t-Test and ANOVA.

FINDINGS

Self-Efficacy Beliefs Towards Educational Software Development Before And After ESDDE Course

Table: 2
Distribution of ESD self-efficacy beliefs

Dimensions	Before ESDDE				After ESDDE			
	Min	Max	$\bar{X}$	SD	Min	Max	$\bar{X}$	SD
Project management	385	960	746.72	121.30	580	990	862.44	96.70
Animation and sound-video design	210	600	429.72	85.28	360	600	515.77	62.11
Graphics design	65	300	231.48	51.59	170	300	262.54	30.75
Programming	0	300	167.61	81.05	90	300	225.11	55.51

It was clear from the findings presented in Table: 2 that the students' self efficacy beliefs towards educational software development improved after ESDDE course in each dimension (project management, animation and sound-video design, graphics design and programming). And these improvements were found to be statistically significant (p=0.000) as presented in Table: 3.

Table: 3
One sample t-Test results for ESD self-efficacy beliefs

	n	$\bar{X}$	SD	dF	t	p
Before ESDDE	46	157 5.52	264.84	45	40.35	0.000**
After ESDDE	46	186 5.85	195.21	45	64.83	

** (p<0.001)

Table: 3 showed that the difference between educational software development self efficacy beliefs before and after ESDDE course was significant at p=0.001 level ($t_{(45)}$=40.35, p<.001).

Table: 4
t-Test results for ESD self-efficacy beliefs regarding gender

	Gender	n	$\bar{X}$		t	p
Before ESDDE	Female	21	1480.71	275.22	2.332	0.024 *
	Male	25	1655.16	232.21		
After ESDDE	Female	21	1873.05	229.02	-0.227	0.822
	Male	25	1859.80	166.31		

*** (p<0.05)**

Table: 4 revealed that male students' self-efficacy beliefs towards educational software development were significantly higher than the female before ESDDE course. However, after the course, the difference was insignificant.

Table: 5
ANOVA results for ESD self-efficacy beliefs regarding perceived level of programming competency

		Sum of squares	df	Mean squares	F	p
Before ESDDE	Between groups	1259289	4	314822.24	6.804	0.000**
	Within groups	1897065	41	46269.87		
	Total	3156353	45			
After ESDDE	Between groups	318471.5	4	79617.87	2.338	0.071
	Within groups	1396326	41	34056.74		
	Total	1714798	45			

****(p<0.001)**

Table: 5 presented that the students' self-efficacy beliefs before ESDDE course were significantly different from each other according to their perceived level of programming competency.

Nevertheless, the differences in their self-efficacy beliefs after ESDDE course were insignificant according to their perceived level of programming competency. Achievement motivation levels for educational software development before and after ESDDE courseIn the first part of the Achievement Motivation Scale, Umay (2002) described a series of statements representing achievement motivation level.

In Table 6, expected responses from students with high level of achievement motivation and their distribution for the participants before and after the ESDDE course was presented. It is clear from Table: 6 that students' achievement motivation levels were generally increased after ESDDE course.

Table: 6
Distribution of expected responses of students with high achievement motivation level

Expected responses of students with high achievement motivation	Before ESDDE		After ESDDE	
	f	%	f	%
I feel that I can succeed in developing educational software	36	78.3	42	91.3
I think success is to surpass oneself	39	84.8	45	97.8
I think effort and working are keys for success	30	65.2	33	71.7
I mostly study to learn something new or to develop myself for a course	31	67.4	39	84.7
I want to be successful for myself	41	89.1	45	97.8
I plan on short-term learning goals when studying with computers e.g. designing two buttons in an hour	12	26.1	8	17.4
I struggle to get the highest score that I expect to get.	28	60.9	26	56.5

Table: 7
One sample t-Test results for ESD achievement motivation levels

	n	$\bar{X}$	SD	dF	t	p
Before ESDDE	46	33.24	3.16	45	71.42	0.000**
After ESDDE	46	34.41	3.44	45	67.94	

** (p<0.001)

Table: 7 showed that the difference between educational software development achievement motivation before and after ESDDE course was significant at p=0.001 level in favor of after ESDDE scores ($t_{(45)}$=71.42, p<.001).

Table: 8
t-Test results for ESD achievement motivation regarding gender

	Gender	n	$\bar{X}$	SD	t	p
Before ESDDE	Female	21	33.84	2.79	1.425	0.161
	Male	25	32.52	3.47		
After ESDDE	Female	21	34.64	3.38	0.485	0.630
	Male	25	34.14	3.57		

(p<0.05)

Table 8 revealed that female students' achievement motivation towards educational software development were higher than the male before ESDDE course although that difference is statistically insignificant. After ESDDE course, the male and the female almost showed equal achivement motivation while the female scores were 0.5 point higher than the male. However, this difference is also insignificant.

Table: 9
ANOVA results for ESD achievement motivation regarding perceived level of programming competency

		Sum of squares	Df	Mean squares	F	p
Before ESDDE	Between groups	7.82	4	1.96	0.182	0.946
	Within groups	440.55	41	10.74		
	Total	448.37	45			
After ESDDE	Between groups	31.74	4	7.93	0.651	0.629
	Within groups	499.42	41	12.18		
	Total	531.15	45			

($p<0.05$)

Table: 9 presented that the students' achievement motivation both before and after ESDDE course were insignificantly different from each other according to their perceived level of programming competency.

DISCUSSION

The results of this study revealed that the students' self efficacy beliefs towards educational software development significantly improved after ESDDE course in each dimension including project management, animation and sound-video design, graphics design and programming. As it is expected, after the ESDDE course and having prepared educational software by them, the students tend to feel confident in their educational software development skills at every dimension and showed more positive self-efficacy beliefs than before.

This finding is considered to be an indicator of the positive outcomes of the ESDDE course for preservice teachers.When we review the findings related to gender and self efficacy beliefs for educational software development, we came across an interesting finding. Before ESDDE course, male students' self-efficacy beliefs were significantly higher than the female in consistent with the findings of Aşkar & Dönmez (2004) and Demirer et al. (2009) who found male preservice computer teachers' self efficacy beliefs were higher than female. However, in this study, after ESDDE course there was no significant difference in self-efficacy beliefs between male and female students. It is considered that at the end of the course, by developing educational software themselves, female students felt more confidence in their abilities for developing educational software.

The findings related to perceived level of programming abilities and self efficacy beliefs for educational software development before and after the course led us to similar results. It seemed that after the course, the students' perceptions of their programming abilities has no longer significantly effect their self efficacy beliefs towards educational software development. On the other hand, the students' achievement motivation levels after the course were significantly higher than before. This finding may evidence the positive effects of the ESDDE course on students' achievement motivation which may also indicate the success of the course activities.

Meanwhile, the variables such as gender and perceived level of programming competency had no significant effect on achievement motivation for educational software development.

IMPLICATIONS AND CONCLUSION

The results of this study about self-efficacy beliefs and achievement motivation of preservice computer teachers in educational software development had some conlusions. Studies investigating the relation between gender and computer self efficacy come up with different findings; while some of them (Aşkar & Dönmez, 2004; Demirer et al., 2009; Meelissen & Drent, 2008; Vekiri & Chronaki, 2008; Whitley, 1997) found that male students had higher self-efficacy beliefs than female, some of them (Pamuk & Peker, 2009) found that no significant difference regarding gender and some of them (İmer & Özkılıç, 2009) found difference only in animation and sound-video design dimension of educational software development according to gender. In this study, preservice computer teachers had significantly different self-efficacy beliefs according to gender before the ESDDE course.

However, the situation was not the same after the course. Regardless of gender, the course activities in this study seemed to have a positive impact on all preservice computer teachers' self-efficacy beliefs for educational software development. It is clear that making gender related generalizations and prejudgments about computer and/or technology self efficacy beliefs may be inappropriate since many other factors need to be considered and further investigated in various contexts. As Volman & Eck (2001) implied that the way in which teachers interact with students during ICT related activities contributes implicitly to the impression that boys are inherently better in ICT than girls.

Such impressions may mislead female students about their self-efficacy beliefs for developing such computer based educational materials as supported by Vekiri & Chronaki (2008).

Therefore, educators in ICT field need to avoid making inherent impressions that male students can better and/or easily succeed in ICT related courses than female can do. They must be aware of their possible prejudgments against female students with regard to their computer skills.

Similarly, the preservice computer teachers' perceived level of programming competency was a significant factor in their self-efficacy beliefs before the course while it was not after the course. It is considered that preservice computer teachers perceived programming capabilities as a crucial requirement for educational software development before the ESDDE course.

However, after they developed educational software by themselves, they possibly realized that programming capabilities were less important for educational software development than they thought it was.

In order to develop self-efficacy beliefs and motivation of preservice computer teachers for educational software development, further investigations about the effects of the independent variables such as gender, cognitive engagement, computer self efficacy beliefs, attitudes towards computers, perceptions and willingness of preservice teachers' use of technology in instruction as well.

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REFERENCES

Askar, P. & Umay, A. (2001). Perceived computer self-efficacy of the students in the elementary mathematics teaching programme. *Hacettepe University Journal of Education*, *21,*1-8.

Askar, P. & Dönmez, O.(2004). A self-efficacy scale for educational software development. *Educational Science and Practice, 6(3),* 259-274.

Bandura, A. (1989). Human Agency in Social Cognitive Theory. *American Psychologist, 44* (9), 1175-1184.

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman [Ed.], *Encyclopedia of mental health*. San Diego: Academic Press, 1998).

Bandura, A. & Lock, E.A. (2003). Negative Self-Efficacy and Goal Effects Revisited. *Journal of Applied Psychology, 88* (1), 87-99.

Barretto, S.F.A., Piazzalunga, R., Ribeiro, V.G. , Dalla, M.B.C. and Filho, R.M.L. (2003). Combining interactivity and improved layout while creating educational software for the Web. *Computers & Education, 40 (2003),* 271–284.

Borich, G. D. (2007). *Effective teaching methods: Research based practice.* Sixth edition. Upper Saddle River, New Jersey: Pearson Prentice Hall.

Bozanoglu, I. (2004). Academic Motivation Scale: Development, Reliability, Validity. *Ankara University, Journal of Faculty of Educational Sciences, 37* (2), 83-98.

Cakmak, M. & Ercan, L. (2006). Views of Experienced and Student Teachers about Motivation in Effective Teaching Process. *Journal of Gazi Educational Faculty, 26 (3),*133-143.

Demirer, V., Ozdinç, F. & Sahin, I. (2009). Computer teacher candidates' self-efficacy for educational software development. *In Proceedings of the 9th International Educational Technology Conference (IETC2009)*, Ankara, Turkey, 435-441.

Imer, G. & Ozkilic, R. (2009). Self-Efficacy Of Teacher Trainees Toward Educational Software Development. *E-Journal of New World Science Academy,4,*2.

Kurbanoglu, S. S. (2003).Self-efficacy: a concept closely linked to information literacy and lifelong learning", *Journal of Documentation*, *59* (6), 635-646.

Marshall, G. (1998). *A Dictionary of Sociology.* UK: Oxford University Press.

Meelissen, M. R. M., & Drent, M. (2008). Gender differencies in computer attitudes: Does the school matter?. Computers in Human Behavior, 24 (3), 969-985.

Ortaçtepe, D. (2006). The relationship between teacher efficacy and professional development within the scope of an in-service teacher education program. *Unpublished master thesis.* Institute of Social Sciences, Boğaziçi University, Turkey.

Smith, R.S. (2001). *Interface Design for Educational Multimedia I.* Retrieved August 28, 2008, from http://www-rohan.sdsu.edu/~iacc/IDEMM1.pdf .

Umay, A. (2002). Level of achivement motivation of mathematics teacher candidates, change of achievement motivation and factors effects this change, *Hacettepe University Journal of Education, 22*, 148-155.

Volman, M. & van Eck, E. (2001). Gender equality and information technology in education: The second decade. *Review of Educational Research,* 71(4), 613-634.

Whitley, B. E. (1997). Gender differences in computer-related attitudes and behavior: A meta-analysis. *Computers in Human Behavior*, 13(1), 1–22.