


## Exploring the Predictive Role of E-Learning Readiness and E-Learning Style on Student Engagement

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### Abstract

The aim of this study was to determine the factors predicting student engagement. The sample of the study consisted of 527 students from Karabuk University Distance Education Center. Independent variables of the study were e-learning style and online learning readiness. The data were analyzed using the stepwise multiple regression analysis. The findings revealed that students, who set a learning goal, can manage their time in line with this goal, put effort, organize their learning considering their needs, pay attention to learning situations or the learning object, prefer to work with visual elements, enjoy doing research, can remember easily and study with visuals that facilitate retrieval, prefer to work independently, take responsibility for their learning, and believe in their learning ability, have higher levels of engagement.

**Keywords:** Student engagement, online learning readiness, e-learning style

### Introduction

Electronic learning (e-learning) can support active learning without time and space barrier. It has also introduced significant innovation for educational environments in the twenty-first century, benefiting from web-based communication, collaboration, multimedia and information transfer (Motaghian, Hassanzadeh, & Moghadam, 2013). With e-learning, content can be managed through various learning activities and the quality of teaching can be improved. For example, LMSs can influence students' engagement with the environment, change collaboration and communication, and help access learning materials. E-learning environments enhance student learning by providing a broader source of interaction, making course content more accessible, providing automated and adaptable assessment styles, and improving technology literacy. Although e-learning classroom has advantages over traditional learning environments, it can also have significant limitations. In the traditional classroom, learning communities can be seen by the teacher, and students can easily communicate with their friends thanks to the rich visible social clues in the environment. However, in e-learning environments, students are often isolated from each other and from the educator, and it may be difficult to develop community feeling (Daniel & Schwier, 2010). This may be due to the fact that online students cannot allocate time for the course and participate in learning environments (Mupinga, Nora & Yaw, 2006); they do not expend enough effort to learn, and they have low level of readiness or some differences in learning styles.

### Theoretical Framework

The effort and time spent by students in the learning environment is called student engagement (Ergün & Usluel, 2015). Astin (1984) defines engagement as “the amount of physical and psychological energy the student devotes to academic experience” (p. 297). Chakraborty and Nafukho (2014) found four factors that are important in engaging students online: “creating and maintaining positive learning environment; building learning community; giving consistent

feedback in timely manner; and using the right technology to deliver the right content". Skilling, Bobis and Martin (2020) examined the relationships between student engagement and mathematics achievement. They revealed that students with low levels of engagement tend to have low mathematics performance. They further stated that students with high engagement levels believe in the importance of the subject they learn.

Fredricks, Blumenfeld and Paris (2004) discuss three types of engagement, namely behavioral, affective and cognitive engagement. Each type of engagement has positive, neutral and negative aspects. Accordingly, while behavioral engagement of a learner is positive, his/her cognitive engagement can be negative (Trowler, 2010). Therefore, in this study, it was thought that conducting separate regression analyses for behavioral, affective and cognitive engagement, which are the sub-factors of engagement, would facilitate the understanding of the engagement construct.

High level of engagement enables students to learn the course content more effectively. It enables students to expand the knowledge obtained by creating new ideas or to critically examine the existing ideas to produce new solutions (Strachan & Liyanage, 2015). According to the social learning theory, engagement of learners is the primary element in the emergence of desired learning outcomes and motivation of students to learn (Bandura, 1977). Student engagement has the mediating role in learning participation and educational outcomes (Inkelas, Szele'nyi, Soldner & Brower, 2007). Hampton and Pearce (2016) note that being focused and engaged in course work as an online student is critical for success.

Student engagement is an important part of the learning and teaching process; however, as students have different learning styles, achieving this engagement is difficult. Each learner approaches the materials in the environment in various ways. For example, visual materials may be useful to a student, yet they may not be useful as a learning tool for someone else. For this reason, teachers should discover the needs of their students and what to do about those needs. Teachers need to provide a safe environment for students so that they all believe that they can learn. Furthermore, students must have some competences in online learning environments. They must be responsible for their own learning, be able to manage time well, adjust the speed of learning, use technological tools in the environment, and do their homework on time (Hung, Chou, Chen & Own, 2010). In order to achieve this, they must have the necessary competencies and attitude. A student who feels uncomfortable in the learning environment will not make an effort to learn, and it will be difficult to encourage this student to learn. Thus, student engagement will be adversely affected. The stakeholders in this process need to pay attention to students' learning styles and level of e-readiness to design and implement effective e-learning programs.

### *Student Engagement and Online Learning Readiness*

In e-learning, learners need to manage their own learning. Students with such an ability can work alone, insist on learning, use the computer, make a plan in order to complete a task, and read (Piskurich, 2003). The ability to use multimedia technologies and learning resources to improve the quality of learning is expressed as student readiness. It is stated that online learning readiness has the dimensions of technology and student characteristics (Kaymak-Demir & Horzum, 2013), and is an important part of distance education as it is associated with the success of e-learning programs (Kaur & Abas, 2004). In order for e-learning programs to be successful, it is essential to evaluate the e-readiness levels of students as well as providing them with the necessary infrastructure and materials. Hong and Gardner (2018) maintain that e-readiness involves self-efficacy, self-regulation, social competence, and digital competence. They further state that low level of readiness has an important effect on the engagement level of students and depth of learning. Parkes, Stein

and Reading (2015) argue that unprepared learners cannot actively participate and use critical thinking skills. They investigated the perceptions of university students about online learning readiness using the LMS. The findings indicated that the students were prepared to engage in e-learning technology, whereas they were unprepared for such activities as being clear and concise in responses, reading and writing, synthesizing ideas, planning strategies, having discussions, and working with other students. Engagement and in-depth learning levels of learners who are unprepared for online learning environments are particularly adversely affected. It is stated that such unprepared students cannot actively participate in the process and cannot use their critical thinking skills. Students need to have certain technical skills and be ready to learn online to take advantage of online learning.

### *Student Engagement and E-learning Style*

Research suggests that each student learns in a unique way and prefers specific learning activities. Students use different cognitive, affective and metacognitive learning skills. They develop their own learning styles adopting a learning method. Learning styles are the result of the interaction between personal and contextual factors (Schmeck, Geisler-Brenstein & Cercy, 1991). Examples of personal factors include intelligence, age, educational experience and prior knowledge, while contextual factors include task structure, complexity of information, learning objectives, and teaching methods. Personal factors lead to consistency in the way students learn, while contextual factors lead to variation (Vermunt, 2005).

Having knowledge about the learning processes of students is an important variable in collecting information about the quality of the learning environment since students learn in different ways. Techniques, tools, or examples that are effective in helping a student learn the course concepts and methods may be less effective or ineffective in helping other students understand and learn the same concepts and methods. During a face-to-face course, an instructor can understand which content or method is effective in student learning. In this way, s/he can change his/her approach if necessary and receive immediate feedback on what additional information or explanation s/he needs to give. However, due to the asynchronous nature of the online learning environment, such changes cannot be made directly. Students may choose not to use videos and interactive tools and applications, and can only review course readings, and thus, they can only obtain superficial knowledge about course concepts and methods. Learning styles influencing how students respond to materials and the online environment are critical to student engagement. For this reason, online courses should include elements that increase the behavioral, cognitive and affective engagement of students.

Beer, Clark, and Jones (2010) argue that although some studies took participation into account while assessing online learning, this assessment does not represent the online learning process of students and does not provide information about the quality of online learning. The researchers maintain that student engagement may help in such an assessment. The aim of the present study is to investigate whether e-learning styles in electronic environments and online learning readiness are the predictors of student engagement. The following research questions are addressed in this study:

1. Are e-learning styles in electronic environments and online learning readiness the predictors of students' behavioral engagement?
2. Are e-learning styles in electronic environments and online learning readiness the predictors of students' affective engagement?
3. Are e-learning styles in electronic environments and online learning readiness the predictors of students' cognitive engagement?

## Method

The aim of this study was to determine the predictive role of e-learning styles and online learning readiness in student engagement. The research method is correlational.

### *Participants*

527 senior students of a public university in Turkey who took the Measurement and Evaluation in Education course through distance education during the 2016–2017 academic year constituted the study group. The primary aim of the course is the upskilling of teacher candidates before they enter the teaching profession.

### *Instruments*

The e-Learning Styles Scale for electronic environments (Gülbahar & Alper, 2014), The Scale of Online Learning Readiness (Hung et al., 2010) and Student Engagement Scale (Sun & Rueda, 2012) were used to collect data.

### *The e-Learning Styles Scale*

The scale was developed by Gülbahar and Alper (2014). In the validity study of the scale, principle component analysis and confirmatory factor analysis were used. As a result of the principle component analysis, the factor loadings for 38 items were found to be between .46 and .82. The results of the CFA produced the following values:  $\chi^2(632, N=2344) = 5195.95$ ,  $p < .000$ , RMSEA= 0.056, S-RMR= 0.047, GFI= 0.90, AGFI= 0.88, CFI= 0.98, NNFI= 0.97, IFI= 0.98. These values indicate that the model fits well to the data. Cronbach alpha reliability for the scale and the factors of the scale vary between .72 and .82, which indicates that the e-Learning Styles Scale is reliable and valid. The scale consists of seven factors (independent learning, social learning, audio-visual learning, active learning, verbal learning, logical learning, and intuitive learning) with a total of 38 items.

### *The Scale of Online Learning Readiness*

The scale was developed by Hung et al. (2010), and it was adapted to Turkish culture by Yurdugül and Alsancak Sırakaya (2013). The 5-Likert type scale consisting of 18 items is used to measure the readiness of preservice teachers for online learning. The factors of the scale are self-directed learning, computer/internet self-efficacy, learner control, motivation for learning, and online communication self-efficacy. After the original form of the scale was adapted to Turkish culture, it was applied to a group of 724 university students. In the validity study, confirmatory factor analysis was used. The results of the CFA produced the following values:  $\chi^2/sd=4,63$ ; RMSEA=0,07; GFI=.94; CFI=0,94; NFI=0,92. These values indicate that the model fits well to the data. Cronbach alpha reliability for the scale and the factors of the scale changed between .80 and .92. The findings indicated that the scale is reliable and valid.

### *Student Engagement Scale*

The scale was developed by Sun and Rueda (2012) and it was adapted to Turkish culture by Ergün and Usluel (2015). During the adaptation process, first, the original form was translated into Turkish by five experts, followed by the process of back translation into English. This translation

was evaluated by the researchers, and the most appropriate form for each item was used in the study. The data was analyzed with the CFA, which produced the following values:  $\chi^2(84, N=393) = 453.93$ ,  $p < .000$ , RMSEA = .072, S-RMR = .059, GFI = .89, AGFI = .86, CFI = .96, NNFI = .96, IFI = .96. These values indicate that the model fits well to the data. According to the results of the CFA, the Student Engagement Scale consists of three factors, namely behavioral, affective and cognitive factors. The behavioral engagement factor includes 5 items, while the affective engagement factor and the cognitive engagement factor include 6 and 8 items, respectively. The alpha values for the factors and item total correlations and the overall scale success were satisfactory. The analysis showed that the psychometric properties of the Turkish version of the Student Engagement Scale were acceptable, indicating that the scale is reliable and valid for use in Turkish.

### Data Collection

During 14 weeks, only online classes were given using Moodle. Weekly lecture topics and notes were available to revise on demand on Moodle. Digital instruments were used in the classes, and the students were able to contribute to class only by using the chat window. The e-Learning Styles Scale was applied after the midterm exam. The Scale of Online Learning Readiness and the Student Engagement Scale were applied after the final exam.

### Data Analysis

The stepwise multiple regression analysis, which is a statistical method for prediction studies, was used to analyze the data. The stepwise multiple regression analysis identifies the independent variables affecting one dependent variable (Albayrak, 2006; Büyüköztürk et al., 2017). In the present study, prior to the stepwise multiple regression analysis, the reliability of the collected data was examined and the Cronbach  $\alpha$  coefficients were calculated for each scale used in the study. Table 1 shows the Cronbach  $\alpha$  coefficients of the scales.

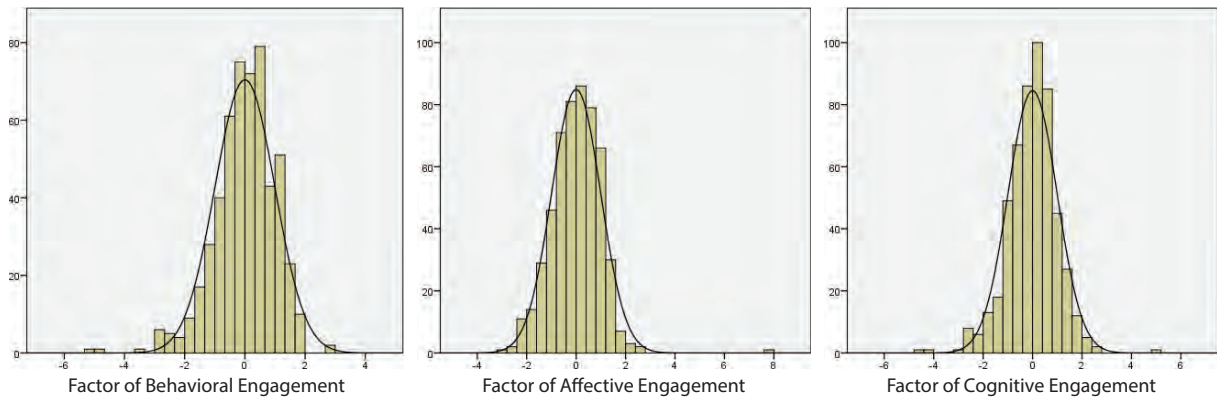
**Table 1: The Cronbach  $\alpha$  coefficients of the Scale of Online Learning Readiness, the e-Learning Styles Scale, and the Student Engagement Scale**

Scale	Cronbach $\alpha$
The Scale of Online Learning Readiness	.87
The e-Learning Styles Scale	.86
The Student Engagement Scale	.85

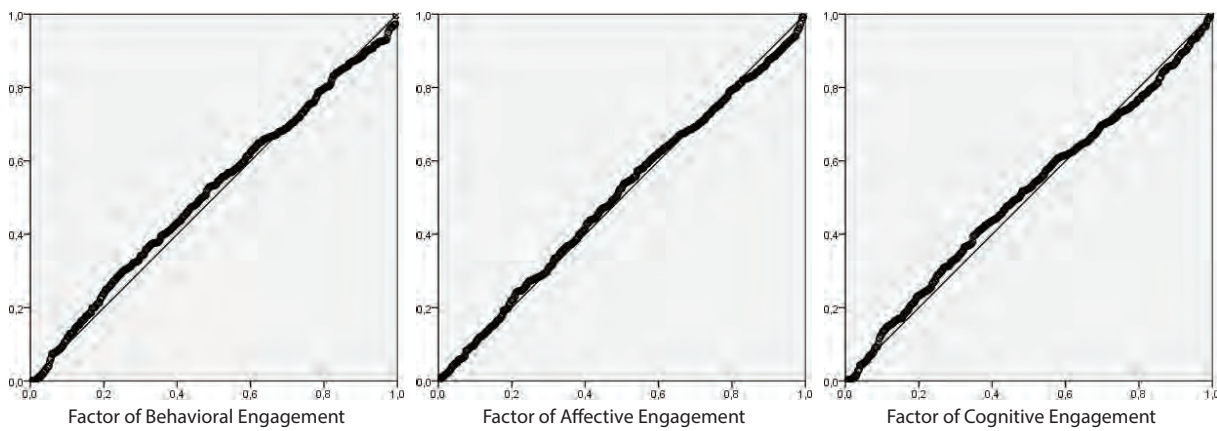
The Cronbach  $\alpha$  co-efficients of the scales used in the present study changed between .85 and .87, which indicates that data is reliable.

Whether the normality and linearity assumptions were met was investigated, and histograms and scattering diagrams were given in Figure 1 and Figure 2.





**Figure 1: Histogram and Normal Distribution Curves for the Standardized Predicted Values.**



**Figure 2: Scattering Diagrams for the Standardized Residual Values and Standardized Predictive Values.**

When Figures 1 and 2 are examined, it can be said that the histogram and normal distribution curves for the predicted values show a distribution close to normal, that the points in the scattering diagram tend to gather around an axis, and that the scattering diagram defines a linear and positive relationship. These results suggest that the data were appropriate for stepwise multiple regression analysis. However, to implement the stepwise multiple regression, the presence of a multicollinearity problem must be investigated.

The results as to whether there is multicollinearity between fixed variance, autocorrelation, and independent variables were examined. The results obtained and the criteria with which the results were compared (Albayrak, 2006; Büyüköztürk et al., 2017; Kalaycı, 2009) are given in Table 2.

**Table 2: Evidence showing that there is no multicollinearity problem with the results obtained**

	Student Engagement Scale and Factors			
	Criterion	Behavioral	Affective	Cognitive
Durbin-Watson	1,5-2,5	1,75	2,00	1,87
Tolerance	$1-R^2 > 0,20$	0,59-0,99	0,52-0,72	0,64-0,76
VIF	$VIF < 10$	1,01-1,68	1,37-1,91	1,30-1,57
CI	$CI < 30$	17,238	26,43	24,64

When the criteria in Table 2 that can be used to determine whether there is a multicollinearity problem are compared with the results obtained, it can be concluded that none of the tested models has a multicollinearity problem and autocorrelation. This evidence shows that the assumptions of the stepwise multiple regression are accepted.

The online learning readiness variables were first entered together, and then, the variables for e-learning styles for electronic environments were entered together as a set. The stepwise regression was then used to determine which, if any, contextual variables might explain the significant amount of variance beyond that explained by these independent variables.

## Findings

Whether e-learning styles and readiness predict the behavioral engagement factor was analyzed using the stepwise multiple regression. The regression analysis results and the regression equation are given in Table 3.

**Table 3: Results of the Multiple Regression Analysis of the Behavioral Engagement Factor**

Variable		B	R	$\Delta R^2$	b	T	p	Pairwise r	Partial r
Constant		9,285				9,952	.000		
Online Learning Readiness	Self-directed learning [ $X_1$ ]	0,415	0,402	0,162	0,362	8,203	.000	.34	.33
	Computer/internet self-efficacy [ $X_2$ ]	0,130	0,411	0,007	0,093	2,096	.037	.09	.08

$R = 0,411$   $R^2 = 0,169$   $F = 53,321$   $sd = 2,525$   $p = .000$

Behavioral Engagement =  $9,285 + 0,415 X_1 + 0,130 X_2$

Stepwise regression analyses were performed to predict behavioral engagement. As depicted in Table 3, self-directed learning was the strongest predictor of behavioral engagement. In combination with self-directed learning, computer/internet self-efficacy accounted for 16% of the variance in behavioral engagement ( $R = 0,411$ ;  $R^2 = 0,169$ ;  $p < .05$ ).

When the contribution of the predictor variables to the variance was examined, it was seen that self-directed learning variable explained 16% of the total variance and computer/internet self-efficacy 1% of the total variance. The standardized regression coefficients ( $\beta$ ) give the relative order of importance of the predictor variables. It can be concluded that the self-directed learning variable was more important in explaining behavioral engagement compared to the computer/internet self-efficacy variable.

When the paired and partial correlations between the predictor variables and the predicted variable were examined, it was found that there was a close to moderate ( $r = .34$ ,  $r = .33$ ) positive relationship between self-directed learning and engagement, while there was a low positive correlation between computer / internet self-efficacy and engagement ( $r = .09$ ,  $r = .08$ ). When other variables were controlled, these relationships remained about at the same level.

Whether e-learning styles and readiness predicted the affective engagement factor was analyzed through stepwise multiple regression. The regression analysis results, and the regression equation are given in Table 4.

**Table 4: Results of the Multiple Regression Analysis of the Affective Engagement Factor**

Variable	B	R	$\Delta R^2$	b	T	p	Pairwise r	Partial r	
Constant	7,699				4,160	.000			
Online Learning Readiness	Learner control [ $X_1$ ]	0,683	0,286	0,082	0,235	4,854	.000	.21	.20
	Self-directed learning [ $X_2$ ]	0,333	0,304	0,011	0,173	3,029	.003	.13	.13
	Motivation for learning [ $X_3$ ]	-0,397	0,320	0,010	-0,176	-3,089	.002	-.13	-.13
	Online communication self-efficacy [ $X_4$ ]	0,299	0,333	0,008	0,112	2,221	.027	.10	.09

$R = 0,333$   $R^2 = 0,111$   $F = 16,308$   $sd = 4;523$   $p = .000$

Affective Engagement =  $7,699 + 0,683 X_1 + 0,333 X_2 - 0,397 X_3 + 0,299 X_4$

When the paired and partial correlations between affective engagement and its predictors were examined, it was seen that there was a low positive relationship between learner control ( $r = .21$ ,  $r = .20$ ), self-directed learning ( $r = .13$ ,  $r = .13$ ) and online communication self-efficacy ( $r = .10$ ,  $r = .09$ ). When other variables were controlled, these relationships remained approximately at the same level. It was also seen that there was a low and negative relationship between affective engagement and motivation for learning ( $r = -.13$ ), and the relationship remained the same when the other variables were controlled.

Four predictors of affective engagement were found and these predictors accounted for 11% of the total variance in affective engagement ( $R = 0.333$ ;  $R^2 = 0.111$ ;  $p < .05$ ). When the change in squares of the regression coefficients ( $\Delta R^2$ ) was examined, it was seen that the variables of learner control, self-directed learning, motivation for learning, and online communication self-efficacy contributed to the total variance by 8%, 1%, 1%, and 1%, respectively. The standardized regression coefficients ( $\beta$ ) show the relative order of importance of the predictors in explaining affective engagement. The relative order of importance of the predictors explaining affective engagement was found to be learner control, self-directed learning, motivation for learning, and online communication self-efficacy.

Whether e-learning styles and readiness predict the cognitive engagement factor was analyzed using the stepwise multiple regression. The regression analysis results and the regression equation are given in Table 5.



**Table 5: Results of the Multiple Regression Analysis of the Cognitive Engagement Factor**

Variable		B	R	$\Delta R^2$	b	T	p	Pairwise r	Partial r
Constant		8,410				5,618	.000		
Online Learning Readiness	Self-directed learning [ $X_1$ ]	0,665	0,500	0,250	0,383	8,418	.000	.35	.30
	Learner control [ $X_2$ ]	0,277	0,510	0,010	0,105	2,488	.015	.11	.09
e-Learning Styles	Audio-visual learning style [ $X_3$ ]	0,159	0,532	0,023	0,159	3,766	.000	.16	.14
	Logical learning style [ $X_4$ ]	-0,310	0,544	0,013	-0,177	-4,267	.000	-.19	-.15
	Intuitive learning style [ $X_5$ ]	0,282	0,561	0,019	0,160	3,760	.000	.16	.14

$R = 0,561$   $R^2 = 0,315$   $F = 47,846$   $sd = 5,521$   $p = .000$

Cognitive Engagement =  $8,410 + 0,665 X_1 + 0,277 X_2 + 0,159 X_3 - 0,310 X_4 + 0,282 X_5$

As seen in Table 5, there was a low positive relationship between cognitive engagement and self-directed learning ( $r = .35$ ,  $r = .30$ ), learner control ( $r = .11$ ,  $r = .09$ ), audio-visual learning style ( $r = .16$ ,  $r = .14$ ), and intuitive learning style ( $r = .16$ ,  $r = .14$ ). When other variables were controlled, it was observed that these relationships remained approximately the same. A low and negative relationship ( $r = -.16$ ) was found between cognitive engagement and logical learning style. When other variables were controlled, the relationship did not change significantly ( $r = -.14$ ).

The stepwise multiple regression analysis revealed that self-directed learning, learner control, audio-visual learning style, logical learning style, and intuitive learning style were the predictors of cognitive engagement and these variables together explained 31% of the total variance in cognitive engagement ( $R = 0.561$ ;  $R^2 = 0.315$ ;  $p < .05$ ). When the change in the squares of the regression coefficients ( $\Delta R^2$ ) was examined, it was seen that the variables of self-directed learning, learner control, audio-visual learning style, logical learning style, and intuitive learning style contributed to the total variance by 25%, 1%, 2%, 1%, and 2%, respectively. The standardized regression coefficients ( $\beta$ ) show the relative order of importance of the predictors in explaining cognitive engagement. When the standardized regression coefficients ( $\beta$ ) were examined, it was seen that three variables (audio-visual learning style, logical learning style, intuitive learning) were included in the regression equation in contrast to the results concerning the behavioral and affective sub-dimensions. The relative order of importance of the predictive variables was found to be self-directed learning, learner control, audio-visual learning style, logical learning style, and intuitive learning.

## Discussion

This study investigated whether the level of readiness and learning styles of students in online learning environments predict student engagement. The findings are discussed below.

The self-directed learning and computer/internet self-efficacy variables together explained 16% of the total variance of behavioral engagement. As far as behavioral engagement was concerned, the contribution of self-directed learning to the total variance was found to be greater than that of computer/internet self-efficacy. The self-directed learning factor is related to time management, preparing a

study plan, seeking help when needed, and setting learning goals. Behavioral engagement involves behavioral situations such as paying attention to the subjects related to the course, asking questions, and having motivation and making effort to learn (Finn & Rock, 1997). Behavioral engagement also includes observable actions and refers to the participation of students in academic activities and their effort to perform academic tasks (Fredricks et al., 2004; Suarez-Orozco, Pimentel & Martin, 2009). Students with a high level computer/internet self-efficacy (with a belief in their ability to use the online learning environment) develop more behavioral engagement in learning environments, and this can also be observed in behaviors such as participating in conversations, attending classes, and being motivated to learn. Based on these findings, it can be said that students who have high computer/internet self-efficacy, who can set learning goals, and who can manage time and prepare a study plan have higher levels of engagement, and this engagement is reflected in their behaviors.

The variables predicting affective engagement are learner control, self-directed learning, motivation to learn, and online communication self-efficacy. These four variables accounted for 11% of the total variance in affective engagement. In this study, the regression results revealed that learner control was the most influential variable on students' interest in and positive feelings about the course. Learner control is defined as paying attention to learning situations or the learning object, identifying learning needs, and guiding the learning process. Affective engagement involves situations such as paying attention to the subject and the course and developing positive feelings about the online course (Stipek, 2002). When students identify their own needs and organize their learning in this direction, their affective engagement levels are positively affected. Learner control as well as self-directed learning contribute to affective engagement. Self-directed learning, which is the ability of students to direct their own learning, is an important aspect of online learning environments (Song & Hill, 2007). In self-directed learning, learners are active in the process of determining their learning objectives, activities, needs and competence levels, and they take more responsibility for their own learning (Eunjoo, 2006). Furthermore, Floratos, Guasch, and Espasa (2015) state that the more the student is active within a course, the more engaged she/he is with this course.

Motivation to learn is another predictor of affective engagement. It includes behaviors such as being open to new ideas, being motivated to learn, drawing lessons from mistakes, and sharing ideas with others. Students who have a flexible approach in learning, who can discuss their opinions, and who see their mistakes as a new learning experience have higher levels of affective engagement in online courses. Online learning environments, where learning responsibility is largely in the hands of students, require more effort, responsibility, motivation and self-directed control (Sakal, 2017). Online communication self-efficacy is the fourth variable predicting affective engagement. Students who are confident in terms of sending online e-mail, chatting, participating in chats, and starting discussions etc. can develop more positive emotions towards the course and pay more attention to it. Hung et al. (2010) state that in online learning, communication self-efficacy is a necessary dimension to overcome the limitations of online communication. For this reason, learning environments need to include communication tools to facilitate communication between teachers and students. Students need to ask questions and exchange ideas to improve their learning using synchronous tools such as live chat, instant messaging, audio discussions like Skype, and asynchronous tools such as e-mail.

In this study, the predictors of cognitive engagement were found to be self-directed learning, learner control, audio-visual learning style, logical learning style, and intuitive learning style. These five variables together explained 31% of the total variance in cognitive engagement. When the regression results of behavioral and affective engagement were examined, it was seen that learning styles did not predict affective and behavioral engagement. Pedone (2014) stated that cognitive strategies can help students identify their learning styles and strategies. However, when the regression results

related to cognitive engagement were examined, it was concluded that audio-visual learning, logical learning and intuitive learning style predicted cognitive engagement, followed by readiness in terms of relative order of importance. Here, firstly, the relationship between self-directed learning, learner control, and cognitive engagement is discussed, followed by the discussion on the relationship between learning styles and cognitive engagement.

The mental effort students expend to deal with learning materials is defined as cognitive engagement (Richardson & Newby, 2006; Walker, Greene & Mansell, 2006). Cognitive engagement is a prerequisite for meaningful learning (Shukora, Tasira, Meijdenb & Harun, 2014), and it involves behaviors such as willingness to make the necessary effort to understand complex situations or problems associated with learning situations. The results of our study revealed that students who can pay attention to learning situations or the learning object, who identify their learning needs, and who guide the learning process (students with high levels of learner control) have higher cognitive engagement. It can further be said that students who choose the appropriate learning strategies, who are willing to study and who can evaluate their own learning outcomes (Knowles, 1975), i.e. who have high self-directed learning level, are willing to use their cognitive processes. Students with visual-auditory learning skills believe that they can distinguish between different sounds, they enjoy listening, and they prefer to learn with tools such as shapes, comic strips, charts and so on (Gülbahar & Alper, 2014). According to the results of the study, it can be said that students who have these characteristics make the necessary effort to understand the complex situations or problems related to their learning situations. In other words, they have high levels of cognitive engagement. In particular, emerging new web technologies provide a variety of tools to engage with the learning environment. Advances in educational technology create powerful and innovative ways through which learners can engage in all kinds of content and activities in their self-learning experiences (Saeed, Yang & Sinnappan, 2009). In addition to audiovisual learning, intuitive learning style, which includes choosing to work independently, taking responsibility for learning, and believing in one's ability to learn, also predicts cognitive engagement. Hung et al. (2010) maintain that online students who create and implement their own learning methods can show a better learning performance. Beeland (2002), on the other hand, states that visual and auditory elements affect student engagement in the learning process. These results suggest that the search for learning in different ways and the effort students devote to find solutions to the course-related problems affect their cognitive engagement positively.

Logical learning style has an inverse correlation with cognitive engagement. In other words, students who like doing calculations or who are interested in science and mathematics were found to have lower levels of cognitive engagement, which may be affected by the course content. However, the course within the scope of this study includes subjects that require calculation and numerical reasoning. Therefore, the inverse relationship between logical learning style and cognitive engagement cannot be explained by the course content. The way classroom activities are performed, and the limitations of the interface used (the lack of opportunities for students to express themselves) may have made it difficult for students with a logical learning style to express themselves. Mupinga et al. (2006) highlight the importance of considering multiple learning styles in the design of online learning activities and proposed several strategies. The first recommendation is identifying the learning preferences, technical skills, prior knowledge and specific interests of students, as well as their learning and technological needs. The second recommendation is to provide students with information in various formats. Some students need time to internalize new ideas before participating in the class. Electronic discussions or chat rooms can ensure the participation of these students. A third approach is adding pictures, graphs, tables, or audio to lecture notes that summarize the main points of the course to accommodate audiovisual students. Such an approach attracts students'

attention, and information can be communicated more easily than with verbal explanations. In addition to all these recommendations, the changes that could occur in the engagement levels of the students who have different learning styles when different interfaces are used could be investigated.

## Conclusion

It is difficult to maintain student engagement in e-learning environments because learners and the instructor are not in the same place. However, an increase is observed in the sense of engagement of students if they set a learning goal, can manage time in line with this goal, put in effort, identify their needs and organize their learning to meet those needs, pay attention to learning situations or the learning object, prefer to work with visual elements, enjoy doing research, find it easy to remember and study with visuals facilitating retrieval, prefer to work independently, take responsibility for their learning, and rely on their learning ability. The emotional and intellectual investment are important considerations for course design and pedagogy for lecturers seeking to maximise the engagement of online students (Redmond, Heffernan, Abawi, Brown, & Henderson, 2018). The contribution of these characteristics to academic achievement may be the subject of other research studies. Furthermore, there may be an increase in student engagement through training on time management, self-regulation, working with visual elements, independent study and taking responsibility for learning or through guidance on these aspects. In future studies, students with low levels of engagement may be given training so that they develop their skills in the aspects listed above, and the changes in student engagement levels can be investigated.

Students need to interact with their friends, teachers or tools in the online learning environments during the learning process. As interaction increases, the likelihood of meeting student learning needs also increases (Kaymak-Demir & Horzum, 2013). Group work, doing assignments regularly, feedback, and interaction between students are necessary to achieve success in the online learning environment (Levy, 2008). Positive emotions are important in initiating an interaction between students. While students need to strive to develop their knowledge and skills and manage their own learning process, the institution needs to provide and organize appropriate environments that facilitate student learning. In online courses, direct instructor-to-student interaction may not be the primary factor affecting student engagement (Bryan et al., 2018). Improving student-faculty interaction or student-institution interaction and diversification of student-student and student-instructor communication channels contribute to increasing student engagement (Dixson, 2010). At this point, the effort of the instructor to increase student engagement is important and necessary (Saeed & Zyngier, 2012).

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