⌈Araştırma Makalesi / Research Article⌋

Kastamonu Eğitim Dergisi
Kastamonu Education Journal
Mayıs 2019 Cilt:27 Sayı:3
kefdergi.kastamonu.edu.tr

Başvuru Tarihi/Received: 19.05.2018
Kabul Tarihi/Accepted: 7.08.2018
DOI: 10.24106/kefdergi.3079

The Effects of Adaptive Educational Web Environment on Students' Academic Achievement and Motivation[1]

Uyarlanabilir Eğitsel Web Ortamlarının Öğrencilerin Akademik Başarılarına ve Motivasyonlarına Etkisi

Özlem CANAN GÜNGÖREN[2]

Özet

Bu çalışmanın amacı uyarlanabilir olan, uyarlanabilir olmayan ve yüz yüze öğrenme etkinlikleri ile desteklenmiş uyarlanabilir web temelli öğrenme ortamlarının, öğrencilerin başarıları ve motivasyonları üzerindeki etkilerinin farklı olup olmadığını belirlemektir. Araştırmada iki faktörlü 3x2'lik faktöriyel desen kullanılmıştır. Araştırma deseninin birinci faktörü deneysel işlemleri içeren öğrenme ortamı (uyarlamaların bulunduğu web temelli öğrenme ortamı, uyarlamaların bulunmadığı web temelli öğrenme ortamı ve yüzyüze öğrenme etkinlikleri ile desteklenmiş uyarlamaların olduğu web temelli ortamı), ikinci faktörü ise öntest ve sontest ölçümlerini içeren ve başarının değişimini ortaya koyan tekrarlı ölçümlerdir. Araştırmanın bağımlı değişkenleri başarı ve motivasyondur. Araştırma 2013-2014 öğretim yılı bahar döneminde Sakarya Üniversitesi Eğitim Fakültesi Sınıf Öğretmenliği, İlköğretim Matematik Öğretmenliği ve Fen Bilgisi Öğretmenliği bölümlerinin 2. sınıfında öğrenim görmekte olan ve Temel Bilgi Teknolojisi Kullanımı dersini alan 72 öğrenci ile yürütülmüştür. Elde edilen bulgulara göre yüzyüze öğrenme etkinlikleri ile desteklenmiş uyarlamaların olduğu web temelli ortamdaki başarı anlamlı olarak daha yüksektir. Farklı öğrenme ortamlarındaki öğrencilerin ürünlerinin incelenmesi sonucunda kullanılan ortam türlerinin öğrencilerin rubrik başarı puanlarını etkilemediği ortaya konmuştur. Ayrıca kullanılan öğrenme ortamlarına göre öğrencilerin motivasyonları arasında farklılık olmadığı tespit edilmiştir.

Anahtar Kelimeler: uyarlanabilir öğrenme, web temelli öğrenme, başarı, motivasyon

Abstract

The aim of this research is to determine whether the effects of adaptive web-based learning(WBL) environment, non-adaptive WBL environment and adaptive WBL environment supported by face-to-face learning activities on the students' achievement and motivation are different. A 3x2 factorial design was used in this study. The first factor of the research design is learning environment including experimental procedures (adaptive WBL environment, non-adaptive WBL environment and adaptive WBL environment supported by face-to-face learning activities) The second factor is repeated measures, which revealed the change of achievement including pre and post measurements. The dependent variables of the study are academic achievement and motivation. The research was conducted in 2013-2014 spring semester with 72 second-year students, who took the course of Basic Information Technology at Sakarya University, Education Faculty, Department of Primary Education, Primary Math Education and Science Education. In such a way that each group of 24 students, learning environments were formed as peer groups based on pretest. According to the findings, academic achievement in the adaptive WBL environment supplemented with face-to-face learning was significantly determined to be higher. As a result of the examination of the students' products in different learning environments, it was shown that environment type did not influence students' rubrics grade points. Moreover, there was no significant difference among students' motivation according to their learning environment used.

Keywords: adaptive learning, web-based learning (WBL), achievement, motivation

1. This study were obtained from the doctoral thesis under the supervision of Dr. Mehmet Barış HORZUM and it was funded by Sakarya University (BAP2013-70-02-003).

2. Sakarya University, Sakarya, Turkey; http://orcid.org/0000-0002-9184-6110

Atıf / Citation: Güngören Canan, Ö. (2019). The effects of adaptive educational web environment on students' academic achievement and motivation. *Kastamonu Education Journal, 27*(3), 1311-1326. doi:10.24106/kefdergi.3079

Extended Summary

Introduction

With the increasing number of WBL environments and individual learning, setting web-learning environments specific to individual traits is a noteworthy aspect. It is stated that every learner will perform different activities of learning based on the adoption of the principle "one size does not fit all"(Reigeluth, 1996), and the learning requirements of individuals using the same environment varies according to their different personality traits, ways of learning, analysis of information and usage of different information sources(Riding & Rayner, 1998). However, traditional educational web systems offer the same content and connections to all users. Uniformly designed web environments have emerged due to the opinion that users are monotype/standard users(Brusilovsky, 2001). The adaptivity presented as web-based is important for users(Weber, 1999).

In this research, an answer was sought for the question "Is there any difference between the achievement and motivation in the adaptive WBL environments in which there are adaptations of both adaptive presentation and navigation suitable for students' individual characteristics, such as their pre-knowledge, learning modality, learning approaches and preferences, adaptive WBL environments, non-adaptive WBL environments and adaptive WBL environments supported by face-to-face learning activities?".

Method

Research Design

The two-factor 3x2 factorial design was used in the research. The first factor of the design is the learning environment. Repeated measures are the second factor of the research design. The second dependent variable of the research is motivation.

Experimental Groups

The experimental groups(72 students) were selected from second-year students who take the Basic Information Technology class that replaced the Computer class in the new program and has the same content.

Data Collecting Tools

The tools used in the research were a pretest-posttest; four module tests and three scales.

Achievement Test (Pretest and Posttest)

An achievement test used in pretest and posttest was developed to measure students' achievement in the research.

Module Tests

The aim of module tests is to determine the transitions between modules.

BİG16 Learning Modality Inventory

In the research, the adaptations were made taking students' learning modality into account. To this end, the BİG16 Learning Modality Inventory developed by Şimşek(2002) was used.

The Revised Two-Factor Study Process Questionnaire(R-SPQ-2F)

The Revised Two-Factor Study Process Questionnaire(R-SPQ-2F) was used to reveal students' learning approaches.

Scale of Student Motivation in Adaptive Environments

To measure students' motivation in the adaptive educational web environment, the Student Motivation Scale developed by Erdoğan(2013) was used.

Rubric

In the research, the PowerPoint presentation titled "Internet and Social Networks" prepared by students for primary fourth-grade students at the end of the application was evaluated with the holistic rubric.

Teaching Materials

The materials were developed based on three learning environments: adaptive WBL environment, adaptive WBL environment supported by face-to-face learning activities and non-adaptive WBL environment.

Adaptive Web-Based Learning Environment

The adaptive WBL environment was developed within the framework of a model through the examination of the components of adaptive educational systems.

Adaptive WBL Environment supported with Face-to-Face Learning Activities

The adaptive WBL environment supported by face-to-face learning activities was established using and running both WBL environment in which face-to-face education continues and adaptive WBL environment at the same time.

Non-Adaptive Web-Based Learning Environment

Content related to Microsoft PowerPoint 2010 was prepared regardless off students' individual characteristics in the non-adaptive WBL environment.

Application, and the Collection and Analysis of the Data

Experimental procedures were conducted for 4 weeks in the spring term of the academic year 2013-2014. 72 students who participated to the research and continued the experimental process realized their learning of Microsoft PowerPoint 2010 through the WBL system.

Results

The effect of experimental procedures on achievement and motivation was examined in the research. Firstly, as a result of the Covariance Analysis, significant differences were found between the mean of adjusted posttest achievement scores according to groups' pretest achievement scores ($F(2\text{-}68) = 5.493$, $p < .05$, $\eta p2 = .139$). As a result, it was observed that the achievement in the adaptive WBL environment supported with face-to-face learning activities at a significance level of .05 ($\overline{X} = 69.947$) was higher than the achievement in the adaptive WBL environment ($\overline{X} = 62.550$), and no significant difference was observed between the achievements in the adaptive and non-adaptive WBL environments. Secondly, since there were rubric scores for three independent groups to be compared in the research, one-way variance analysis (ANOVA) was used for unrelated samples. It was found that there was no significant difference between groups in terms of rubric achievement scores ($F(2, 69) = .869$, $p>.05$, $\eta 2 = .025$). This shows that the environments used were not effective on students' rubric achievement scores. Thirdly, to compare the motivation scores of three independent groups in the research, one-way variance analysis (ANOVA) was used for unrelated samples. It was found that there was no significant difference between groups in terms of motivation scores ($F(2, 69) = .1.164$, $p>.05$, $\eta 2 = .033$). This shows that the environments used were not effective on students' motivation scores.

Conclusion and Discussion

The research results show that students' achievements in the adaptive WBL environment supported with face-to-face learning activities were higher than students' achievements in the adaptive and non-adaptive WBL environments and no significant difference was observed between the achievement scores in the adaptive and non-adaptive WBL environments. It was found as a result of evaluating student products within the scope of the research that students' achievement scores did not differ in terms of learning environments. Moreover, it was found that there was no difference between the motivations of the students learning in the adaptive and non-adaptive environments and the environments supported with face-to-face activities.

Adaptive WBL environments are designed in different ways, student modeling is performed according to different individual characteristics, different adaptation methods and techniques are used, different adaptation approaches are preferred, and therefore, studies performed with these environments result in differently. The findings obtained with the adaptive WBL environment modeled in the research comply with studies in differently designed adaptive WBL environment from some aspects and conflict them from other aspects.

1. Introduction

Recently, web-based learning (WBL) is becoming more popular with the increasing use of Internet, information and communication technologies, and web applications. Indeed, WBL has become one of the most benefited applications in higher education. WBL, which was first applied in large companies, colleges and universities in the US in 1997, became widespread in two years with 10% of colleges and universities and 25% of companies engaging in it. The rate reached 80% in colleges and universities and 60% in companies in 2001 (Lynch, 2002). The number of students taking WBL courses reached 3.6 million after an increase of 360,000 in 2005 compared to the previous year (Allen & Seaman, 2006), reaching 4.6 million in 2008 (Allen & Seaman, 2010), 6.1 million in 2010 (Allen & Seaman, 2011), and 5.8 million, increased the rate by 3.9% in fall 2014 compared to the previous year (Allen, Seaman, Poulin & Straut, 2016). The fact that, as of 2008, Massive Open Online Courses (MOOCs) had been developed to provide students with the opportunity of participating in the course whenever they want, communicating with instructors and everyone taking that course, asking questions, and accessing tools such as videos, lecture notes, etc. (Lewin, 2013) can be considered to be an important factor of the increasing number of students taking WBL courses.

In Turkey, many universities utilize WBL-related applications and WBL continues to become widespread (Horzum, 2012). According to the 2017 data from Turkish Statistical Institute (TSI), 66.8% of individuals in Turkey are regular Internet users; Internet is used for getting information, ordering goods or services for personal use; over 1 million higher education students continue their education through WBL. This development indicates that WBL established a powerful learning environment and may have wider area of usage in future.

With the increasing number of WBL environments and individual learning, setting web-learning environments specific to individual traits is a noteworthy aspect. It is stated that every learner will perform different activities of learning based on the adoption of the principle "one size does not fit all" (Reigeluth, 1996), and the learning requirements of individuals using the same environment varies according to their different personality traits, ways of learning, analysis of information and usage of different information sources (Riding & Rayner, 1998). However, traditional educational web systems offer the same content and connections to all users in the same way. Uniformly designed web environments have emerged due to the opinion that users are monotype/standard users (Brusilovsky, 2001).

Learning environments differentiating according to personal needs are needed with the rising importance of individual learning. Traditional educational web systems cannot meet the requirements of the personal learning of individuals with different knowledge, needs and interests (Brusilovsky, 2001). Accordingly, there is a need for setting adaptable, adaptive and personalized WBL environments that take individual differences into account.

Adaptable learning environments are established with learners selecting their own learning experiences; on the other hand, adaptive learning environments are formed in a way that the learning system changes environments and courses by using the learner's needs and traits. In personalized learning systems, adaptivity and adaptability can be used together (Burgos, Tattersall & Koper, 2007).

Adaptive learning environments from web systems that take individual differences into consideration are advanced hyper-environment systems that are configured through modeling with learner goals, interests and preferences and are able to customize learning for each student (Brusilovsky, 1998). Content area and student characteristics are determined via adaptive environments, and individual spaces are formed in accordance with these data in the adaptable environments. These individual spaces can adapt both presentation and navigation to individual traits, and therefore, both presentations and links can be shaped in accordance with the personal needs, individual traits and preferences of students.

Adaptive presentation is the presentation of content to students with different pre-knowledge, goals, and preferences; in other words, different types of characteristics (Brusilovsky, 1994). For adaptive presentation, multimedia presentation, text presentation, and modality can be adapted (Kelly, 2005). Adaptivity can be performed with different methods and techniques (Methods: additional explanations, prerequisite explanations, comparative explanations, sorting, explanation variants, Techniques: inserting/removing fragments, conditional text, stretchtext, fragment variants, page variants, frame-based technique, dimming fragments) (De Bra, 1998; Brusilovsky, 2001). Different information is offered to different students. For example, novice students are provided with introductory explanations, while experienced students are provided with more detailed information. Adaptive navigation means changing or explaining the rich connection structure to direct students to interesting and related information and keep them away from unrelated information. By this means, orientation problems about navigation can be eliminated (De Bra, Houben & Wu, 1999). Methods that could be used for adaptive navigation are global guidance, local guidance, global orientation, local orien-

tation; techniques are direct guidance, link sorting, link hiding, link annotation, link generation, and map adaptation (Brusilovsky, 1996; De Bra, 1998). Adaptive learning environments are the environments that can be altered according to individual traits, thanks to adaptive presentation and adaptive navigation, which have different methods and techniques.

The web is a very popular tool in terms of online learning (Khan, 1997), adaptive learning environments, which can be shaped according to individual traits and personal needs with the advancing technology and can be presented in a web-based form. The adaptivity presented as web-based is important for users. Web-based applications are used by more diverse users, differently than any independent application; a web application designed for a certain class of users may not be suitable for other users. In this sense, adaptivity is important for providing the environment suitable for every user in web applications and in terms of diversity (Weber, 1999).

In the literature there are many studies on adaptive WBL environments in which adaptations are made according to different individual traits and preferences. Learning styles (Brusilovsky, Eklund & Schwarz, 1998; De Bra et al., 2013; Despotović-Zrakić, Marković, Bogdanović, Barać & Krčo, 2012; Graf, 2007; Limongelli, Sciarrone & Vaste, 2011; Meccawy, Blanchfield, Ashman, Brailsford & Moore, 2008; Özyurt, 2013; Somyürek, 2008; Stash, Cristea & De Bra, 2006), personality types (Despotović-Zrakić et al., 2012; Kim, Lee & Ryu, 2013), cognitive styles (Cesur, 2013; Lo, Chan & Yeh, 2012; Yang, Hwang & Yang, 2013), pre-knowledge level (Brusilovsky et al., 1998; Çelebi, 2014; De Bra et al., 2013; Erdoğan, 2013; Eryılmaz, 2012; Limongelli et al., 2011; Meccawy et al., 2008; Weber & Brusilovsky, 2001), intelligence (Kelly, 2005), learning goals (Brusilovsky et al., 1998; De Bra et al., 2013), and motivation (Sang & Keller, 2001) are among primary the individual characteristics in the studies.

Various studies have examined whether variables are affected by adaptive WBL environments in which adaptations are made in accordance with different individual characteristics. These variables include achievement (Despotović-Zrakić et al., 2012; Eryılmaz, 2012; Graf, 2007; Hopcan, 2013; Kelly, 2005; Limongelli et al., 2011; Magoulas, Papanikolaou, & Grigoriadou, 2003; Özyurt, 2013; Šimko, Barla & Bieliková, 2010; Somyürek, 2008; Tseng, Chu, Hwang & Tsai, 2008; Uysal, 2008; Weber & Brusilovsky, 2001), motivation (Erdoğan, 2013; Sang & Keller, 2001; Šimko et al., 2010; Yang et al., 2013), cooperation (Gaudioso & Boticario, 2003; Šimko et al., 2010), satisfaction (Eryılmaz, 2012; Gaudioso & Boticario, 2003; Somyürek, 2008), and cognitive load (Eryılmaz, 2012).

The literature reports that adaptive WBL environments designed using different methods and techniques may affect the learning of students from several aspects, and some variables are not effective. In this research, an answer was sought for the question "Is there any difference between the achievement and motivation in the adaptive WBL environments in which there are adaptations of both adaptive presentation and navigation suitable for students' individual characteristics, such as their pre-knowledge, learning modality, learning approaches and preferences, adaptive WBL environments, non-adaptive WBL environments and adaptive WBL environments supported by face-to-face learning activities?". Within this context, the following hypotheses were tested:

- There is a significant difference between participant students' test-based academic achievements in the adaptive, non-adaptive and adaptive WBL environments supported with face-to-face learning activities.
- There is a significant difference between participant students' product-based academic achievements in the adaptive, non-adaptive and adaptive WBL environments supported with face-to-face learning activities.
- There is a significant difference between participant students' motivations in the adaptive, non-adaptive and adaptive WBL environments supported with face-to-face learning activities.

When the goals and hypotheses are taken into consideration, this study, in which an adaptive educational web-based environment was developed, is *original* in terms of supporting the developed adaptive educational web environment with face-to-face learning activities, addressing the achievement and the motivation in adaptive, non-adaptive and adaptive educational web environments provided with face-to-face support and using students' pre-knowledge, learning modality, learning approach and preference for student modeling, and making adaptions through methods and techniques suitable both for adaptive presentation and adaptive navigation; *up-to-date* in terms of addressing the adaptive web environment, which also looks out for individual differences in learning environments; *necessary* for revealing the achievement and the motivation in adaptive educational web environments and for these variables to be able to offer solutions for individual differences; and *functional* in terms of giving advice to designers who are planning to make more effective designs by enhancing students' achievement and motivation in the adaptive educational web environments through its results.

2. Method

Research Design

The two-factor 3x2 factorial design was used in the research. The first factor of the design is the learning environment, which includes experimental procedures. There are three sublevels of the learning environment: adaptive WBL environment, non-adaptive WBL environment and adaptive WBL environment supported with face-to-face learning environments. Repeated measures, which include the pretest and posttest measures and reveal the change in the achievement, are the second factor of the research design. The second dependent variable of the research is motivation. Symbolic notation of the research is given in Table 1.

Table 1. Symbolic Notation of Research Design

Experimental Groups	Group	Assignment	Pretest	Procedures	Posttest
Adaptive WBL environment	G1	R	O1.1	X1	O1.2
Non- adaptive WBL environment	G2	R	O2.1	X2	O2.2
Adaptive WBL environment supported with face-to-face learning activities	G3	R	O3.1	X3	O3.2

The variable that includes the repeated measures in the research design is a pretest performed on experimental groups before the experimental procedures and a posttest performed after the 4-week experimental procedures. The measure for the independent motivation variable was performed only while the posttest was in progress.

Experimental Groups

The experimental groups were selected from second-year students studying at Sakarya University, Faculty of Education, Departments of Science Teaching (ST), Class Teaching (CT) and Elementary Mathematics Teaching (EMT) who take the Basic Information Technology class that replaced the Computer class in the new program and has the same content. Although 87 students were included in the research by forming equal groups according to the pretest results, 15 students who did not participate in the 4-week application period or whose application data was found to be deficient were excluded from the scope of the research. A total of 72 students who kept taking part in the research during the experimental process constitute the study group. There are three groups, each composed of 24 students. The groups used three learning environments (adaptive WBL environment, non-adaptive WBL environment and adaptive WBL environment supported with face-to-face learning environments).

Data Collecting Tools

The tools used in the research were a test that was used as a pretest and a posttest to measure achievement; four achievement tests that ensure the transition between modules and are applied at the end of each module; two scales that determine students' learning modality and learning approaches to be used for modeling students in the adaptive WBL environment; a scale that determines students' motivational levels in learning environments; and a holistic rubric evaluation tool to evaluate the homework prepared by students at the end of the application.

Achievement Test (Pretest and Posttest)

An achievement test used in pretest and posttest was developed to measure students' achievement in the research. Test items, which were prepared with questions and distractors in accordance with goals determined beforehand, were examined by three field experts and an assessment-evaluation specialist. Adjustments were made in accordance with the suggestions of the experts, and it was decided that the test would include 25 items. The 25-question achievement test was applied to 264 third-year students who study at Sakarya University, Faculty of Education, Class Teaching, Mentally Handicapped Teaching and Social Studies Teaching in the fall term of the 2013-2014 academic year. Ten questions were excluded from the achievement test, of which item analysis results were obtained via ITEMAN software, as their distinctiveness was below 0.25 and their distracters in the questions did not function. In the light of the data obtained, the 15-item achievement test's average difficulty index was found to be 0.519; average distinctiveness level was found to be 0.316. According to Özçelik (2010) and Güler (2012), it can be concluded that these values can exist in a good test.

The test's KR20 reliability coefficient was found to be 0.512. This value seems to be consistent with the statements of Rosenthal et al. (1979; Matthews, Zeidner & Roberts, 2004: 574) stating that a KR20 value is expected to be 0.35 on average in tests with 20 or less items and of Kehoe (1995) stating that it may be satisfactory when the KR20 reliability

coefficient takes lower values such as 0.50 in 10-to-15-question tests, and it can also be said that the value of KR20 reliability coefficient shows the test is a reliable one.

Considering the goals and the answers given by the students to the 15-question achievement test, the scoring of test items was decided to be 10 points for question 15; 8 points for questions 1, 6 and 9; 6 points for questions 2, 3, 4, 5, 7, 8, 12 and 14; and 4 points for questions 10 and 13, in accordance with the opinions of the experts.

Module Tests

The aim of module tests is to determine the transitions between modules. The following tests were prepared for the transitions of the students: Module 1 Test to control students' transition from module 1 to 2; Module 2 Test applied at the end of module 2 to control students' transition from module 2 to 3; Module 3 Test applied at the end of module 3 to control students' transition from module 3 to 4; and Module 4 Test applied at the end of module 4 to control students' completion of modules and transition to the posttest. In accordance with the goals, Module 1 Test was prepared with 11 questions; Module 2 Test with 5 questions; Module 3 Test with 12 questions; and Module 4 Test with 7 questions. Module 1 Test was applied to 143 second-year students studying Preschool Teaching; Module 2 Test to 96 second-year students studying Turkish Teaching; Module 3 Test to 144 second-year students studying Psychological Counseling and Guidance; and Module 4 Test to 94 second-year students studying English Teaching and Mentally Handicapped Teaching. As a result of the application, item discrimination distinctiveness levels, item difficulty indexes and distracters' functionality were examined via ITEMAN software, and some items were excluded from the tests. The 6-question Module 1 Test's average difficulty index, average discrimination level and KR 20 reliability coefficient were found to be 0.630, 0.468, and 0.487, respectively; the 4-question Module 2 Test's average difficulty index, average discrimination level and KR 20 reliability coefficient were found to be 0.840, 0.662, and 0.573, respectively; the 5-question Module 3 Test's average difficulty index, average discrimination level and KR 20 reliability coefficient were found to be 0.611, 0.477, and 0.364, respectively; and the 4-question Module 4 Test's average difficulty index, average discrimination level and KR 20 reliability coefficient were found to be 0.949, 0.617, and 0.485, respectively. These values can be evaluated to be suitable for the tests.

BİG16 Learning Modality Inventory

In the research, the adaptations were made taking students' learning modality into account. To this end, the BİG16 Learning Modality Inventory developed by Şimşek (2002) was used. The 5-point Likert type scale is composed of 48 items and covers three learning modalities, which are kinesthetic, auditory and visual styles, and there are 16 items for each learning modality. Explained total variance of the scale of which validity and reliability studies were performed by Şimşek (2002) was found to be 42.923%. The factor loads of all its items were found to be over .40, and the Cronbach's Alpha reliability coefficient was found to be .684 for the kinesthetic style, .774 for the auditory style, .793 for the visual style, and .844 for the whole inventory.

The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F)

The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) was used to reveal students' learning approaches, decide whether the student is a deep or surface learner and determine whether the adaptive system runs smoothly. This scale was developed by Biggs, Kember and Leung (2001) and adapted into Turkish language by Önder and Beşoluk (2010). The 5-point Likert type scale with 20 items is composed of "Deep Learning Approach" (10 items) and "Surface Learning Approach" (10 items) scales and each scale is composed of "Strategy" and "Motive" sub-scales, each with 5 items. In the adaptation study of the two-factor study, the factor loads of all items were found to be over .30, Cronbach's Alpha reliability coefficient was found to be .78 for "Deep Learning Approach", .74 for "Surface Learning Approach", and it was also found that item-total score correlations were between .333 and .691.

Scale of Student Motivation in Adaptive Environments

To measure students' motivation in the adaptive educational web environment, the Student Motivation Scale developed by Erdoğan (2013) was used. The scale is composed of 45 items and four dimensions which are self-efficacy (5 items), intrinsic motivation (16 items), encouragement of the environment (8 items) and anxiety (6 items). In the development studies of the scale, it was stated that the factor loads of the items were above .40 and the four-factor structure explained 55.58% of the total variance, while Cronbach's Alpha reliability coefficient was found to be .87 for the whole scale, .85 for the self-efficacy factor, 0.93 for the intrinsic motivation factor, .81 for the encouragement of the environment factor, and .77 for the anxiety factor.

Rubric

In the research, the PowerPoint presentation titled "Internet and Social Networks" prepared by students for primary fourth-grade students at the end of the application was evaluated with the holistic rubric. Criteria and items were prepared using the steps suggested by Andrade (2001), then which type of rubric to be used was decided upon. Performance levels were determined and levels were defined, which were then evaluated by two field experts and an assessment-evaluation specialist, and necessary corrections and adjustments were made as a result of the evaluation.

This is a holistic rubric that is composed of 5 criteria, which are the placement of slides, the selection and shaping of constituents, the placement of constituents, color and target group and includes 4 different performance levels graded as (0), (1), (2), and (3); each student can score within the range of 0-15 through this rubric. The student homework was evaluated by three field specialists through the rubric prepared and the consistency between evaluators was examined. It was determined that there was a highly positive relationship between the evaluation scores of the first and second evaluators ($r=.764$, $p<.05$), the evaluation scores of the first and third evaluators ($r=.666$, $p<.05$), and the evaluation scores of the second and third evaluators ($r=.672$, $p<.05$). In addition, it was found that the scores given by the three evaluators were in concordance with each other according to Kendall's W Coefficient of Concordance [$w=.723$, $p<.05$].

Teaching Materials

The materials were developed based on three learning environments that include training for Microsoft PowerPoint 2010 software in the research: adaptive WBL environment, adaptive WBL environment supported by face-to-face learning activities and non-adaptive WBL environment. Asp.Net-C #, HTML, Css, Javascript and SQL languages and Microsfot Visual Studio Ultimate 2012, Adobe Dreamweaver CC and Microsoft SQL Server Management Studio package programs were used to create the environments and web-based software was developed with the help of a computer programmer. Students accessed each of the three environments by logging into a web address.

Adaptive Web-Based Learning Environment

The adaptive WBL environment was developed within the framework of a model through the examination of the components of adaptive educational systems. The developed environment is an adaptive environment organized according to the macro-adaptive approach defined by Park and Lee (2004) as environments in which adaptations are made grouping the students according to the measurements before the educational process and the student groups are not changed during the educational process.

There must be 4 basic components of adaptive environments. These are the content area model, the student model, the reasoning mechanism and the adaptations. Determining the goals and the module contents within the framework of the content area model, achievements tests were developed to control the learning of students, ensure the intermodular transition and find out whether the module requirements are met. In the software developed to configure the student modeling in the study, direct questions were asked and information on students' characteristics was collected in the light of the result of the interaction between students and the system. Four types of student characteristics were gathered in the study: Preknowledge, Learning Modality, Learning Approach, Preference of Monitoring Stretchtexts. The reasoning mechanism was established based on the content area model and the student model. The system drew conclusion related to four factors: Content, Type of presentation, Type of knowledge, Stretchtext. It was decided with which module the students could start according to their preknowledge; which learning modality the students had as a result of the BİG16 Learning Modality Inventory in the Type of Presentation; students' learning approach as a result of the Revised Two-Factor Study Process Questionnaire and their interaction with the text named Visual Design in the Type of Knowledge; and whether there would be stretchtext in the content given to the students in accordance with their preference of monitoring stretchtexts during their interaction with the text named Visual Design in the stretchtext. Based on the content area model and the student model, the adaptations were designed in regard to presentation and navigation. Inserting/removing fragments and stretchtext methods were used as the adaptive presentation; link hiding and link annotation methods were used as the adaptive navigation. The components of the WBL environment with adaptations are presented in Figure 1.

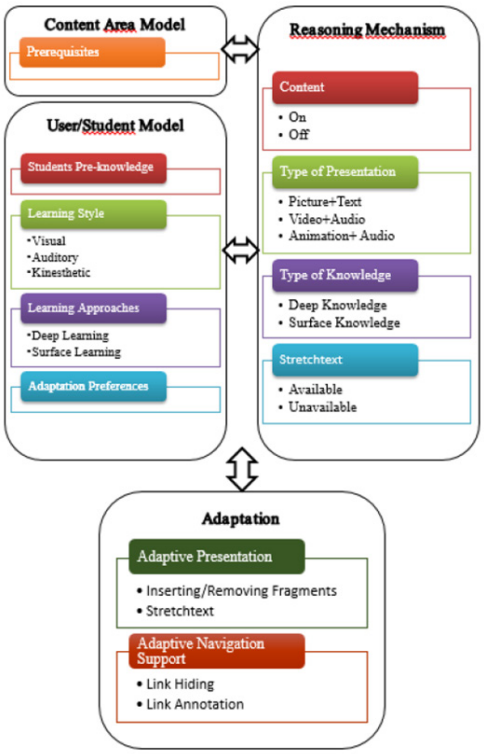

Figure 1. Adaptive WBL Environment Model

Within the framework of the Adaptive WBL Environment and based on three environments mentioned in the research (adaptive, non-adaptive and adaptive supported with face-to-face learning activities) materials were prepared in 48 different ways for the environment with adaptations and a way for the environment without adaptations, totally in 49 different ways, to cover the same content. 17 of 48 different materials prepared were used. The most used material types were deep knowledge-visual presentation-stretchtext unavailable-link passive-link annotation available (9) and surface knowledge-visual presentation-stretchtext unavailable-link passive-link annotation available (8).

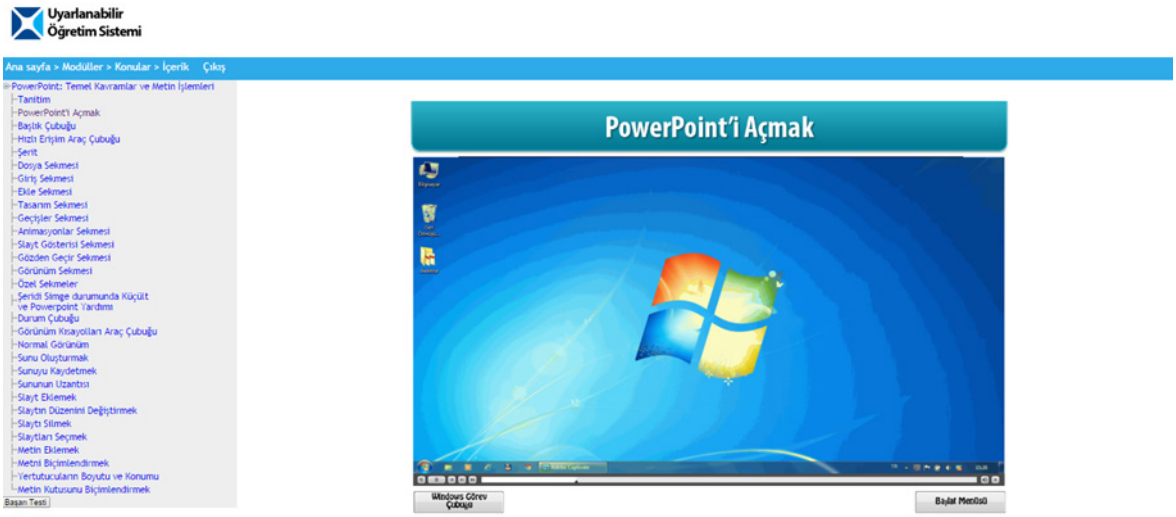

Figure 2. Adaptive WBL Environment Screen

Adaptive WBL Environment supported with Face-to-Face Learning Activities

The adaptive WBL environment supported by face-to-face learning activities was established using and running both WBL environment in which face-to-face education continues and adaptive WBL environment at the same time. The adaptations were made as they were in the adaptive WBL environment. Face-to-face activities continued for 4 weeks (4x1 class hours) in the laboratory environment and lessons were taught and applications were made in respect to the topics in the WBL environment.

Non-Adaptive Web-Based Learning Environment

Content related to Microsoft PowerPoint 2010 was prepared regardless off students' individual characteristics in the non-adaptive WBL environment. All students were presented with the same content in the same order as in other environments. The presented content was selected randomly from the different material types prepared before. In addition, connections and stretchtext were not offered in accordance with student preferences but the connection feature and the stretchtext preference in the randomly selected material type.

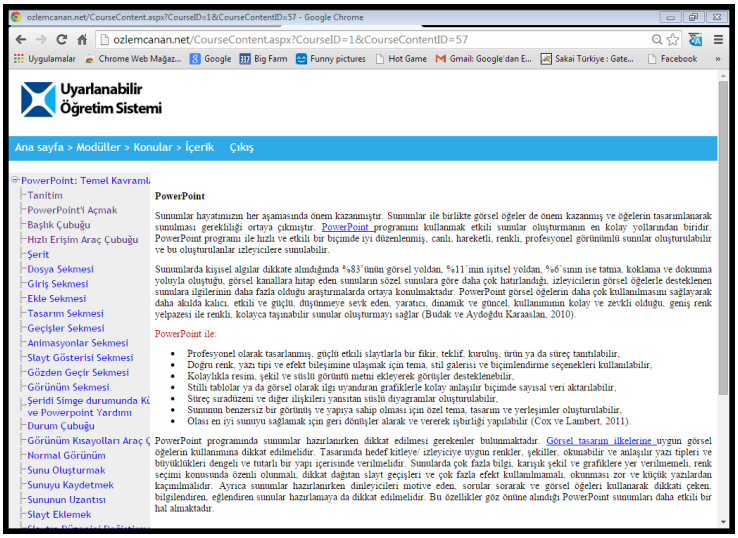

Figure 3. Non-Adaptive WBL Environment Screen

Application, and the Collection and Analysis of the Data

The software and materials developed within the scope of the research were evaluated by three field experts after the developmental process. Moreover, a pre-application was performed before the final application to control and test the software, identify its deficiencies and correct its faults. 70 first-year students studying at Computer Education and Instructional Technologies Teaching in the spring term of the academic year 2013-2014 participated to the pre-application. In the light of data obtained from the pre-application, the software was updated and finalized.

Experimental procedures were conducted for 4 weeks in the spring term of the academic year 2013-2014. 72 students who participated to the research and continued the experimental process realized their learning of Microsoft PowerPoint 2010 through the WBL system. The 4-week application was performed in 4 different modules. The subjects given in the modules were basic concepts and text procedures in Module 1, design elements in Module 2, visual elements in Module 3, and how to make the presentation in Module 4. Among three experimental groups composed of 24 students each, 24 students who were studying in the adaptive WBL environment accessed the content prepared in accordance with the content area, the student modeling and the adaptations during the application.

In the analysis of the data collected during the research, also based on the pretest effect for pretest-posttest achievement scores, a Covariance Analysis was performed examining the assumptions to compare students' achievement scores in all three environments, and the ANOVA test was performed examining the assumptions to obtain unrelated measurements for achievement scores obtained from the examination of homework prepared by students at the end of the application through rubric and for the motivation variable. Microsoft Excel 2010, IBM SPSS Statistics 20 and ITEMAN software packages were used in the analysis of the data. The significance level of .05 was taken as a basis in all statistical analyses.

3. Results

The effect of experimental procedures on achievement and motivation was examined in the research. Also considering the pretest effect for the pretest-posttest achievement scores, the assumptions were examined and the Covariance Analysis (ANCOVA) was applied. As a result of the Covariance Analysis, average posttest achievement scores of students in respect to groups and the adjusted mean of the same scores in respect to the pretest achievement scores were found. The distribution of students' posttest achievement scores in respect to groups is shown in Table 2.

Table 2. Descriptive Statistics of Posttest Achievement Scores in respect to the Experimental Groups

Group	N	x̄	Adjusted x̄
Adaptive WBL environment	24	61,250	60,170
Adaptive WBL environment supported with face-to-face learning activities	24	70,166	69,947
Non- adaptive WBL environment	24	61,250	62,550

According to the adjusted posttest achievement scores in Table 2, the most contributing environment is the adaptive WBL environment supported with face-to-face learning activities (x̄= 69.947). It is observed that the adaptive WBL environment is the least contributing one in terms of achievement (x̄= 60,170). The results of the Covariance Analysis performed to test the significance of the difference between groups' adjusted posttest achievement scores are given in Table 3.

Table 3. Covariance Analysis Results in respect to the Experimental Groups of Posttest Achievement Scores adjusted according to Pretest Achievement Scores

Source of Variance	Sum of Squares	Sd	Means of Squares	F	P	**ηp2**
Pretest (Regression)	1451,097	1	1451,097	12,780	,001	,158
Group	1247,391	2	623,695	5,493	,006	,139
Error	7721,236	68	113,548			
Total (Adjusted)	10444,444	71				

(*p<.05)

According to the results in Table 3, significant differences were found between the mean of adjusted posttest achievement scores according to groups' pretest achievement scores ($F_{(2-68)}$ = 5.493, p < .05, η_p^2= .139). This shows that the environments used were effective on student achievement. The partial eta squared effect size value, which gave the variance rate explained by the posttest when the pretest was excluded, supports the fact that the environments were an intermediate level of effect on student achievement based on the eta squared values explained by Green and Salkind (2005: 187) (.06< η_p^2 <.14).

LSD multiple comparison test was performed to reveal the differences between groups' adjusted posttest achievement scores. As a result, it was observed that the achievement in the adaptive WBL environment supported with face-to-face learning activities at a significance level of .05 (x̄= 69.947) was higher than the achievement in the adaptive WBL environment (x̄= 62.550), and no significant difference was observed between the achievements in the adaptive and non-adaptive WBL environments.

The rubric scores developed to evaluated students' products were used as achievement marks and students' rubric scores were compared according to their learning environments. Since there were rubric scores for three independent groups to be compared in the research, one-way variance analysis (ANOVA) was used for unrelated samples and the results in Table 4 were obtained with the analysis.

Table 4. Variance Analysis Results of Experimental Groups' Rubric Achievement Scores

Group	N	x̄	S	Source of Variance	Sum of Squares	Sd	Means of Squares	F	P	η2
Adaptive WBL environment	24	10.918	3.021	Between groups	11.354	2	5.677	.869	.424	.025
Adaptive WBL environment supported with face-to-face learning activities	24	11.877	1.872							
Non-adaptive WBL environment	24	11.253	2.641	Within groups	450.869	69	6.534			
Total	72	11.450	2.552	Total	462.223	71				

(*p<.05)

As for Table 4, it was found that there was no significant difference between groups in terms of rubric achievement scores ($F_{(2, 69)}$ = .869, p>.05, η^2= .025). This shows that the environments used were not effective on students' rubric achievement scores.

To compare the motivation scores of three independent groups in the research, one-way variance analysis (ANOVA) was used for unrelated samples and the results in Table 5 were obtained with the analysis.

Table 5. Variance Analysis Results of Experimental Groups' Motivation Scores

Group	N	$\bar{x}$	S	Source of Variance	Sum of Squares	Sd	Means of Squares	F	P	η2
Adaptive WBL environment	24	130.333	24.608	Between groups	1331.540	2	665.770	1.164	.318	.033
Adaptive WBL environment supported with face-to-face learning activities	24	120.083	31.040							
Non-adaptive WBL environment	24	127.312	12.141	Within groups	39477.639	69	572.140			
Total	72	125.910	23.975	Total	40809.178	71				

(*p<.05)

As for Table 5, it was found that there was no significant difference between groups in terms of motivation scores ($F_{(2, 69)}$ = .1.164, p>.05, η^2= .033). This shows that the environments used were not effective on students' motivation scores.

4. Conclusion and Discussion

The learning environments changing along with the improvement in web technologies contribute to offering individual-specific environments. These environments come across as systems that can respond to changing needs and preferences, and individual differences today. Adaptive WBL environments is among these learning environments that can adapt to the improving technology and the changing needs and can meet individual responsibilities. Within the scope of the research, students' preknowledge, learning modalities, learning approaches and adaptation preferences were used for student modeling. The environment of the presentation and navigation adaptation was formed through the reasoning mechanism prepared accordingly. The effect of the achieved adaptive WBL environment on achievement and motivation was investigated.

A significant difference was found between students' posttest achievement scores in the adaptive environment, the non-adaptive environment and the adaptive environment supported with face-to-face learning activities. Pretests were controlled in terms of achievement, and next, posttests were compared accordingly and it was found that students' achievements in the adaptive WBL environment supported with face-to-face learning activities were higher than students' achievements in the adaptive and non-adaptive WBL environments. This finding indicates that supporting an adaptive educational web environment with face-to-face activities increased students' achievement. The reason for this may be that students are more accustomed to face-to-face learning, they do not have experiences with educational web environments and they are resisting using new learning environments (Weibelzahl, 2005).

As a second result, no significant difference was observed between the achievement scores in the adaptive and non-adaptive WBL environments. However, there are many studies in the literature showing that adaptive learning environments increase achievement. Weber and Brusilovsky (2001) who developed ELM-ART (Episodic Learner Model - The Adaptive Remote Tutor) found that this multi-adaptive and intelligent tutoring system are more successful than ELM-PE (Episodic Learner Model - Programming Environment) that cannot be adapted. It was found that Triantafillou et al. (2002) who developed a prototype of an adaptive educational system that was adapted to cognitive styles increase students' achievements, performances and satisfactions in the adaptive hypermedia learning environment. With ALEF (Adaptive LEarning Framework) system, Šimko et al. (2010) supported the idea that adaptive WBL environments increase student achievement with their study. Despotović-Zrakić et al. (2012) who created an adaptive remote training course in the Moddle learning management system found as a result of the application that student achievement was higher in the adaptive e-Learning environment. Özyurt (2013) observed that eleventh grade students' achievements increased with the adaptive intelligent web-based mathematics learning environment named UZWEBMAT. Yang et al. (2013) who used an adaptive learning system adapted to Felder-Silverman's learning styles through field dependent/independent learning styles showed that students were more successful in the adaptive learning system than in the traditional learning system without adaptations. Research results are not in compliance with these studies showing

that adaptive learning environments affect achievement. The reason for this may be that experimental group, the subject selected, student modeling and adaptations in the research are different.

There are studies in which the difference between the achievements in the environments with and without adaptations. In the study performed by Somyürek (2008) on adaptive educational web environments, there is no difference between student achievements in the adaptive and non-adaptive environments, and the study provides data supporting the results of this research. In the study performed by Uysal (2008) to reveal the effect of teaching software and exercise software that can be adapted to teaching software and learning styles on students' academic achievement, it was found that whether exercise software was adaptive for learning styles did not affect students' academic achievement. These studies have similar results to the results of this research. Similar measurement of the achievement variable in the studies, student modeling and adaptive system structure caused that the results resembled each other. For the achievement variable, Weibelzahl (2005) defined the problems experienced in adaptive environments. One of them is that learners who do not have experience with educational web environments follow the way they prefer in adaptive web environments all the time. Hence, the path students choose to go in the environments with and without adaptations may not differentiate and this choice of path may diminish the effect of learning environment on learners' achievement. Based on this test-oriented finding, experimental duration and number of materials can be increased to improve students both cognitive and psychomotor knowledge and skills in the adaptive WBL environment. It is thought that, by increasing the experimental duration and number of materials, it can be ensured that students improve their metacognitive skills and the permanence and transfer of the information and skills they have learnt.

It was found as a result of evaluating student products within the scope of the research that students' achievement scores did not differ in terms of learning environments. This result shows that the achievement scores and the findings obtained from the achievement scores measured with the grading key based on the product contradicted the different achievements of the adaptive WBL environment group and the group in the adaptive WBL environment supported with face-to-face activities. It was revealed with pretest-posttest achievement scores that cognitive knowledge of students who realized their learning in different environments differed within the context of environments. However, upon evaluating student products, no difference was observed between the environments in terms that students reflected the knowledge and skills they obtain on their activities, transferred the knowledge and turned it into metacognitive skill. It can be said that the reason for the difference in the test-based and product-based achievement measures was that the test rather gave place to measures concerning basic cognitive levels. Measuring the metacognitive skills is in question in product-based measures. The second reason for the difference may be that the fact that students reflected the information they acquired and used to the product-based achievement measure. It was revealed in this sense that all three environments used in the research did not make any difference in terms of achievement in gains based on acquiring information and using, in other words, applying this information. Based on this finding obtained from the product-based achievement measures in the research, a macro-level adaptive educational web environment can be prepared on a micro level in future. Hence, system can be adjusted dynamically and optimized for the change in accordance with the changes in students' characteristics during the process. Students' behaviors and performances can be monitored and evaluated on this system.

The motivation was examined as the second dependent variable in the research, and it was found that there was no difference between the motivations of the students learning in the adaptive and non-adaptive environments and the environments supported with face-to-face activities. However, there are many studies in the literature showing that adaptive educational web environments increase motivation. Šimko et al. (2010) found that ALEF (Adaptive LEarning Framework) adaptive WBL environment developed by them increased students' motivation. In the study conducted by Erdoğan (2013) to investigate the effect of the adaptability of Learning Management System prepared by Erdoğan according to different adaptive teaching approaches on student satisfaction, motivation and achievement, it was concluded that motivations of the students learning in the micro-level adaptive environment than those of the students learning in the non-adaptive environment. Yang et al. (2013) determined with regard to learning motivation that adaptive learning system was more effective on learning in terms of control belief. The experimental group, the type of adaptation, student modeling, the adaptive system structure, measure of the motivation variable and types of motivation in previous studies differ from this research. Hence, it can be said that the results of the research do not resemble with other studies.

Even though there are studies showing that adaptive educational web environments increase motivation, motivation did not differ between the three environments used in the research. The fact that Horzum and Balta (2008) found in their study on achievement, motivation and computer anxiety in different web-based teaching environments that presentation of information in different ways did not differentiate motivation between different web-based environments

supports the results of this research. The fact that presentation of the content in different ways did not affect the motivation in the adaptive WBL environment; students who chose their paths in the adaptive WBL environment used the same path to browse the system; they did not accept to use the WBL environment; they had a negative attitude towards using the WBL environment; and they did not have or did have little experience with WBL environments can be shown as the reasons for the results of the research. Moreover lower motivation scores may be due to students in the adaptive WBL environment scoring low in the Confidence dimension of Keller's ARCS Model. In addition, groups' motivation was not measured before the application in the research, and groups' motivations were assumed to be similar. It is also possible that students' motivations were not similar in all three environments before the application. With this possibility because dissimilarity of groups' motivation before the application might affect their motivation after the application, their motivation might not have been differed according to the environments. Based on this finding, identifying groups' motivations before the application in future studies can ensure that both pre-and post-application motivation and post-application group motivations can be compared.

Adaptive WBL environments are designed in different ways, student modeling is performed according to different individual characteristics, different adaptation methods and techniques are used, different adaptation approaches are preferred, and therefore, studies performed with these environments result in differently. The findings obtained with the adaptive WBL environment modeled in the research comply with studies in differently designed adaptive WBL environment from some aspects and conflict them from other aspects. Within this context, the following factors not only explain that the research have different results than other studies but also reveal the limitations to the research: whether the participant students took education in any educational web environment and had such experiences before this study was not investigated; the experimental process was limited to 4 weeks; the WBL environment was included in the experimental process with a certain course and within the framework of certain topics; and the adaptations and the student modeling were limited to certain methods and techniques.

The research results and the structure of the adaptive WBL environment designed may serve as an example for future studies. In this sense, it is suggested for future studies that the experience with educational web environment be taken into account while establishing the study groups; the experimental process be managed without associating it with a course; adaptive educational web environments also be set for primary and secondary education levels; student models be created in accordance with students' different individual characteristics; adaptive educational web environments be established using different types of adaptive navigation and adaptive presentation; the effects of adaptive educational web environments on students' metacognitive knowledge and skills be investigated and investigation be carried out as to whether students' achievements are affected by the change in the metacognitive knowledge and skills, as well as a change in other factors (attitude, self-efficacy, satisfaction, readiness, etc.) affecting the achievement other than motivation in WBL environments and their effect on achievement.

Acknowledgement

This study were obtained from the doctoral thesis under the supervision of Dr. Mehmet Barış HORZUM and it was funded by Sakarya University (BAP2013-70-02-003).

5. References

Allen, I. E. & Seaman, J. (2006). Making the Grade. Online Education in the United States. Newburyport: Sloan Consortium. Retrieved on 11/08/2010 from https://docs.google.com/viewer?url=http%3A%2F%2Ffiles.eric.ed.gov%2Ffulltext%2FED530101.pdf

Allen, I. E. & Seaman, J. (2010). Learning on Demand Online Education in the United States, 2009. Newburyport: Sloan Consortium (SLOAN-C). Retrieved on 11/08/2010 from http://sloanconsortium.org/publications/survey/pdf/learningondemand.pdf

Allen, I. E. & Seaman, J. (2011). Going the Distance: Online Education in the United States. Newburyport: Sloan Consortium. Retrieved on 04/03/2012 from http://sloanconsortium.org/publications/survey/pdf/learningondemand.pdf .

Allen, I. E., Seaman, J., Poulin, R., & Straut, T. T. (2016). Online report card: Tracking online education in the United States (Rep.). Babson Survey Research Group. Retrieved on 13/11/2016 from http://onlinelearningsurvey.com/reports/onlinereportcard.pdf.

Andrade, H. G. (2001). The Effects of İnstructional Rubrics on Learning to Write. Current Issues in Education, 4(4), 1-28. Retrieved on 12/07/2014 from http://cie.asu.edu/volume4/number4/

Brusilovsky, P. (1998). Methods and Techniques of Adaptive Hypermedia. In P. Brusilovsky, A. Kobsa and J. Vassileva (Eds.), *Adaptive Hypertext and Hypermedia*. Boston: Kluwer Academic Publishers.

Brusilovsky, P., Eklund, J. & Schwarz, E. (1998). Web-based Education for All: A Tool for Development Adaptive Courseware. *Computer Networks and ISDN Systems (Proceedings of Seventh International World Wide Web Conference, 14-18 April 1998), 30* (1-7), 291-300.

Bruskilovsky, P. (2001). Adaptive Hypermedia. *User Modelling and User Adapted Insruction, 11*(1-2), 87-110

Burgos, D., Tattersall, C., & Koper, R. (2007). How to Represent Adaptation in E-learning with IMS Learning Design. *Interactive Learning Environments*, *15*(2), 161-170.

Cesur, E. G. (2013). *Investigate the effects of adaptive learning on disorientation and cognitive load of students in terms of their cognitive styles* (Unpublished master dissertation). Ankara University, Institute of Education Sciences, Computer and Instructional Technology Department, Ankara.

Çelebi, F. (2014). *Effect of navigation strategies on navigation time, navigation path and percieved disorientation in adaptive learning environments* (Unpublished master dissertation). Ankara University, Institute of Education Sciences, Computer and Instructional Technology Department, Ankara.

De Bra, P., Houben, G. J. & Wu, H. (1999, February). AHAM: a Dexter-Based Reference Model for Adaptive Hypermedia. *Proceedings of the tenth ACM Conference on Hypertext and hypermedia: Returning to Our Diverse Roots. Darmstadt*, 147-156. ACM, Germany.

De Bra, P., Smits, D., Van Der Sluijs, K., Cristea, A. I., Foss, J., Glahn, C., & Steiner, C. M. (2013). GRAPPLE: Learning Management Systems Meet Adaptive Learning Environments. *Intelligent and Adaptive Educational-Learning Systems*, 133-160. Berlin Heidelberg: Springer.

Despotović-Zrakić, M., Marković, A., Bogdanović, Z., Barać, D., & Krčo, S. (2012). Providing Adaptivity in Moodle LMS Courses. *Educational Technology & Society*, *15* (1), 326–338.

Erdoğan, B. (2013). *The Effect Of Adaptive Learning Management System On Student's Satisfaction, Motivation And Achievement In Online Learning* (Unpublished doctoral dissertation). Ankara University, Institute of Education Sciences, Computer and Instructional Technology Department, Educational Technology Department, Ankara.

Eryılmaz, M. (2012). *The effect of hyper media on academic achievement satisfaction and cognitive load of students by using adaptive presentation and adaptive navigation* (Unpublished doctoral dissertation). Ankara University, Institute of Education Sciences, Computer and Instructional Technology Department, Educational Technology Department, Ankara.

Gao, T. & Lewandowski, J. (2002). Motivating Students with Interactive Web-based Learning. Society for Information Technology & Teacher Education International Conference, 2002 (1), 166-172. Retrieved on 27/09/2012 from http://editlib.org/d/6710

Graf, S. (2007). *Adaptivity in Learning Management Systems Focussing on Learning Styles* (Unpublished doctoral dissertation). Vienna University of Technology, Austria.

Green, S. & Salkind, N. (2005). *Using SPSS for Windows and Macintosh: Understanding and Analysing Data*. New Jersey: Pearson Prentice Hall.

Güler, N. (2012). *Eğitimde Ölçme ve Değerlendirme* (3th edition). Ankara: Pegem Akademi Yayıncılık.

Hopcan, S. (2013). *Development, implementation and evaluation of adaptive web-assisted learning system for 1.-3. Grade students with specific learning disabilities* (Unpublished master dissertation). Sakarya University, Institute of Education Sciences, Computer and Instructional Technology Department, Sakarya.

Horzum, M.B. (2012). The Effect of Web Based Instruction on Students' Web Pedagogical Content Knowledge, Course Achievement And General Course Satisfaction. Çukurova University Faculty of Education Journal, 41(1), 36-51.

Kehoe, J. (1995). Basic Item Analysis for Multiple-Choice Tests. Practical Assessment, Research & Evaluation, 4 (10). Retrieved on 27/07/2014 from http://PAREonline.net/getvn.asp?v=4&n=10

Kelly, D. (2005). *On the Dynamic Multiple Intelligence Informed Personalization of the Learning Environment* (Unpublished doctoral dissertation). University of Dublin.

Khan, B. H. (1997). *Web-Based Instruction*. Englewood Cliffs, NJ: Educational Technology Publications.

Kim, J., Lee, A. & Ryu, H. (2013). Personality and Its Effects on Learning Performance: Design Guidelines for an Adaptive E-Learning System Based on A User Model. *International Journal of Industrial Ergonomics*, *43*(5), 450-461.

Limongelli, C., Sciarrone, F. & Vaste, G. (2011), Personalized E-Learning in Moodle: the Moodle_LS System, *Journal of E-Learning and Knowledge Society, 7*(1), English Edition, 49-58. ISSN: 1826-6223, e-ISSN:1971-8829

Lo, J. J., Chan, Y. C. & Yeh, S. W. (2012). Designing an Adaptive Web-Based Learning System Based on Students' Cognitive Styles İdentified Online. *Computers & Education*, *58*(1), 209-222.

Lynch, M. M. (2002). *The Online Educator: A Guide to Creating the Virtual Classroom*. London: Routledge Falmer Taylor & Francis Group.

Magoulas, G. D., Papanikolaou, Y. & Grigoriadou, M. (2003). Adaptive Web-Based Learning: Accommodating Individual Differences Through System's Adaptation. *British Journal of Educational Technology*, *34*(4), 511-527.

Matthews, G., Zeidner, M. & Roberts, R.D. (2004). *Emotional Intelligence: Science and Myth.* MIT Press.

Meccawy, M., Blanchfield, P., Ashman, H., Brailsford, T. & Moore, A. (2008). Whurle 2.0: Adaptive Learning Meets Web 2.0. In P. Dillenbourg and M. Specht (Eds.), *EC-TEL 2008* (pp. 274-279).Berlin Heidelberg: Springer.

New York Times. (4 November 2012). The Year of the MOOC.

Önder, İ. & Beşoluk, Ş. (2010). Adaptation of Revised Two Factor Study Process Questionnaire (R-SPQ-2F) to Turkish. *Education and Science*, *35*(157), 55-67.

Özçelik, D.A. (2010). *Test Hazırlama Klavuzu* (4th edition). Ankara: Pegem Akademi Yayıncılık.

Özyurt, Ö. (2013). *The development and evaluation of a web based adaptive testing system: the case of probability unit* (Unpublished doctoral dissertation). Karadeniz Technical University, Institute of Education Sciences, Department of Secondary Science and Mathematics Education, Mathematics Education Department, Trabzon.

Park, O. & Lee, J. (2004). Adaptive Instructional Systems. In D.H. Jonnasen (Ed.), *Handbook Of Research On Educational Communications and Technology.* Lawrence Erlbaum Associates.

Reigeluth, C. M. (1996). A new paradigm of ISD? *Educational Technology and Society*, *36*(3), 13-20.

Riding, R. & Rayner, S. (1998). *Cognitive Styles and Learning Strategies*. London: David Fulton Publishers.

Rosenthal, R., Hall, J. A., DiMatteo, M. R., Rogers, P. L. & Archer, D. (1979). *Sensitivity to Nonverbal Communications: The PONS Test*. Baltimore, MD: The Johns Hopkins University Press.

Sang, S. & Keller, J. M. (2001). Effectiveness of Motivationally Adaptive Computer-Assisted Instruction on the Dynamic Aspects of Motivation. *ETR&D*, *49* (2), 5–22.

Šimko, M., Barla, M. & Bieliková, M. (2010). ALEF: A Framework for Adaptive Web-Based Learning 2.0. *Key Competencies in the Knowledge Society*, 367-378. Springer Berlin Heidelberg.

Somyürek, S. (2008). *The effects of adaptive educational web environments to learners academic achievement and navigation* (Unpublished doctoral dissertation). Gazi University, Ankara.

Stash, N., Cristea, A. & De Bra, P. (2006, January). Learning Styles Adaptation Language for Adaptive Hypermedia. *Adaptive Hypermedia and Adaptive Web-Based Systems*. s. 323-327. Berlin Heidelberg: Springer.

Şimşek, N. (2002). BIG16 Learning Modality Inventory. *Educational Sciences and Practice, 1*(1).

Triantafillou, E., Pomportsis, A. & Georgiadou, E. (2002). AES-CS: Adaptive Educational System Based on Cognitive Styles. *Adaptive Hypermedia 2002 Workshop on Adaptive Systems for Web-based Education*. Universidad de Malaga, Malaga, Spain.

Tseng, J., Chu, H., Hwang, G. & Tsai, C. (2008). Development of an Adaptive Learning System with Two Sources of Personalization İnformation. *Computers & Education, 51*(2), 776–786.

Uysal, M.P. (2008). *The effects of instructional software designed in accordance with instructional transaction theory and the adaptive drill software on achievements of students* (Unpublished doctoral dissertation). Gazi University, Institute of Education Sciences, Department of Education Sciences, Ankara.

Weber, G. & Brusilovsky, P. (2001). ELM-ART: An Adaptive Versatile System for Web-based Instruction. *International Journal of Artificial Intelligence in Education (2001), 12*, 351-384.

Weber, G. (1999). *Adaptive Learning Systems in the World Wide Web* (pp. 371-377). Vienna: Springer.

Weibelzahl, S. (2005). Problems and Pitfalls in the Evaluation of Adaptive Systems. In S. Chen and G. Magoulas (Eds.), *Adaptable and Adaptive Hypermedia Systems* (pp. 285-299). Hershey, PA: IRM Press.

Yang, T. C., Hwang, G. J. & Yang, S. J. H. (2013). Development of an Adaptive Learning System with Multiple Perspectives based on Students? Learning Styles and Cognitive Styles. *Educational Technology & Society*, *16*(4), 185-200.