JOURNAL OF EDUCATIONAL
AND INSTRUCTIONAL STUDIES IN THE WORLD
November 2017, Volume: 7 Issue: 4 ISSN: 2146-7463

AN ANALYSIS OF THE SELF EFFICACY ABOUT COMPUTER PROGRAMMING OF THE ELECTRICAL-ELECTRONICS AND TEXTILE ENGINEERING STUDENTS IN TECHNOLOGY FACULTY

Rsrch. Assist. Eyüp Emre Ülkü
Marmara University
Technology Faculty Computer Engineering Department- Turkey
emre.ulku@marmara.edu.tr

Assist. Prof. Dr. Buket Doğan
Marmara University
Technology Faculty Computer Engineering Department- Turkey
buketb@marmara.edu.tr

Assist. Prof. Dr. Önder Demir
Marmara University
Technology Faculty Computer Engineering Department- Turkey
odemir@marmara.edu.tr

Assist. Prof. Dr. Kazım Yıldız
Marmara University
Technology Faculty Computer Engineering Department- Turkey
kazim.yildiz@marmara.edu.tr

Abstract
In this study, it is examined how the self-efficacy perception, which is as effective as cognitive level of academic achievement, changes according to department and sex in computer programming. Self-efficacy perception scale related to programming is used as data collection tool in the study. The research group consists of 119 students who take computer programming course in electrical-electronics and textile engineering departments of Marmara University Faculty of Technology during the spring semester of 2016-2017 academic year. The results of the study revealed that; the self-efficacy of students is high to perform simple programming tasks, but low in terms of performing complex programming tasks. In addition, it is observed that students in the electrical-electronics engineering department have a higher self-efficacy perception than students in the textile engineering department. Also self-efficacy beliefs differed with respect to their gender, male students have a higher self-efficacy perception than female students.

Keywords: Self - efficacy, Computer programming education, Engineering education.

INTRODUCTION

Self-efficacy is an important measure of understanding and predicting an individual's performance and mediates between the individual's knowledge and actions. This concept was first used by Bandura to explain the individual's ability to judge how well an individual will perform a task (Bandura, 1977, 1986).

Self-efficacy is a concept that includes beliefs about the motivation needed to meet situational demands, the cognitive resources of the individual and the capacity to start an action. Perceived self-efficacy has a structure that can be used to predict behavior (Bandura & Cervone, 1986).

Educational researchers are increasingly paying more attention to the role of students' thoughts and beliefs in the learning process. Self-efficacy; it is seen as an important factor because it affects the motivation and learning of the students (van Dinther, Dochy, & Segers, 2011).

As a result of rapid technological developments in information and communication technologies, demand for graduates with a high level of experience in computer skills is increasing in knowledge-based economies around the world. It is also seen that the level of investment in software-related industries has increased significantly compared to hardware-related industries (Shapiro, 2014). This is another factor that sets out the importance of courses related to programming instruction. On the other hand, the drop-out and failure rates in the introduction to computer programming in universities are a sign that learning these courses is a difficult task. There are studies showing that the drop-out rate and failure rate in computer programming entry courses is as high as 30 percent (Watson & Li, 2014).

In addition, the literature reveals several factors that may affect the success of the introductory courses in computer programming. These factors include previous computer experience (Byrne & Lyons, 2001; Ramalingam, LaBelle, & Wiedenbeck, 2004), self-efficacy in computer programming(Karsten & Roth, 1998), learning environment(Cigdem, 2015) mathematics or science background (Byrne & Lyons, 2001; Wilson & Shrock, 2001) and the mental model of the student in programming (Ramalingam et al., 2004; Soloway & Ehrlich, 1984).

Self-efficacy is an important concept related to the field of education, and potentially can also be used for different research in this area. The reason is that the self-efficacy theory also acknowledges that the actual performance of an individual affects their own self-efficacy and therefore may affect future performances. Therefore; it is likely that students with high self- efficacy in any area performing at challenging tasks and struggling with difficulties will be more successful than students with lower self-efficacy. In particular, achievements that progress by moving the student to higher levels than the lower levels positively affect self- efficacy. On the other hand, individuals with low self- efficacy tend to see their assigned tasks more difficult than they actually are. In this case, the individual may experience stress, depression, and a narrow viewpoint that cannot solve the problem. This reduces the chances of seeking new opportunities for learning. (Askar & Davenport, 2009). Researching student self-efficacy in the field of computer programming where failures are often experienced is increasingly important issue and presents new opportunities for solving educational problems and developing new pedagogical approaches in this area.

Aim of the Study

The aim of the study is to examine the programming self-efficacy perceptions of the undergraduate engineering students who have taken Computer Programming course in Technology Faculty. Within the scope of the study, students' self-efficacy perceptions of programming is examined in terms of 'performing simple programming tasks' and' performing complex programming tasks', and answers to the following questions are sought.

1. What are the programming self-efficacy perceptions of engineer candidates who take computer programming courses?
2. Does the self-efficacy perceptions of engineer candidates taking computer programming course differ according to the following variable?

a) According to sex
b) According to the department

METHOD

This research is a descriptive study performed with the relational scanning model in the scanning models. In the relational screening model, it is aimed to describe the situation in the past or present as it exists. (Karasar, 2006).

Participants

Universe of the study is constituted of Marmara University Faculty of Technology students who take Computer Programming course in 2016-2017 academic year. The sample of the research included 119 undergraduate students studying Computer Programming course which is realized as two hours theoretical and two hours application in Electrical-Electronics and Textile Engineering departments of Marmara University Faculty of Technology in spring semester of 2016-2017 academic year. 80(67%) of the students who participated in the study are male and 39 (33%) are female. 68 (57%) of the students are in electrical and electronics engineering, and 51(43%) are studying in the textile engineering department.

Data Collection Tools

The data of the study are collected by using " Self-Efficacy Perceptions Scale Related to Programming" which was adapted to Turkish by Altun and Mazman (Altun & Mazman, 2012). This scale contains a total of 9 items. These three to nine belong to the "Simple Programming Tasks", which contain basic level tasks. The other 6 items regard to "Complex Programming Tasks", which involve more advanced programming tasks. In the scale prepared on the Seventh Likert type, substances scored as 1 = I do not trust myself at all, 2 = I usually do not trust myself, 3 = I trust myself a little, 4 = 50% / 50%, 5 = I am very confident in myself, 6 = I usually trust myself, 7 = I completely trust myself ' Those who responded to the scale get a maximum score of 63 on the scale, while they get the lowest score of 9. Gender, age and departmental information of the students were taken as demographic data and the scale was applied to the students at the last lesson of the semester.

RESULTS

In this section, the findings and interpretations based on the purpose and sub-objectives of the research have been given.

Self-Efficacy Perceptions of Students Related to Computer Programming

Table 1 shows the self-efficacy perceptions of the 119 students who participated in this research. The minimum, maximum, and average scores that can be taken from the scale were all calculated as 9, 63 and 31 respectively. According to Table 1, the average score of the students is 31. The calculated average score of the students for "performing simple programming tasks" was found as 13.7. Since this value is higher than the average score 12, which can be taken for this dimension, it can be interpreted that students have higher self-efficacy perceptions towards this dimension. In the aspect of "performing complex programming tasks", the average score of the students is 17.3. Since the mean score of this dimension is 24, it is obvious that the students have a low self-efficacy perception in terms of performing complex programming tasks.

Table 1: The statistical values of self-efficacy perceptions of students regarding computer programming.

Groups	N	Minimum	Maximum	Mean	Standard Deviation
Simple Programming Tasks	119	3	21	13.7	5.1
Complex Programming Tasks	119	6	42	17.3	10.8
Total	119	9	63	31	15.9

Self-Efficacy Perceptions of Students Regarding Computer Programming in terms of Gender

In order to determine the self-efficacy perceptions of students regarding to computer programming in terms of gender, independent sample t-test was conducted. In Table 2, when the self-efficacy analysis result of computer programming according to the gender of the students is examined, it can be seen

that the difference between the self-efficacy scores of the male and female students was statistically significant. (t(117)=-4.98, p<0.001). This difference was found to be a positive difference in favor of male students with an average arithmetic mean score of 4.77.

Table 2: T-Test results of self-efficacy perceptions of students in terms of gender regarding computer programming.

Groups	N	Arithmetic Mean	Standard Deviation	Degree Of Freedom	t	p
Male	80	4.77	1.31	117	4.98	< .001
Female	39	3.54	1.12			

Self-Efficacy Perceptions of Students Regarding Computer Programming in terms of Departments

Independent sample t-tests were used to determine the self-efficacy perceptions of students regarding computer programming in terms of departments. According to the Table 3, the difference between the self-efficacy scores of Electric and Electronic Engineering and Textile Engineering students, was found as statistically significant (t(117)=- 7.61, p<0.001). This difference was determined as a positive difference in favor of Electric and Electronic Engineering students with an average arithmetic mean score of 5.05.

Table 3: T-Test results of self-efficacy perceptions of students in terms of department regarding computer programming.

Groups	N	Arithmetic Mean	Standard Deviation	Degree Of Freedom	t	p
Electric and Electronic Engineering	68	5.05	1.02	117	7.61	< .001
Textile Engineering	51	3.45	1.27			

DISCUSSION AND CONCLUSIONS

This study examines the self-efficacy perceptions related to computer programming of the students in technology faculty. Results reveal the differences in the level of self- efficacy in terms of department and gender. Students participating in this study take programming courses for the first time in their higher education.

Students have a self-efficacy over the average in the dimension of simple programming tasks in the scale.

In the context of complex programming tasks, it appears that students have self-efficacy beliefs below the average. It is important that the students' self-efficacy perception of any course is directly related to the performance they will exhibit. In addition, it is necessary to include activities and tasks in the curriculum that will increase this self-efficacy level.

In our study, male students have higher self-efficacy in computer programming than female students. This situation is parallel to other studies (Askar & Davenport, 2009; Gezgin & Adnan, 2016). But there are also studies indicating that self-efficacy does not change depending on the sex (Korkmaz & Altun, 2014)

As in many areas, self-efficacy perceptions in the field of computer programming are also important determinants of achievement. In computer programming which is an important area in engineering

career, students need to improve their analytical thinking skills and cognitive experience in order to be successful.

Taking these lessons before the higher education will increase these experiences and also increase the success of computer programming. In addition, by integrating the flipped classroom or blended learning environments into the computer programming lessons where students can follow the lesson in any time and place it is possible to increase their self-efficacy and as a result their success in programming (Cigdem, 2015).

Acknowledgment: The authors would like to thank Marmara University Faculty of Technology for supporting the study.

WJEIS's Note: This article was presented at 6th World Congress on Educational and Instructional Studies- WCEIS 2017, 26-28 October 2017, Antalya-Turkey and was selected for publication for Volume 7 Number 4 of WJEIS 2017 by WCEIS Scientific Committee.

REFERENCES

Altun, A., & Mazman, S. G. (2012). Programlamaya ilişkin öz yeterlilik algısı ölçeğinin Türkçe formumun geçerlilik ve güvenirlik çalışması. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi, 3*(2), 297-308.

Askar, P., & Davenport, D. (2009). An investigation of factors related to self-efficacy for Java programming among engineering students. *TOJET: The Turkish Online Journal of Educational Technology, 8*(1).

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review, 84*(2), 191.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of social and clinical psychology, 4*(3), 359-373.

Bandura, A., & Cervone, D. (1986). Differential engagement of self-reactive influences in cognitive motivation. *Organizational behavior and human decision processes, 38*(1), 92-113.

Byrne, P., & Lyons, G. (2001). *The effect of student attributes on success in programming.* Paper presented at the ACM SIGCSE Bulletin.

Cigdem, H. (2015). How Does Self-Regulation Affect Computer-Programming Achievement in a Blended Context? *Contemporary Educational Technology, 6*(1), 19-37.

Gezgin, D. M., & Adnan, M. (2016). Makine Mühendisliği ve Ekonometri Öğrencilerinin Programlamaya İlişkin Öz Yeterlik Algılarının İncelenmesi. *Journal of Kirsehir Education Faculty, 17*(2).

Karasar, N. (2006). *Bilimsel Araştırma Yöntemi*. Ankara: Nobel Yayın Dağıtım.

Karsten, R., & Roth, R. M. (1998). Computer self-efficacy: A practical indicator of student computer competency in introductory IS courses. *Informing Science, 1*(3), 61-68.

Korkmaz, Ö., & Altun, H. (2014). Adapting Computer Programming Self-Efficacy Scale and Engineering Students' Self-Efficacy Perceptions. *Online Submission, 1*(1), 20-31.

Ramalingam, V., LaBelle, D., & Wiedenbeck, S. (2004). *Self-efficacy and mental models in learning to program.* Paper presented at the ACM SIGCSE Bulletin.

Shapiro, R. J. (2014). The US Software Industry As an Engine for Economic Growth and Employment.

Soloway, E., & Ehrlich, K. (1984). Empirical studies of programming knowledge. *IEEE Transactions on software engineering*(5), 595-609.

Van Dinther, M., Dochy, F., & Segers, M. (2011). Factors affecting students' self-efficacy in higher education. *Educational research review, 6*(2), 95-108.

Watson, C., & Li, F. W. (2014). *Failure rates in introductory programming revisited.* Paper presented at the Proceedings of the 2014 conference on Innovation & technology in computer science education.

Wilson, B. C., & Shrock, S. (2001). *Contributing to success in an introductory computer science course: a study of twelve factors.* Paper presented at the ACM SIGCSE Bulletin.