# Blended Learning Experience in a Programming Language Course and the Effect of the Thinking Styles of the Students on Success and Motivation

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**ABSTRACT**
High-level thinking and problem solving skill is one requirement of computer programming that most of the students experience problems with. Individual differences such as motivation, attitude towards programming, thinking style of the student, and complexity of the programming language have influence on students' success on programming. Thus, curriculums and learning environments should be designed in order to support students' learning attempts and willingness to achieve the goals of the course. Blended learning is one of the educational approaches that used in Information and Communication Technology (ICT) courses in order to ease the learning process. In this manner, the purpose of this study is to investigate the effect of blended learning approach, consisted be blending face-to-face and e-learning approaches, on academic success and motivations of students with different learning styles in a programing language course. Results of the study showed that courses supported with online learning tools has a positive effect on students' motivation, and correspondingly has a positive effect on academic success. In addition, the results revealed that introvert students need online learning tools more than others. Furthermore, it was found that thinking styles have an effect on motivation and academic success. Eventually, using blended learning approach in a programming language course has a positive effect of students' motivation, academic success and satisfaction.

**Keywords:** programming languages, thinking styles, computer programming, motivation, academic achievement.

## 1. INTRODUCTION
There are many differences that affect the learning behavior of the students. The learning styles of the students (cognitive styles, learning styles and thinking styles) are the leading in the individual differences, which affect the learning in the learning process (Buluş, 2005). There are some differences between these styles and skills. Sternberg (1997) defines the skill as "the thing that an individual can make" and defines the style as "the choice of the individual related with the skill usage form". The thinking style is the way, which an individual prefers in using his talents. The thinking styles are not classified as good or bad, only their differences may be mentioned (Sternberg, 1994) and they are the approaches and inclination which the individuals present as the result of the mental processes against various problems, cases, phenomenon and variables confronted by the individuals. Sünbül (2004), Buluş (2005), Sternberg (1994), Sternberg and Grigorenko (1995), and Zhang (2000) have identified the thinking styles as an expression of the choices for the method of the efficient usage of the talents. The thinking styles are neither talent nor intelligence; they are the style of intelligence usage (Fer, 2005).

The individuals have thinking styles which are different from each other therefore the individuals are evaluated not only with the type of thinking style but with the level of the various features of the individuals. The individuals think different from each other in the solution of a problem or in a situation which they need to make a decision and they seek different solutions. They use some of them in upper level and some of them in lower level according to the special cases. Besides, the thinking styles of the individuals may change according to the social environment, time and the culture of the society (Zabukovec & Kobal-Grum, 2004).

There are many style theories, which are suggested as the result of the studies made by the researches for describing the thinking form of the people (Holland, 1973; Renzulli & Smith, 1978). The thinking styles, which are suggested by Sternberg (1997) for Mental memory theory, are taken as the basis in this study. 13 thinking styles under 5 factors as to be functions, forms, levels, scope and inclinations are as follows (Stenberg, 1997).

**Thinking Styles**

| DIMENSIONS | SUB DIMENSIONS | CHARACTERISTICS |
|---|---|---|
| Functions | 1. Law maker | They are innovative, generate ideas, and prefer unstructured problems. They are focused on planning designing and formatting. |
| | 2. Judgmental | They are focused on evaluation, judgment and comparison. They evaluate rules and procedures; compare incidents and phenomenon and analyze them. |
| | 3. Executive | They follow given instructions. They prefer to implement processes in the same way they have been done so far. |
| Forms | 4. Progresser | They very well concentrated on what will implement; and they work by determining their priorities on majority of their assignment. |
| | 5. Singularist | They focus on doing single task and dedicate all of their energy to this task. |
| | 6. Pluralist | They perform multiple works at the same time without determining their priorities. |
| | 7. Anarchical | They evaluate problems arbitrarily. They tend to focus on relax and flexible works instead of planned and systematic tasks. |
| Levels | 8. Elaborator | They focus on tasks which require them to work by concentrating on details. They tend to perform their assignments based on concrete opinions. |
| | 9. Integrator | They prefer to concentrate on theoretical opinions and whole concept of an opinion. They are interested in abstract thoughts and general framework. |
| Tendencies | 10. Innovative | They prefer to deal with indetermined indefinite works; they are innovative and visionary. |
| | 11. Conservative | They are traditionalists, realist; and they are attached to the codes relevant with their works. |
| Inclinations | 12. Introvert | They prefer to work alone; they are self-sufficient and less social. |
| | 13. Extrovert | They prefer works require cooperation. They enjoy establishing relationship with others. |

The thinking styles of the people may change according to the time and their life styles and may be formed by the conditions of the people (Yıldız, 2012). Besides the thinking style is an important individual distinctness variable, which affects the success of the individuals in academic and professional lives (Dinçer & Saracaloğlu, 2011).

The teachers may create learning environments that shall provide thinking ability for developing different points of view and increase the efficiency in the discussion environment (Von Oech, 1983; as cited in Çubukçu, 2004). The participation to the course and active role of the students in learning environment, bring the academic success together. The fundamental of the transition to the student-based education from teacher-based education, rests on this. The efficient usage of the computers and the Internet in the education activities today makes an efficient contribution to the interaction between teacher and student and to the success of the student. Therefore, it is thought that the usage of online interaction tools in the education activities, the observation of course activities and the discussion of the results shall make contribution to the body of literature. As mentioned by Emir (2013), the usage of the learning environment which provides opportunity to the students for using their thinking styles, shall develop the critical thinking skills and high level problem solving skills.

The high level thinking strategies of the persons may be developed with the educational activities (Duman & Çelik, 2011) and the mental style choices of the individuals may change (Esmer & Altun, 2013). According the literature, thinking styles affect the motivation and academic success of the student (Cano-Garcia & Hughes, 2000; O'Hara & Sternberg, 2000; Zhang & Sternberg, 1998). When the literature is considered again, it is seen that the various demographic features predict the thinking styles (Sternberg & Grigorenko, 1995; Zhang, 1999; Zhang, 2002). For example, the results which examine the thinking styles,

social skills and the relation between their attitude for some learning environment and the learning methods in terms of various variables (Duman & Çelik, 2011; Yıldız, 2012; Paliç & Rize, 2011, Balgalmış & Baloğlu, 2010, Dinçer & Saracaloğlu, 2011), have effect on the thinking styles. In addition to this, new learning strategies must be developed which shall offer an easier and attractive programming teaching and provide motivation to the students (Verdú et al., 2012). To consider the thinking styles in planning educational activities (Paliç & Rize, 2011) and to examine the learning processes of the student groups (Rodríguez Corral, Civit Balcells, Morgado Estévez, Jiménez Moreno, & Ferreiro Ramos, 2014) increase the efficiency. Besides, for an efficient learning environment in the education to be given to the teachers who are one of the most important sharers of the education, the thinking styles must be determined in advance (Esmer & Altun, 2015). In this respect, it is thought that this research shall increase the academic successes of the students who have problems in learning programming languages and shall make a contribution in determining the variables.

The computer programming started to be one of the occupations which its importance increases each day in present where the information sector grows rapidly. The success in computer programming depends on the amount of the problem solving, logical and quantitative thinking skills of the individual (Korkmaz & Demir, 2012; Lau & Yuen, 2009).

The programming courses are the leading among the hardest subjects for the students (Askar & Davenport, 2009; Başer, 2013; Milne & Rowe, 2002; Pillay & Jugoo, 2005). Because programming information requires the highest level problem solving skill. Besides, the motivation, attitude against programming, complication of the programming language is the factors which affect the programming success of the students.

One of the main targets of the lecturers of the Information Technologies and Computer Engineering Departments is to have the students obtain a strong infrastructure in computer programming (Zyda, 2009). It is inevitable that the students in mathematics and some science departments, shall have a good programming infrastructure.

There are many researches which emphasize the negative effect of the attitude, motivation, negative perception and self-efficacy belief in body of literature (Law, Lee, & Yu, 2010; Anastasiadou & Karakos, 2011; Hawi, 2010; Hongwarittorrn & Krairit, 2010; Özyurt & Özyurt, 2015; Korkmaz & Altun, 2013). Besides, it is possible to see some studies which various education methods and implementations for increasing the efficiency of programming education (Lau & Yuen, 2009; Cheng & Chau, 2015; Çetin, 2014; Eckerdal & Thune, 2005; Fleury, 2000; Haberman & Averbuch, 2002; Khalife, 2006; Winslow, 1996). In the literature, thinking styles and programming languages have intensively been studied separately or by different variables. However the number of studies examining the relationship between these two structures is few.

The number of studies made for the implementations and factors (Geçer & Dağ, 2012) affecting the programming process (Özdinç & Altun, 2014), is limited. For example, Abdul-Rahman & Du Boulay (2014) examined the success of the students they grouped according to their learning style in the programming languages course. As a result, they found that learning aproach of students in programming education differentiated the academic achievement. Besides, it is suggested to examine the effect of the programming languages where Web 2.0 tools are used, on performance and satisfaction (Hwang, Shadiev, Wang, & Huang, 2012; Shaw, 2012). To examine the method and techniques, the education process related with programming education and to discuss the reasons of the success or failure, may make a contribution to the literature. To determine the thinking style of the student may help to understand the individual differences and to reach the desired success in the education of programming languages. Therefore, as Esmer and Altun (2015) noted, planning learning environments in a way that enhances the dominant learning style in accordance with the academic subjects to be learned and expected teacher qualification or making prospective teachers become compatible with dominant learning styles can be seen as an important step in improving the quality of teacher education. Through various educational strategies, the thinking styles may be oriented in the best way both in class and out of class (Cheng & Chau, 2015). Besides, it is understood from the literature that the course contents and the learning environments which are designed more careful, increase the desire and effort of the students in target acquisition of the students (Verdú et al., 2012 ; Forte & Guzdial, 2005). In this respect, it is thought that this research shall lead the educators about the route to be followed in programming education which is the leading in the hardest courses.

As a result of the researches carried out, it is observed that thinking styles are very effective individual difference variables in achieving academic and business lives of individuals as well as in their daily lives. Also, as Abdul-Rahman & Du Boulay (2014) who have examined the learning approaches and Tekedere & Mahiroğlu who have examined the locus of control mention, it is necessary to examine the different individual characteristics on success and motivation. In this context it is expected that, in a course requiring high level thinking skills such as programming languages, researching the relationship between thinking styles and academic achievement will contribute to the literature.

The purpose of this research is to examine the effect of the programming languages requiring high level problem solving skills which are designed and implemented through blended, face-to-face and e-learning, methods on the academic successes and motivation of the students with different thinking styles. In accordance with this general purpose, the below research questions are tried to be answered.
1. Do the online learning tools used in learning process form a significant difference in pretest- last test success points of the students?
2. What is the thinking style usage level of the students?
3. Do the success points of the students show a significant difference according to their thinking styles?
4. Do the motivations of the students against the course show a significant difference according to their thinking styles?
5. Do the thinking style and the motivation against the course show a significant difference according to the gender variable?
6. What are the opinions of the students related with the learning process?
7. Do the pretest- posttest success points of the students show a significant difference according to the thinking styles?

## 2. METHOD
### 2.1. PARTICIPANTS OF THE STUDY
The population of the research in pre-test post-test semi experimental design model, is formed by 2$^{nd}$ grade students which study in Computer Education and Instructional Technology (CEIT) department of Faculty of Education in Ahi Evran University spring semester of 2013-2014 academic year. The distribution of the participants of study according to the gender and thinking styles, are summarized in Table 1.

**Table 1:** Demographic features of the students

| Variable | Feature | f | % |
|---|---|---|---|
| **Gender** | Male | 30 | 66,7 |
| | Female | 15 | 33,3 |
| **Thinking Style** | Self-Enclosed | 23 | 51,1 |
| | Extraverted | 22 | 48,9 |
| **Total** | | | |

When the specifications of the teacher candidates in research are considered, it is observed that the number of the male students (30) is twofold of the number of the female students (15) and their thinking style choices (%51.1) are nearly equal with Self-Enclosed and %48.9 Self-Enclosed rates.

### 2.2. PLANNING AND IMPLANTATION OF THE COURSE
In the process of 10 weeks implementation that is made in scope of research, an environment is developed including the online interaction tools as to provide the online information sharing by the author for the course, which is carried out in the form of three hours theoretical, two hours application. The blog tool, which provides opportunity for the interaction between the students and the instructor and messaging tool having the similar features with the e-mail which the students can communicate with the instructor, is benefitted in this environment. The print screens of "Education Management System" can be seen in Figure 1 and Figure 2.
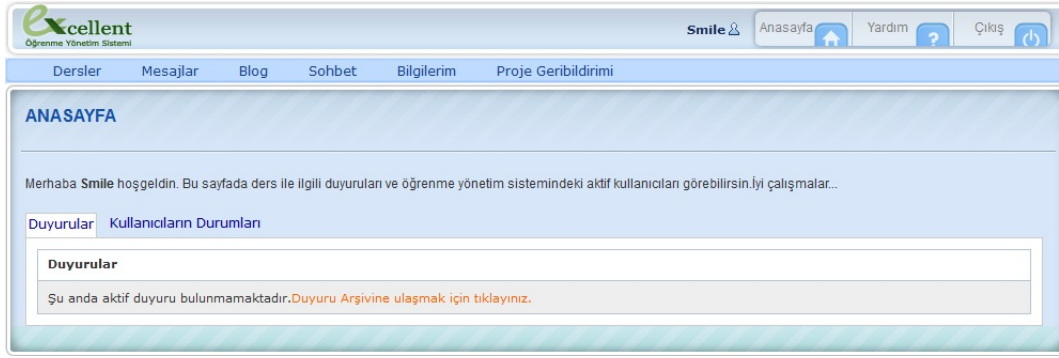
**Figure 1.** *"Main Page Screen" of education management system*



**Figure 2.** *Status of the users*

An evaluation point is given in four different categories at the end of the learning activities; participation of the students in discussions at *BLOG site*, project implementations in scope of semester end activity, evaluation of the result by watching and implementing the videos including C# courses and academic success test which its reliability and expert opinion has been provided in the previous semester.

## 2.3. DATA COLLECTION TOOLS

For determining the thinking styles of the students in scope of the research "Thinking Styles Scale" is used, for determining their motivations "Motivation and Learning Strategies Scale" is used, and the student opinion form and individual information form which is developed by the researches is used. Besides, for measuring the programming success of the students, pretest and posttest programming information success tests which are developed by the author by taking the opinion of an expert and are analyzed in terms of validity and reliability, are used in 2012-2013 academic year. In measuring the posttest success points, task points which are given within the implementation process together with the academic success test; course activities participation points and project points are used. An opinion is taken from the expert of five different fields and whole data collection tools and online learning environment to be used in scope of the application and it is used after giving the last form by making the essential regulations.

### 2.3.1. SCALE OF THINKING STYLES

Five likert type "Thinking Styles Scales" which is formed from 94 items and 14 factors and which is adopted into Turkish by Sünbül (2004), is used for determining the thinking styles of the students. 10 items were removed from the scale of Sternberg & Wagner (1992) consisting of 104 items, as the result of the factor analysis and reliability analysis. In each article of the scale, a case is presented which shows the mental mindscape and forms of the person in any information and problem status and the individuals are requested to mention the frequency of this case on the scale (Sünbül, 2004). The items are graded in the scale as follows; "Always (1)", "Frequently (2)", "Sometimes (3)", "Rarely (4)" and "Never (5)". Cronbach α reliability coefficient which is calculated for determining the internal consistency of the scale, change between 0.70 and 0.86 for all lower dimensions. At the same time, it is verified that the factor analysis and the scale form a structure of 13 factors after the change made by taking the item test and the item correlations as the basis. 13 factors which are gathered under five main titles;

a.    Functional style: Subjective thinking, normative thinking, judgmental thinking.
b.    Figural Style: Singular, gradual, equivalent, irregular.
c.    According to level: Monolith thinking, elaborative thinking.
d.    According to scope: Self-Enclosed, Self-Enclosed.
e.    According to inclination: Innovative and traditional thinking styles.

### 2.3.2    MOTIVATION SCALE

Motivated Strategies for Learning Questionnaire (MSLQ) which is developed by Pintrich, Smith, Garcia and McKeachie  (1991) and is adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004) has been used in determination of the students' motivation. The motivation section of the scale, which is established from the motivation, and learning strategies section, is used. In the septet likert type consisting of 31 items and 6 factors, the reply answer changing between "absolutely wrong" (1) and "absolutely right form me" (7) has been used in answering each items. The validity study of the scale has been actualized with the explanatory factor analysis and confirmatory factor analysis calculations. The scale is formed of internal target regulation, external target regulation, task value, control belief related with learning, self-efficacy and exam concern related with learning and performance. The internal consistency coefficients related with the sub-dimensions of the scales, change between .59 and .86.

### 2.3.3.    STUDENT OPINION FORM

As to be in conformity with the purposes of the research, an open ended opinion form with two question is prepared for mentioning the opinion of the students related with the learning process and online learning environment. This form has been submitted to the expert opinion and has been used in application after making the essential changes. The student opinion form has been shared with the students at the end of application process, has been shared with the students and the opinions of the students have been taken related with the questions in the form.

*Student Opinion Form:*
If you evaluate your education over 5 points, what point you shall give? Please mention your opinion by explaining the positive and negative applications.
Please evaluate your satisfaction level related with your education over 5 points. Please mention your reasons.

### 2.3.4    ACADEMIC SUCCESS TEST

Academic success which has been developed by the researcher, has been used for measuring the cognitive skills of the students for C # programming language course. The draft academic success test consists of 8 items. The weight of the courses in the distribution of the questions are considered for increasing the scope validity of the test and the validity of the question is provided by applying to the expert opinions. The validity of the questions is controlled with a pivot study by applying to 53 students before application.

### 2.4.  DATA COLLECTION AND ANALYSIS

The data which is obtained in scope of the research, has been analyzed by using SPSS (The Statistical Package for The Social Sciences) packaged software and all hypotheses have been tested in 0.95 trust level (p < 0.05). Thinking styles scales and the collected data is analyzed through calculating the dimension averages by calculating each thinking style separately. It is expected to have an apparent difference between the size averages. The student may use more than one thinking styles (Sünbül, 2004)so it is possible to have equal or close values of the size averages.

Before starting the analysis of the data, Kolmogorov – Smirnov normality test results are considered for mearing whether each dependent variable shows a normal distribution. Kolmogorov-Smirnov normality test analysis results show a normal distribution for gender, class level variables so non-parametric tests are used because the parametric tests do not show a normal distribution for the academic success level variable.

In determination of the satisfaction level of the students' thinking styles, motivation related with evaluation of the learning process, frequency (f), percentage (%), average (X) and standard deviation (Ss) values are used as descriptive statistics. For measuring the relation between demographic features (gender) and motivation average points and thinking styles of the students T-test and bilateral Anova tests are used. For testing whether the academic success points and motivations of the students show a significant difference according to the thinking styles, t test in the level of p<.05, Anova test and Ancova test are made.

In the evaluation scale used in commenting the findings which are obtained after data analysis; (5-1) / 3 evaluation interval is taken as the basis and the relation level between the average point limits and

information levels are determined as 1 – 2.33 Low level, 2.34 – 3.67 Medium Level, 3.68 – 5.00 Advanced Level.

## 3. FINDINGS AND COMMENTS
The findings obtained as the result of the research, are summarized as follows.
### 3.1. Do the online learning tests used in learning process form a difference in pretest- posttest success points of the students?
Dependent sample t-test results, which are made for determining the existence of significant difference in the pretest-posttest success points of the students, are given in table 2.

**Table 2:** Results of dependent sample t-tests according to pretest, posttest of the students

| Thinking Style | Success Test | N | $\overline{X}$ | S | Sd | t | P |
|---|---|---|---|---|---|---|---|
| Self-Enclosed | Pretest | 23 | 62.57 | 5.366 | 22 | -2.414 | 0.025* |
|  | Posttest | 23 | 71.74 | 4.519 |  |  |  |
| Self-Enclosed | Pretest | 22 | 60.23 | 5.07 | 21 | -3.24 | 0.004* |
|  | Posttest | 22 | 68.59 | 4.9 |  |  |  |

p<.01

According to table 2, a statistically significant difference is seen in the pretest, posttest points (p<.01) of both Self-Enclosed and Self-Enclosed students in programming languages course which is supported with the online learning tools. An increase of 9.17 points is observed in the pretest- posttest success point averages of the students choosing Self-Enclosed thinking styles and an increase of 8.36 points is observed in the students choosing Extraverted thinking style. This result shows that the discussions made in the blog site, video and project development applications form a statistically significant difference in the academic successes of the students. Besides in table 2, it is seen that the increase in the success points of the Self-Enclosed students are higher than extraverted students. This information may be commented in the form that the Self-Enclosed students need the course supported with online learning tools. In similar way, in the experimental study of Çetin & Top (2014)  where they examine the success and "visualization and ACE cycle in programming education", a significant difference is found in posttest success points of the experimental group students and control group.  Well-structured web and multimedia technologies for problem solving skills and integrated design affect the academic success positively (Uysal, 2014).

### 3.2. What are the levels of students in using the thinking styles?
The descriptive statistics analysis results related with the thinking styles of the students, are given in table 3.

**Table 3:** Descriptive statistics related with the thinking styles of the students

| Thinking style | Point interval | N | $\overline{X}$ | SS |
|---|---|---|---|---|
| Self-Enclosed | 16-40 | 45 | 27.96 | 6.075 |
| Extraverted | 14-39 | 45 | 28.16 | 5.713 |

According to Table 3, it is observed that the average points of Self Enclosed thinking styles which like the works requiring cooperation of the students ($\overline{X} = 28.16$) are higher than the Extraverted thinking style average points which likes working in single form ($\overline{X} = 27.96$). According to this finding, we may say that the students prefer to take part in the learning environment which requires cooperation like blog sites, project applications in educational activities.

### 3.3. Do the evaluation points of the students who a significant difference according to their thinking styles?
The results of t-test analysis made for determining whether the average points of the students obtained from each measuring tool show a significant difference according to their thinking styles, are given in table 4.

**Table 4:** T test results of the students according to the thinking styles of project, video, exam and blog points

| Thinking styles | | N | $\overline{X}$ | S | Sd | t | p |
|---|---|---|---|---|---|---|---|
| Participation in discussion in BLOG | Self-Enclosed | 23 | 61.39 | 5.868 | 45 | .332 | .742 |
|  | Extraverted | 22 | 58.59 | 6.070 |  |  |  |
| PROJECT Evaluation Point | Self-Enclosed | 23 | 72.61 | 3.280 | 45 | -.113 | .910 |
|  | Extraverted | 22 | 73.18 | 3.872 |  |  |  |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **VIDEO Watching** | **Self-Enclosed** | 23 | 79.78 | 4.327 | 45 | -.466 | .644 |
| | **Extraverted** | 22 | 82.27 | 3.064 | | | |
| **Academic Success Test** | **Self-Enclosed** | 23 | 61.96 | 6.355 | 45 | .549 | .586 |
| | **Extraverted** | 22 | 56.59 | 7.468 | | | |
| **General Average** | **Self-Enclosed** | 23 | 71.74 | 4.519 | 45 | .223 | .639 |
| | **Extraverted** | 22 | 68.59 | 4.906 | | | |

It is observed from Table 4 that the points averages which the students obtain from application tools (blog, project, video) and from the academic success test do not have a statistically significant difference according to the thinking styles. This finding can be commented as the form that the thinking styles of the students do not affect the academic success of the students in programming language courses which are supported with the online learning tools. It is possible to confront the similar results in literature. Dinçer and Saracaloğlu (2011) mentioned that only the academic success levels of the students preferring a global and conservative thinking style shows a significant difference. Similarly Buluş (2005) expressed that there is a relation between the academic success points and thinking styles of the teacher candidates preferring the anarchic and conservative thinking styles. Lam (2000) reached the conclusion in his study that only the global style has positive effect on the academic success.

**3.4. Do the motivation of the students against the course show a significant difference according to the preferred thinking style?**
T test analysis results which are made for showing whether the motivation of the students against the course show a significant difference according to the preferred thinking style, are given in table 5.

**Table 5:** T test results of the students' motivation against the course according to their thinking styles

| Thinking Style | N | $\overline{X}$ | S | Sd | t | p |
|---|---|---|---|---|---|---|
| **Self-Enclosed** | 23 | 151.65 | 4.519 | 43 | 0.080 | 0.937 |
| **Extraverted** | 19 | 151.14 | 4.650 | | | |

In table 5, it is observed that the motivation of the students against the courses does not show a significant difference according to their thinking styles. This case shows that the thinking styles of the students do not motivate the interest and curiosity of the students against the course. Besides it is observed that the motivation of the students against the course, are in advanced level. Under the light of this finding, we may say that the students like the programming languages course which they found as hard and boring at the beginning through the online learning tools. It is understood from the literature that the programming language course which is offered with these types of learning environments, affect the motivations of the students positively. For example Forte & Guzdial (2005) and Serrano-Cámara, Paredes-Velasco, Alcover, and Velazquez-Iturbide (2014) mentioned that the students have higher motivation and attitude than the course which is carried out with traditional method in programming languages course adapted in terms of instructional design. In a blended learning study, Cheng and Chau (2015) found that the motivation and participation is higher.

**3.5. Do the thinking styles of the students and their motivation against the course show a significant difference according to gender variable?**
The relation between the thinking styles, motivation and genders of the students, is given in Table 6.

**Table 6:** T test result of the thinking styles and motivations of the students according to the gender

| | | N | $\overline{X}$ | S | Sd | t | p |
|---|---|---|---|---|---|---|---|
| **Self-Enclosed** | **Male** | 30 | 28,03 | 6,083 | 43 | ,120 | ,905 |
| | **Female** | 15 | 27,80 | 6,270 | | ,119 | ,906 |
| **Extraverted** | **Male** | 30 | 27,73 | 5,771 | 43 | -,697 | ,490 |
| | **Female** | 15 | 29,00 | 5,695 | | -,700 | ,489 |
| **Motivation Point** | **Male** | 30 | 154,40 | 19,753 | 43 | 1,336 | ,189 |
| | **Female** | 15 | 145,40 | 24,204 | | 1,247 | ,225 |

It is seen in table 6 that the thinking styles and the motivation of the students do not show a significant difference according to the gender variable. According to this finding, we may say that the gender does not affect the thinking style and motivation of the students. While this result overlaps the research results of Verdú et al. (2012), Robinson (1995), Çubukçu (2004), Duman & Çelik (2011), Saracaloğlu, Yenice & Karasakaloğlu (2008), Düzgün'ün (2011) , it contradicts with the research results of (Dinçer & Saracaloğlu

(2011), Balgalmış & Baloğlu (2010) and Sünbül (2004). In the study of Yıldızlar (2010)  with the title "Thinking Styles of the teacher candidates coming from different culture", it is concluded that the male teacher candidates in Turkey prefer Self-Enclosed thinking style more than the female teacher candidates.

### 3.6.  What are the opinions of the students related with the learning process?

A student opinion form is used for evaluating the education of the students. The findings related with the answers given to the questions in this form, are discussed below.

The average of the points given to the questions "What grade you will give for evaluating your education over 5 points? Please mention your opinion by explaining the negative and positive applications" is found as 3.69. The point average of the answers given by the students preferring Self-Enclosed thinking style is 3.87, and the point average of the answers of the students preferring the extraverted thinking style is 3.50. This finding may be commented as the students are within a positive attitude in advance level related with the programming languages education. In the evaluation of the students related with the education, while the expressions like  providing interaction opportunities" and "prompting to the research" come to the forefront "experiencing technical failures" and "requiring internet access" are expressed as the negative features.

T test results according to the thinking styles of the students related with the evaluation points, are given in table 7.

**Table 7:** T test results according to the thinking styles of the students related with the evaluation points

| Thinking Styles | N | $\overline{X}$ | S | Sd | T | p |
|---|---|---|---|---|---|---|
| Self-Enclosed | 23 | 3.87 | .202 | 43 | 1.352 | .183 |
| Extraverted | 22 | 3.50 | .183 | | | |

It is understood from Table 7 that the evaluation points related with the preferred education do not show a significant difference according to the thinking style preferred by the students (p > .05).  This finding may be commented as the non-existence of the effect of the learning styles on the opinions of the students related with the education.

The point average of the questions *"evaluate the level of satisfaction related with this education over 5 points. Please mention the reasons."* is found as 3.62. The point average of the replies given to this question by the students preferring the Self-Enclosed thinking styles is 3.74 and the point average of the replies given to this question by the students preferring the extraverted thinking style is 3.45. According to this finding, the satisfaction level of the students related with the education is *"medium level"*. In the evaluation related with the satisfaction of the students for the education while "the applicable form of the course" and "encouraging for learning" expressions come to the forefront, "experiencing technical failures" and "excessive workload" expression come to the forefront as the negative features. In a qualitative study of Geçer & Dağ (2012) which they made by blending the face to face and e-learning method; they reached to the conclusion that the applied method provides active participation of the students and the students find the implementation of education activities in web environment as interesting and beneficial. Similarly Uluyol & Karadeniz'de (2009) has found the result that in the blended learning environment, the students are in a positive attitude and they think that they have acquisitions in different and positive aspect.

The reason of high evaluation and satisfaction points, is to have an instructor of the course provide a feedback to the students as individual and group in the discussions in blog site and during the intramural group studies, encourage them for making the activities and help the students in video activities.

T test results of the point average of satisfaction level related with the education according to their preferred thinking styles, are given in table 8.

**Table 8:** T test results of the point average of satisfaction level related with the education according to their preferred thinking styles

| Thinking styles | N | $\overline{X}$ | S | Sd | t | p |
|---|---|---|---|---|---|---|
| Self-Enclosed | 23 | 3.74 | .201 | 43 | .945 | .350 |
| Extraverted | 22 | 3.45 | 1.057 | | | |

As seen in Table 8, the points of satisfaction level related with the education of the students do not show a significant difference according to the preferred thinking style (p < .05). In another words, the satisfaction level of the students related with their education, does not change according to their thinking level.

The literature is in the qualification of supporting these findings. In an experimental study Forte & Guzdial (2005) has found that the students have higher motivation and attitude than the traditional courses in the programming languages which are carried out in terms of instructional design. The students have expressed that to follow the course content, homework and project in online learning environment provide active participation to the course (Geçer & Dağ, 2012). Similarly, Çetin & Top (2014) has found that the majority of the experimental group students find the activities in the school efficient but the motivation desired in the extra scholastic group studies, is not provided.

### 3.7. Do the pretest- posttest success points of the students show a significant difference according to their learning styles?

For the validity of Covariance analysis, the homogeneity test must be made for the variance. According to Levene's Test results p value is calculated as .164, this value is higher than .05 therefore the homogeneity of the variance is provided. According to the test results for determining whether the inclination of dependent variable (posttest) and co-variable (pretest) is approximately the same, the p value is calculated as .175, this value is higher than .05 therefore the hypothesis of "the inclination is same for two groups" is provided. The posttest average points of the students having the different thinking styles which are corrected according to pretest and posttest, are seen in table 9.

**Table 9:** Posttest average points which are corrected according to the thinking styles

|  | N | $\overline{X}$ | $\overline{X}$ (Corrected) |
|---|---|---|---|
| **Self-Enclosed** | 23 | 71.74 | 70.928 |
| **Extraverted** | 22 | 68.59 | 69.439 |

It is seen in Table 9 that the corrected posttest average points (70.93) of the students preferring the Self-Enclosed thinking style are higher than the average points (69.44) of the students preferring extraverted thinking style and these points are very close to each other. Hwang et al. (2012) similarly found a relation between the learning performance and learning behavior. The significance of the difference observed in the average points of the students, has been analyzed with ANCOVA test.

In table 10, the Ancova test analysis results are given for determining whether the pretest- posttest points show a significant difference according to groups.

**Table 10:** ANCOVA results according to the final success points which are corrected pursuant to the pretest success points

| Source of the variance | Total of Squares | sd | Average of Squares | F | p |
|---|---|---|---|---|---|
| **Pretest (Reg.)** | 13310.064 | 1 | 13310.064 | 68.628 | ,000* |
| **Internal external** | 24.892 | 1 | 24.892 | .128 | ,722 |
| **Failure** | 8145.689 | 42 | 193.945 |  |  |
| **Total** | 243329.000 | 45 |  |  |  |

When Table 10 is evaluated, it is understood that the average points of the posttests which are corrected according to the pretest points of the students preferring the different thinking styles, do not show a significant difference ($F_{[1-45]} = 0.13, p > 0.05$). This finding shows that the thinking styles preferred by the students do not form a significant difference on the thinking styles in programming language courses.

### 4. DISCUSSION AND CONCLUSION

In the research, it is found that the programming languages course which is supported with the online learning tools, form a significant difference in the pretest-posttest success scores of the students. It is seen that when the programming languages requiring the high level problem solving skills are actualized in cooperative learning environment like online discussion environments and project applications, academic success and motivation can reach to the desired level. Besides, the higher increase in the success points of Self-Enclosed students, shows that the extraverted students need the courses which are supported with the online learning tools.

The self-enclosed thinking style point averages of the students are higher. We can infer that CEIT Department students prefer being in the applications requiring cooperation and productivity and contrary to this they stand apart from the studies requiring individual study.

The students find the programming language education in advanced level. According to this finding, the satisfaction level of the students related with the education is *"medium level"*. In the evaluation related with the satisfaction of the students for the education while "the applicable form of the course" and "encouraging for learning" expressions come to the forefront, "experiencing technical failures" and "excessive workload" expression come to the forefront as the negative features. In a qualitative study of Geçer and Dağ (2012) which they made by blending the face to face and e-learning method; they reached to the conclusion that the applied method provides active participation of the students

Together with this, no significant difference is seen in the evaluation and satisfaction points of the students related with the preferred thinking styles of the students. While the education environment is considered as positive in terms of "providing interaction opportunities" and "prompting to the research and application", it is considered as negative in terms of "requiring internet access", "experiencing technical failures" and "excessive workload".

It is observed that blog, project, video and academic success test average points which are given for evaluating the education process, do not show any difference according to the thinking styles of the students. The motivation of the students against the course, does not show a statistically significant difference according to the thinking style choices. However it is observed that the male students have higher motivation than the female students. Besides the posttest points which are corrected according to the pretest thinking styles do not show a significant difference according to the thinking styles.

In this study, it is understood that a learning design which is blended with online learning tools, must be planned strategically. While this type of course requires more effort for the instructor, the permanent learning and development of high level cognitive skills are provided. It is seen that to offer the courses requiring problem solving skills like programming languages within blended learning environments, affects the academic success, motivation and student satisfaction in positive way.

Besides, it is seen that the thinking styles of the students affect the academic success and motivation. The blended learning environment motivates the academic successes of the students preferring the Self-Enclosed thinking style. This shows that the thinking styles of the students must be predetermined and must be designed.

Under the light of the research findings, the below suggestions can be made.
1. The acquisitions desired in programming education, may be obtained by forming education environments that shall provide integrated problem solving skills with web and multimedia technologies.
2. The success of the programming may be increased by using the alternative programming education methods which are connected with the structural programming techniques.
3. This study is designed in semi experimental pattern model, in further studies, the understanding problems in programming languages may be understood better by making experimental studies including control and experimental groups.
4. In the learning environment which is designed with the blended learning method, the programming language success of the students who have individual features like learning approaches, focus of audit and individual innovations.

One of the limitations of the study is the number of samples and the sample consists of only a university's CEIT department teacher nominees. Therefore, generalizations to be done are limited. This study can be carried out on students taking programming languages courses in different departments of different universities by expanding the number of samples. The second limitation is that the research covers only one educational term. The same study might be carried out with programming languages courses taken at university from 1st grade to the 4th. Another limitation is designing course materials considering thinking styles.

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