Impact of The Individual Innovativeness Characteristics on Success and Contentment at The Computer Programming Course: A Web-Based Blended Learning Experience

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ABSTRACT

The computer programming knowledge requires high level problem solving skills. Complexity of programming language and the learning attributes, control focus, thought processes and individual differences like individual innovativeness characteristics, have an influence on the success of the students in programming. One of the methods in which information and communication technologies are utilized to secure student participation and retain learning is the blended learning method. The purpose of this study is to examine the impact of the introduction to programming course which is designed by web-based blended learning method on the academic successes and contentment of the students with different individual innovative characteristics. The results of the research have indicated that the execution of the course with web-based online learning instruments, has positively impacted the academic success and motivation of the students. One other finding is that there are meaningful deviations between the pretest- posttest success scores within each group whose individual innovative characteristics are being pioneering, questioning and skeptical. Furthermore, the analysis results have indicated that there is no meaningful difference between the three individual innovative with regards to achievement test.

Keywords: *academic success, satisfaction, programming course, web based learning, blended learning*

INTRODUCTION

Knowledge on programming is one of the most challenging issues to comprehend for students since it requires high level problem solving (Askar & Davenport, 2009; Başer, 2013; Milne & Rowe, 2002; Pillay & Jugoo, 2005). Furthermore, motivation, attitudes towards programming and complexity of the programming language impact the performance of the students in programming. The participation of the student to the course cannot be achieved due to such and similar reasons (Geçer & Dağ, 2012; Durak, 2014).

One of the preconditions for the success of the student in a course requiring high level problem solving skills like introduction to programming, is to ensure active participation of the student in the learning process because the student who participates in the whole learning environment, learns more easily and the majority of what is learned stays permanent (Sönmez, 1997).

This study was presented in International Conference on New Horizons in Education (INTE 2017) Conference in Berlin and the abstract of the study was published in the Proceeding Book.

Students' participation level in the learning-teaching process, is one of the best indicators of the quality of educational activities. Explicit or implicit, almost full student participation indicates that the quality of the learning-teaching methods are at sufficient levels (Sarıtepeci & Çakır, 2015). Failure to secure the participation of the majority of the students to the course reflects the existence of problems with the ongoing educational activities; in other words it is an indication of low quality of the educational activities (Senemoğlu, 2009). According to Newman (1992) the most important problem for both student and teacher, is the failure to ensure course participation and not the low success rate.

In addition, the learning attributes, control focus, thought processes and individual differences like individual innovativeness characteristics (IIC), have an influence on the success of the students in programming. Teacher candidates are expected to be the individuals who monitor the innovations and can integrate such innovations to the learning-teaching processes. While the innovativeness concept is identified as an idea, an application or an object which is perceived as new by the group and society according to Rogers (2003), the innovativeness has to do with how early in the process of adoption of new ideas, practices, etc. that the individual or organization is likely to accept a change (Hurt, Joseph & Cook, 1977). In the light of these definitions, individuals can differ as to past lives, individual differences and personal characteristics accordingly, attributes like adopting innovation and can differ from individual to another, may change among the individuals. Rogers (2003) considered the individual innovativeness in five categories:

1. Reformist (Innovators): They are the individuals who are eager for trying new ideas and taking risks, visionary and use technology effectively and have high level thinking skills.

2. Pioneer (Early Adopters): They are the individuals who provide information to other members of the society about innovation s, leading them, technology-focused, eager to take risks and try.

3. Inquirer (Early Majority): They are the individuals who are cautious on innovativeness, less eager to take risks, with median age, education and socio-economic level and have average use of mass communication

4. Skeptical (Late Majority): They are the individuals who are skeptical and reserved about innovativeness, wait until majority of the society adopt the innovativeness, with low education level and older than median age, have very little use of mass communication tools and rather prefer interpersonal communications.

5. Traditional (Laggards): They are the individuals who are prejudiced about change, last to adopt innovation s, wait other people to try the innovativeness before adapting the changes, need support in technologic matters and do not like taking risks.

The blended learning, which increases the effectiveness of instruction is a balanced combination of advantageous sides of face-to face learning and online learning to maximize the benefits (Osguthorpe & Graham, 2003). Thus, the blended learning offers to education- teaching processes the convenience of online learning which supports the learning activities with unrestricted time and locations without losing face-to-face interaction Furthermore, blended learning enables the teachers and students to minimize the effect of any regional differences in curriculum and use same learning and teaching materials. In conclusion, blended learning, is potentially the education approach more powerful than the learning offered by both online learning and traditional face-to-face learning. Such power of the blended learning approach is the result of the flexibility and the pedagogic effectiveness of this model (Osguthorpe & Graham, 2003; Colis & Moonen, 2001; Jordan & Rovai, 2004).

Related Scientific Work

There are many studies in the literature that find the result of the effect of the attitude against the individual differences and programming on the success and motivation of the student (Özyurt & Özyurt, 2015). Tekedere & Mahiroğlu (2014) has researched the effect of the focus of control in the problem-based learning which is actualized in web environment on the attitude of the students against the web-based learning and problem-based learning. As the result, he expressed that the focus of control is effective on the attitude. Ersoy, Madran, & Gülbahar (2011) has developed a model where the robot programming techniques are used for facilitating the programming language and increasing the success. Law, Lee, & Yu (2010) has found that the award and appreciation is more motivating with the direct orientation in learning programming language. In one study where the perceptions of the students are evaluated with the narrative interviews, Hawi (2010) has reached the conclusion that the learning strategy, the lack of implementation, exam concern and hardness of the subjects are efficient of the success. On the other hand, it is suggested to develop learning strategies which shall offer easier and more attractive programming education and create motivation (Khalife, 2006; Winslow, 1996; Haberman & Averbuch, 2002; Lau & Yuen, 2009; Cheng & Chau, 2015; Eckerdal & Thune, 2005; Fleury, 2000). Through various educational strategies, learning styles may be directed in the best way both in and outside the classroom (Cheng & Chau, 2015). Besides, literature indicates that better designed course contents and learning environment would increase the efforts of the students to accomplish their goals (Verdú et al., 2012; Forte & Guzdial, 2005).

Based on such studies and evaluations, it is believed that a review of the education process for programming education and the methods and techniques and accordingly discussing the reasons of success of failure, can be a solution to the failures in programming language.

The purpose of this study is to examine the effect of the introduction to programming which is designed through blending face-to-face learning and e-learning methods and applied accordingly on the academic achievements and satisfaction of the students with the individual innovativeness characteristics. In line with this general purpose, answers to the following questions have been sought:

1. Do pretest-posttest success scores of the students reflect any meaningful difference according to IIC?
2. Do the academic success scores of the students reflect any meaningful difference according to the individual innovativeness characteristics?
3. Do the students motivation level reflect any meaningful difference according to the individual innovativeness characteristics?
4. Do the students have different views on IIC learning process?

METHOD

Study Group

The population of the research on pretest-posttest semi experimental design model consists of 45 students in Computer Education and Instructional Technology (CEIT) Department in 2014-2015 education year fall semester. The students have first taken the course of introduction to programming in the blended learning environment and the voluntary basis is adapted in determination of the participants. The details of the study group in terms of gender and individual innovativeness characteristics are summarized in Table 1.

Table 1. Demographic specifications of the students

Variable	Characteristics	f	%
Gender	Male	30	66,7

	Female	15	33,3
Individual Innovativeness Characteristics	Pioneer	6	13,3
	Skeptical	12	26,7
	Inquirer	27	60,0

As per the students' individual innovativeness characteristics of %60 of them are "inquirer", %27 of them are "skeptical", %13 of them are "pioneer". There are no students in "Reformist" and "traditionalist" categories, the two extreme categories. This finding indicates that the individual innovativeness characteristics of the students are concentrated in "inquirer" category.

Planning and Executing The Course

In the blended learning environment as designed by the researcher, a web based learning platform aiming to presentation various learning activities and course has been developed and on such platform, project-based and video-based learning methods as well as face-to-face learning have been practiced, during the 12 week course process to enable the students to enhance their skills and knowledge on *Introduction to Programming*. Accordingly, it is aimed to create a student-focused learning environment where students are encouraged to conduct more researches, enabled to control self-learning with no limitation on time and location. All information and evaluation criteria related with the course teaching process, are presented to the students as a workflow calendar at the first class in the beginning of semester.

At the end of learning activities, students have been assessed in four different categories; *participation in the discussions on BLOG site*, *project implementation* as a part of semester end activity, *watching videos* on C# *and implementing* and *academic performance test* which was proved to be valid and reliable in prior period.

Data Collection Tools

In the research, "Individual Innovativeness Characteristics Scale, Motivation and Learning Strategies Scale" and the student opinion form developed by the researcher has been used as the data collection tool. In addition, pretest-posttest programming information success test which is analyzed in terms of validity and reliability in 2012-2013 academic year and is developed by taking the opinions of the experts by the author, is used for measuring the programming successes of the students. In the calculation of the posttest success points, the duty points given within the implementation process together with the academic success test, the points for participating to the course activities and project points are used. The opinion is taken from the experts of five different fields related with all data collection tools and online learning environment to be used in scope of the implementation and is used after giving the final form by making the essential regulations. Three expert opinions have been obtained on the validity and reliability of the academic performance tests. Based on expert opinions, scales' items have been revised and scope validity has been assured. In calculating the post test scores; the task performance ratings (10%) , participation ratings (5%) and project ratings (35%) during the implementation process have been considered together with the academic performance test (50%).

Academic Success Test

The academic success test which is developed by the research, is used for measuring the cognitive skills of the students in C # programming language. The draft academic success test consists of 8 articles. The weights of the subjects are considered in the distribution of the questions for increasing the content validity of the test and the validity of the questions is provided by taking the opinions of the expert. The validity of the questions are controlled with a pilot study by applying on 53 students before the implementation.

Individual Innovativeness Characteristic Scale (IIC)

Individual innovativeness scale has been developed in order to assess the innovativeness of the individuals in general. The scale which is developed by Hurt, Joseph & Cook (1977), has been adapted into Turkish culture by Kılıçer & Odabaşı (2010). The scale consists of 20 items in 5 likert scales between "Strongly disagree" and "Strongly agree" to determine the Individual Innovativeness profiles of the university students. 12 articles of the scale are positive (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18. and 19.articles), are negative (4, 6, 7, 10, 13, 15, 17. and 20. articles). Through the scale; the innovativeness score is calculated by subtracting total negative points from total positive points and then by adding 42 points to the balance. The scale core can be 14 points, at lowest and 94 points at highest. The individuals can be categorized in the context of individual innovativeness as per the scores over the scale. Accordingly, if the score is over 80, the individual is reformist, between 69 and 80 points the individual is pioneer, between 57 and 68 points, inquirer, between 46 and 56 points skeptical and below 46 points, the individual is as assessed as traditionalist. Besides, the innovativeness degree of an individual can also be assessed by the scale score. Accordingly, the individuals exceeding 68 points are assessed as the fairly innovative whereas, those are below 64, are assessed as low in innovativeness. The internal consistency factor overall the scale is 0.82 and test-retest reliability is .87 (Kılıçer & Odabaşı, 2010).

Motivation Scale

In determining the motivation of the students, the motivation part of the motivation and learning strategies scale which is adopted into Turkish by Büyüköztürk et al,. (2004), has been used. The purpose of the study by Büyüköztürk et al. (2004), is to adapt the scale of Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia & McKeachie (1991), into Turkish. Motivation and learning strategies scale comprise totally 81 items and 15 sub-factors as per corroborative and exploratory factor analyses. Motivation scale comprises a total of 31 items and six factors as; intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs about learning, self-efficacy about performance and learning and test anxiety. For replying scales, seven likert scale rating is used and for each item, the reply options range from "I strongly disagree (1) to "I strongly agree (7)". Cronbach α values of the items in Turkish adaptation, vary between 0.52 and 0.86.

Student Opinion Form

An opinion form has been developed by the researcher to understand -the views of the students on the learning process and online learning environment. The form comprises two open-ended questions. In preparing the questions, the question types with yes and no answers have been avoided and the questions requiring participants provide detailed information have been developed. Open ended questions are on students' perception as differences on Introduction to Programming Course, their views on their own roles and responsibilities in blended learning environment, their expectations related with the Introduction to Programming Course, the impact of implementing the course as blended with the face-to-face and digital learning material. In addition to these, the students are asked to evaluate their education and their satisfaction related with the education over five points. Pursuant to the development of the questionnaire, the views of experts of education technology and teaching by digital education technologies have been obtained. And after final revisions, the form has been shared with the students at the end of the implementation process.

Analysis of Data

As the data have met the parametric test assumptions, parametric test have been deployed in analyzing the data. Descriptive statistics have been used in determining motivations, assessments and contentment of the students on the learning process. T-test and One-Way Anova tests have been used for measuring the relationship between the individual innovativeness characteristics and median scores of the motivation of the students. T-

test, Anova and Ancova test have been used for determining as to whether the academic performance scores and motivations of the students indicate any meaningful difference according to individual.

FINDINGS AND COMMENTS

Do the pretest posttests of the students show any meaningful difference according to IIC?

To determine as to whether the pretest- posttest scores of the students indicate any meaningful difference according to the individual innovativeness characteristics, T-test analysis results for independent groups are given in Table 2.

Table 2. Two dependent sample t-test results according to pretest-posttest scores of the students

IIC	Success Test	N	$\overline{X}$	S	Sd	t	p	η^2
Pioneer	**Pretest**	6	54.17	5.23	5	-6.42	0.001*	0.89
	Posttest		84.50	6.15				
Inquirer	**Pretest**	27	46.76	22.43	26	-8.68	0.000*	0.74
	Posttest		71.96	20.98				
Skeptical	**Pretest**	12	43.17	8.12	11	-3.75	0.003*	0.56
	Posttest		63.67	6.74				

p<.01*

On Table 2 there are statistically meaningful differences in the pretest-posttest scores (p<.01) of the students with pioneer, inquirer and skeptical innovativeness characteristicsin Introduction to Programming Course which is supported with online learning tools. While the students with pioneer characteristicshave the highest increase in scores compared to median score, the lowest increase in scores is recorded by the students with skeptical specification. This finding may be interpreted as this kind of education environment contributes more to the academic performances of the students with pioneer characteristics. When effect size (η^2) is considered, it is observed that the pretest-post test scores are high. The effect size is identified as small, medium and big respectively as corresponding to the values of .01, .06 and .14 (Cohen, 1988). Uysal (2014) concluded that the well-structured web and multimedia technologies and integrated educational design for problem solving skills affect the academic success positively. In the study of Verdú et al.(2012) where they aimed to develop new strategies for programming language education, they concluded that e-learning environment contributes to academic enhancement of the students.

Do the academic performance scores of the students indicate any meaningful difference according to IIC?

Posttest and average points of posttest corrected as the pretest points of the students with different individual inventiveness scale, are seen in table 3.

Table 3. Posttest median scores as adjusted per IIC

	N	$\overline{X}$	$\overline{X}$ (Adjusted)
Pioneer	6	84.50	79.51
Inquirer	27	71.96	71.98
Skeptical	12	63.67	66.13

The meaning of the difference among median scores of the students, has been analyzed with ANCOVA test and Ancova test analysis results to determine as to whether pretest- posttest scores indicate any meaningful difference according to the groups, are given in table 4.

Table 4. ANCOVA results of the Post test scores adjusted according to pretest scores

Resource of variance	Total of square	sd	Average of squares	F	p
Pretest (Reg.)	10386.15	1	10386.153	52.05	.000*
IIC	721.86	2	360.931	1.81	.177
Error	8180.98	41	199.536		
Total	249874.00	45			

p<.01*

When table 4 is examined, it is observed that posttest median scores which are adjusted according to pretest scores of the students with different individual innovativeness scale, do not indicate any meaningful difference ($F_{[1-45]} = 0.177, p > 0.05$). This finding shows that individual innovativeness scale of the student does not represent any meaningful difference on the learning levels in introduction to programming course. Similarly, Alper & Deryakulu (2008) concluded that the cognitive flexibility variable does not affect the success of the student. Lee (2013) concluded that the learning approaches do not have an impact on success. Contrary to this, Cheng & Chau (2015) and Lau & Yuen (2009) found a significant difference in learning styles and student success. In their research where the cooperative programming education and learning performance of the students are examined, Hwang et al. (2012) found that the learning styles affect the learning success of the students.

Do the motivations of the students for the course indicate any meaningful difference according to individual innovativeness characteristics?

Anova test results for independent groups in order to determine as to whether the motivations of the students for the course indicate any meaningful difference, are shown in table 5.

Table 5. Anova results of the motivations of students for the course according IIC

IIC	N	$\overline{X}$	S	Sd	t	p
Pioneer	6	175.33	5.289	42	7.035	.002*
Inquirer	27	147.11	3.286			
Skeptical	12	142.83	6.500			
Total	**45**	**149.73**	**3.072**			

p<.01*

Table 5 reflects that IIC of the students indicate meaningful difference on their motivations for the course. As a result of the Tukey test made in order to determine in which groups such meaningful differentiation exists, it is observed that it is in favor of the pioneer students in comparison between pioneer and skeptical (p=.003) and pioneer and inquirer (p=.004) characteristics. Such result supports the literature. For instance, Forte & Guzdial (2005) and Serrano-Cámara, Paredes-Velasco, Alcover, & Velazquez-Iturbide (2014) mentioned that the students have higher motivation and attitude in this kind of education environment. Similarly Cheng & Chau (2015) found that the motivation and participation is higher in a blended learning study. Tekedere & Mahiroğlu (2014) found that internally controlled persons have more positive attitudes in the study where the effect of control focus as an individual difference on web based education. Rodríguez Corral et al., (2014) concluded that the motivation of the students is high in an interactive game based programming language education with the tangible user interface.

Do the opinions of the students on IIC learning process indicate any meaningful difference?

Anova results of the students' assessment points on their education according to IIC are given in table 6.

Table 6. Anova results of the assessment points on the education according to IIC

IIC	N	$\overline{X}$	S	Sd	t	p
Pioneer	6	4.33	.33	42	1.75	.186
Inquirer	27	3.61	.17			
Skeptical	12	3.58	.26			
Total	**45**	**3.70**	**.14**			

In table 6, it is observed that the evaluation points of the students on the education do not indicate any meaningful difference according to IIC ($p > .05$). This finding may be interpreted as IIC does not influence the opinions of the students on their education.

The evaluation and contentment points might have been influenced by the researcher's feedback to the students both individually and as group in the discussions at the blog site and during the group studies in school, his encouragement of the students for making activities and hiş help to them in video activities.

Anova results of the median points on the contentment level of the students related with the education, are given in table 7.

Table 7. Anova results of the point averages of the satisfaction level of the students related with the education

ICC	N	$\overline{X}$	S	Sd	t	p
Pioneer	6	4.00	.26	42	1.53	.228
Inquirer	27	3.74	.19			
Skeptical	12	3.25	.31			
Total	**45**	**3.64**	**.15**			

As seen in table 7, the contentment points of the students related with the education, do not indicate any meaningful difference according to IIC scale ($p < .05$). In other words, the contentment points of the students related with the education, do not change according to IIC. However, in table 7, it is observed that the the students have a high contentment level. Similarly, Tekedere & Mahiroğlu (2014) express that the students present more positive attitude in face-to-face education which is supported with web-based education. Forte & Guzdial (2005) express that the students have higher motivation and attitude in the programming languages courses which are applied with blended learning method. In their study where they examine different pedagogic approaches by using e-learning platform, Verdú et al. (2012) found that the contentment level is high. Similarly, Serrano-Cámara, Paredes-Velasco, Alcover, & Velazquez-Iturbide (2014) found that the motivations of the students are high in the programming language education which is supported with cooperative learning tools.

CONCLUSION AND DISCUSSION

As the result of the web-based blended learning implementation in scope of this research, it is observed that there are meaningful differences between the pretest-posttest scores within each group with innovativeness characteristics as pioneer, inquirer and skeptical. In addition to this, it is observed that the students with *pioneer* innovativeness characteristics, have higher increase in scores. In other words, the experimental process had a significant impact on student success without differentiating according to the individual innovativeness characteristics. When the teaching of Introduction to Programming Languages course

which requires a high level problem solvingskills is conducted at online discussion platforms and cooperative learning environments like project applications, it has been observed that the academic performance and motivation can reach to desired level. However, the analysis results show that there is no meaningful differentiation among three individual innovativeness characteristics in terms of success (pretest- posttest). A meaningful difference is found in favor of students having pioneer characteristics in the motivation of the students in different IIC according to the motivation scale applied in the research. This finding may be interpreted as the necessity of developing the learning environments providing the students to work according to their own individual specifications with blended learning applications. So the limitations brought by the individual differences shall lose their effect during the process.

In this research, student evaluation and satisfaction form is used for evaluating the process as well as the success test which is applied at the end of the process. It is seen that there is no significant difference in evaluation and contentment points according to individual innovativeness characteristics.

In addition, it is understood that the design of a learning environment as blended with online learning tools, must be planned strategically. It is observed that the presentation of the courses requiring a high level problem solving skills like introduction to programming, affect the motivation and contentment, academic performance of the student positively.

The individual innovativeness characteristics of the students are compared in the research. The methods which should evaluate both the process and results in the future researches, must be determined and the skills of the students like problem solving and high level thinking must be calculated as well as their scores from the exams and applications. In programming languages courses, investigating other individual differences like learning approach, thinking style, control focus is suggested in projects with Web 2.0 tools and problem based learning applications. This application has been executed in a period of 12 weeks. Implementation in programming languages courses spanning 2 to 3 semesters, is important to be able to generalize the results.

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