Effectiveness of Online Learning Environments Developed Based on the Principles of Interactive Environment Design

Suzan Duygu Erişti
Anadolu Üniversitesi, Türkiye
sdbedir@anadolu.edu.tr

Ferit Karakoyun
Anadolu Üniversitesi, Türkiye
feritkarakoyun@anadolu.edu.tr

Betül Uluuysal
Anadolu Üniversitesi, Türkiye
betul_uluuysal@hotmail.com

Özden Şahin İzmirli
Osmangazi Üniversitesi, Türkiye
ozdens@anadolu.edu.tr

Halil İbrahim Haseski
Anadolu Üniversitesi, Türkiye
halilhaseski@anadolu.edu.tr

Abstract
Online learning environments are technology-based learning environments which allow learners to develop themselves on their own pace independently of time and place through the instructional content presented via computers and which present interactive learning experiences. The visual design as well as the content of the instructional material prepared for effective learning in online learning environments is important. The present study investigated the influence of an online learning environment prepared as appropriate to the elements and principles of visual design on students' academic achievement and tried to determine the participants' views about the online learning environment in question. Depending on the findings obtained in the study and on the observations during the application process, it could be stated that the online learning environment prepared in line with the design elements and principles was considered by the students as quite effective; that it increased learning; and that the students had positive views about the learning environment in question.

Keywords: *Online learning; design elements; design principles; interactive environment design*

Introduction

Today, thanks to the rapid development and spread of computer and Internet technologies, the information produced can reach a great number of people in quite a short period of time. With these developments, it is now clear that learning should be life-long and that in order to benefit better from technology in the teaching-learning processes, new methods and applications have been developed. The concept of online learning has occurred as one of the results of these views.

According to Clark and Mayer (2008), online learning occurs with the presentation of the content prepared in line with the goals via the Internet or the intranet by benefiting from such virtual

environment components as pictures, texts, animations and audios. According to Lrischner and Paas, online learning is a learning activity in which the Internet plays an important role in presenting, managing, supporting and evaluating the instruction (cited in Jockems, Van Merrienboer & Koper, 2004). Clarke (2004) defines online learning environments as learning environments that allow learners to learn on their own pace independently of time and place. Based on the definitions in related literature, it could be stated that online learning is a learning process in which computers and computer networks are used in all phases from the planning of instruction to its evaluation are used as a tool; which removes the obstacles of time and place in reaching the necessary information; and which allows interactive learning via the virtual environment.

In general terms, an online learning environment is made up of three main components. These are the student, the teacher and the environment.

Student

Since online learning environment is student-centered, the environment in question should be designed considering the learners' interests, expectations, learning needs and characteristics (age, gender, social status and so on). (Campbell, 2004). In addition, different from traditional classroom environment, in online learning environment, students taking the responsibility of their own learning, they play an active role in all the phases of the instruction process (Şahan, 2007). In other words, students learn the content interactively via reinforcers and feedback-correction by interacting with each other and with teachers in online learning environments and develop themselves on their own pace by doing as many rehearsals as they want in the learning process.

Teacher

The teacher, another component of online learning environment, has certain responsibilities and duties to carry out in the instructional process presented via the environment in question. Thus, in online learning environment, the teacher acts as a guide that helps and supports students regarding the possible problems by providing them with appropriate feedback in all phases of the process (Clarke, 2004). With the guidance of the teacher, students use the instructional content effectively and structure the presented information in their minds. Therefore, teacher-student interaction is important in achieving the instructional goals in the learning environment in question.

Environment

Online learning environments are generally designed by a professional group of instructional designers, content developers, field-experts, multimedia designers, web programmers and media producers (Joliffe, Ritter & Stevens, 2001). The duties and roles for this design may vary and become detailed depending on the goals, size and content of the design. In online environments, the features of the instructional content are shaped with respect to the qualities of the target population addressed, the subject to be taught and the learning theory considered. In addition, there are various tools determining the quality of the online environment. These tools include such virtual environment applications as chat rooms, forums, e-mail and whiteboard applications that help increase the effectiveness of instruction in both social and individual respects thanks to the communication and interaction opportunities provided by the virtual environment. With the help of these tools, student-student and teacher-student interactions are established in online learning environment; thus, a social learning environment is created.

It is important to design an instructional material – presented in online learning environment to help students achieve instructional goals - on theoretical basis in terms of visual perception (Gillani, 2003). The reason is that preparation of an online learning material as appropriate to visual design elements and to the design principles acting as a guide for the use of these elements will make the visual presentation of the instructional message more systematic and help students understand the message more easily.

In literature, there are 8 basic design elements used in online learning designs (Watzman, 2003). These design principles are:

- Composition (Background and page layout),
- Color,
- Typographic elements,
- Pattern,
- Visual images (pictures, photos and graphics),
- Directives (buttons and links),
- Animations (visual effects, animated images, real visuals),
- Audios (vocalization, music, audio effects).

In online environment, there are design principles that guide designers regarding the appropriate use of these design principles in the instructional material. In literature, there are 8 basic design principles to be taken into consideration while designing online learning environment (Arnheim, 1974). These design principles are:

- Direction
- Space
- Balance
- Proportion
- Hierarchy
- Emphasis
- Permanence
- Unity.

In order to prepare a visually-effective online learning material, it is necessary to know the use of design elements and principles as well as the effects of these elements and principles on learning.

Design Elements and their Effects on Online Learning Environment

Composition

In interactive environment designs, composition can be defined as the qualities that design elements have regarding their effects and functions as a whole and the relationship between design elements. Design principles such as space, balance, proportion, hierarchy, emphasis and direction determine the quality of composition. Composition is made up of such components as background and page layout.
Background, also known as white area, refers to the space out of such elements as texts, graphics and animations found in the screen design. In a design, the white area gathers the design elements or separates them from each other; in this way, the white area creates light on the screen display. Therefore, the proportion of the white area is extremely important. The design produced should not get ahead of the visual description elements but should instead feature the use and description of design elements. In addition, use of space less than necessary in design results in confusing the design elements, while use of space more than necessary causes the design elements to take the backseat and lose their effectiveness (Schwier and Misanchuk, 1993).

Color

In online learning environment designs, color as a design element is used to draw students' attention to the subject being taught or to allow visual perception of the information given. Various determiners such as the feelings aroused by colors, the expectations of the target population, the quality of the visual design and the way of the presentation of this visual design should be taken into consideration while choosing the colors for visual designs. The reason is that in online learning environment design, the use of colors in a relationship with other design elements determines the effectiveness of the design (Uçar, 2004).

Typography

Typography is a design element that allows presenting the information and messages as a visual language in a comprehensible and formal manner (Uçar, 2004). When the definition of typography is examined, it could be stated that the features of *comprehensibility*, *formal manner* and *visual language* are all striking. In addition, basically two features of typography are quite important regarding the design quality of typography. The first one of these features is the easy comprehension and perception of typography. The second feature is related to the fact that typography is visually appropriate to the target population (Bedir, 2005). In typographic arrangements, the criteria regarding the perceptibility of the written text are as follows (Becer, 1999):

- Choosing appropriate font type.
- Facilitating the perceptibility of typographic elements of page layout and space.
- Organizing such qualities as line length and paragraph width in a way to facilitate readability.

In order to achieve the instructional goals in online learning environment design, it is necessary to design such features of typographic elements as form, size and line length considering the age of the target population and its developmental features.

Pattern

The pattern is a design element that evokes such formal effects on the visual design as opaque, rough, bright and transparent. In interactive environment designs, the pattern can be defined as the visual effect that design elements create as a whole or as the visual effect that design elements own alone. As a design element, the pattern should not decrease the functionality of the design but increase its visual and aesthetic quality. The effect of pattern should be used efficiently in the design when necessary (Schwier and Misanchuk, 1993).

Visual Images

In environment designs, visual images are design elements that increase the effectiveness of the design and improve the perceptibility and concretization of the instructional content. Visual images can be grouped as photos, pictures and graphics. According to Erişti (2005), visual images can directly transmit the message to be sent or are used to explain a text; also, visual images should constitute a unity with other elements in the design content.

Directions

In interactive environment designs, directions allow surfing within the material and between pages. In addition, directions also include directive options regarding the use of the design. The directions carried out with the help of buttons, animations, pictures and audios found in the design are found within the scope of the design element in question. As design elements, directions are basic factors that determine the functionality of the design (Cotton & Oliver, 1997). The reason is that students use the online learning material with the help of directions. Therefore, directions should be designed as appropriate to the qualities of the target population to interact with the material.

Animations

Animations are among the design elements that gather a number of graphic applications. In interactive environment designs, animations include various simulations and applications such as virtual reality, music, audios and real images. Interactive environment contents can be concretized by relating them with animated images; in this way, the target population can understand the subject better. In interactive environment designs, the relationship between the content and animations is established with directions, audios, written texts and referential statements (Erişti, 2005).

Audios

Another element found within the scope of interactive environment design includes audios. In multimedia designs, the audio element used as audios, music and audio-effects is a design element used to support visual or written texts aurally. With the help of their sense of hearing, users perceive the message presented via the material. The message transmitted in verbal or musical dialogues draws the user's attention and starts the process of interpretation in the mind. Therefore, it is important that the audios used in the design draw the user's attention and interest. The audio elements used in the design should not get ahead of the message to be sent (Ergin, 1995).
The requirements regarding the use of design principles in interactive environment designs can be stated as (Erişti, 2005):

Direction can be defined as the effect regarding the horizontal and vertical use of design elements that design creates as a whole in interactive environment designs. It can also be regarded as the effect that design elements create separately. Direction is created both as a whole and separately by design elements and is directly associated with the usability of the design. It is necessary to pay attention to how direction will be used in parallel with the purpose of the design.

Space is the distance or area between or around things. Space separates or unifies, highlights, and gives the eye a visual rest [URL-1]. Space is an important feature in interactive environment designs. It determines the unity, relationship and perceptibility of the design elements used in visual designs. The space between design elements should define the relationships between elements, increase perceptibility, and give a unity to the design elements which prevents the elements from drifting apart from each other.

Balance can be defined as the movement created by design elements in interactive environment designs. Interactive environments occur when the parts that the design elements create unite together. At this point, the harmony between each part is attained by balanced positioning, balanced alignment and balanced proportioning. Design appears as a whole with different balancing alternatives (symmetric balance, asymmetric balance). Symmetrical balance is easiest to see in perfectly centered

compositions or those with mirror images, and asymmetrical design is typically off-center or created with an odd or mismatched number of disparate elements (Bear, 1997).

Proportion can be defined as the relationship between the sizes of design elements in interactive environment designs. The size of design elements as a whole and the dimensions and relationships of visual elements in the design give the proportion of the design.

Hierarchy means sizing, color use or giving formal quality for the element to be emphasized in the design. A designer's approach to visual hierarchy reflects his or her personal style, methodology, and training as well as the zeitgeist of the period. Hierarchy can be simple or complex, rigorous or loose, flat or highly articulated (Lupton and Philips, 2008).

Emphasis is the design principle making sure that attention is drawn to the most important part of a design. [Online2] It includes increasing the size of the element, using bright colors or organizing the composition appropriately for the emphasis [URL-2].

In the designs of interactive environments, continuity and unity mean a continuous flow and transition between the elements on the design surface. Unity is achieved when design elements come together in form, size and color without any impression of disorganization or decomposition.

It is essential to relate design elements with each other within the scope of design principles for the efficacy of the online environment designs. Design process should be planned systematically based on a specific design problem. The demands of the target population serve as a guide in every step of design such as defining the design problems, developing solutions, providing alternative solutions and presenting the product. Accordingly, the designer starts the design process bearing in mind the functional and aesthetical dimensions of the design. The design process in online environments includes the following steps (Salisbury, 1996):

- Defining the purpose of the design
- Explaining the motivation behind the design
- Analyzing the target population of the design
- Defining the borders of the design
- Defining the main themes and qualities in the design process
- Associating the qualities of the target population with the content of the design
- Putting forward alternative design suggestions
- Defining the criteria for these alternatives
- Presenting the product by using the criteria developed.
- Defining and evaluating the process of product presentation
- Developing the process and content of design

When starting a new design project, there are several steps in the graphic design process to follow that will help you achieve the best results (Miller, n.d.). The first step in the design process is to define the purpose of the design clearly. The purpose provides an answer to the question of what kind of design is required. In the second step, the reason why a new design is needed and developed instead of the existing ones is questioned. After the purpose and necessities of the design are defined, the qualities of the target population shape the design process especially in designs for educational purposes. The key to solving the problems is the learner. Therefore, the designer should focus on learners. The design should be flexible to do the necessary changes based on innovations and developments. The environment in which educational designs are created should be investigated, and different solutions should be found. Based on the findings, the most appropriate solution for the opinions and values of the target population should be selected. The important thing in offering

solutions is the feedback received from the target population. The design should be developed according to the feedback provided. The feedback plays a vital role in forming the final design because this feedback enables the designer to modify the design based on the expectations.

The design process basically includes the successful production of a set of aesthetic and functional factors. Aesthetic factors include criteria such as unity, visuality, attractiveness and originality for using the intended design elements together (i.e. written, visual and audio elements used in the presentation in a certain composition) in line with the purpose of the design Becer, 1999). As for the functional requirements in the design process, they are defined as the qualities which meet the needs of the target population in terms of physical, social, psychological and economic properties of the population. Any concept, visual, written or audio element employed in the design should be appropriate for the properties and needs of the target population. Meeting the functional needs successfully is directly associated with the harmony of design elements such as color, typography, composition, visual images and motions with the characteristics of the target population such as age, gender, socio-economical status, education, experience and success.

Methodology

Research Design

The present study aimed at exploring the effect of online learning environments within the scope of "*Design Elements and Principles*" with the participation of fifteen students who studied at the Department of Computer Education and Instructional Technology, Faculty of Education at Anadolu University taking the course of BTO 403 Graphics Design with Computer. In the study, the survey method and single-group pretest-posttest model were applied.

The survey model is a research method applied to find answers to the questions regarding the current state of studies and to test the hypotheses (Gay, Mills and Airasian, 2006). In the single-group pretest-posttest model, the independent variable is applied to one of the groups, and measurements are carried out before and after the application. In the model, if the pretest mean scores of the group are significantly different from the posttest means scores of the same group, then the application is accepted to be effective (Karasar,2005).

Participants

The participants of the study were 15 students who studied at the Department of Computer Education and Instructional Technology, Faculty of Education at Anadolu University in the Fall Term of the academic year of 2009-2010 taking the optional course of BTO 403 Graphics Design with Computer. All of the participating students in the experimental group had their own computers and internet connection.

Data Collection Tools

The data in the study were collected via "Design Elements and Design Principles in Interactive Environment Design", "Online Learning Environment Evaluation Form" and "Achievement Test".

Instruments

'Design Element and Design Principles in Interactive Environment Design Online Course' included the topics covered in the syllabus of the optional course of BTO 403 Graphics Design with Computer over

the last month of the academic term. The topics were presented in 7 modules in online environment. The research was carried out in this environment. The students carried out all the interactions regarding the design development and application in online environment during the application process.

WebCT online environment, one of the learning management systems offered by Anadolu University, was used in developing the design which included modules on "*Design Elements and Design Principles in Interactive Environment Designs*". The WebCT learning management system was chosen since the students widely used it within the scope of their lessons and Anadolu University learning management systems. In addition, the opportunities offered by WebCT (e.g. e-mail, chat rooms, white board activities, downloading presentations, developing content) were appropriate to the purpose of the study. After a page layout theme compatible with the colors and composition arrangement intended for the preparation of the content in WebCT system was selected, it was decided to prepare the content with Adobe Flash CS 3 program. A more flexible content preparation and another program which provided opportunities offered by WebCT were required. The researchers paid attention to the effectiveness of WebCT in especially student-lecturer and student-student interaction opportunities. In WebCT environment, student-lecturer and student-student communication was established via e-mail, instant messaging and project loading system. The content, directions, visuals in the content, animations and interactive applications were designed paying attention to the design elements and principles in parallel with the purpose of the research.

Online environment offers different learning environments for students. Instructional contents based on texts, visuals, audios and motions were prepared in relation with each other. In the development process of online environment, it was important to consider the concepts, terms and arrangements appropriate to the target population and to present the content simply and effectively. Moreover, the aesthetic and functional properties of the design were intended to be compatible with the qualities of the target population. These criteria were associated with the design elements in the online environment design process, and the content was formed accordingly. Moreover, Adobe Photoshop CS 3, Adobe Premiere, Gold Wave, All Sound Recorder and Captivate Programs were employed in the design process of online learning environment. The topics concerning the design elements and principles were first explained based on theoretical grounds; a relationship was established between elements and principles; applied examples and reinforcers were included; and then the practices and subjects regarding the use of the design elements and principles in design environments were presented to the students. While teaching the course-associated subjects in the implementation process, the content in Adobe Flash CS 3 program developed by the researchers was used. As for the interaction dimension, the opportunities offered by online environment were used. During the process, the students directly communicated with the lecturers and got feedback for their designs. The interaction system, which also enabled students to interact with each other and to download and share files, reflected on the design development process of the students since students received feedback regarding the subject outside the class hours as well and had a chance to share their designs. Repman and Clark (1998) state that designing the content interactively in a way the user can manage and the students can focus on interactive activities rather than presenting information is important in online learning process.

Figure 1: Online Learning Environment

In terms of composition, one of the design elements, both the qualities of online learning and the qualities of the target population were considered in design process. One-page presentation was used in introducing the content to arrange the composition in a simple and perceivable way, and the scrollbar was not used on purpose. The buttons were used on the left side of the page due to the usage properties of the target population. In placing the design elements and arranging them in a way to facilitate the perception of the negative-positive balance in the content, space principle was taken into consideration. Unnecessary details were particularly avoided, and a composition directly perceivable by the users was arranged. Stain values were used in the background of the composition. Neutral color stain values, which give the effect of horizontal-vertical direction, were used in order to enable users to perceive the design as a whole and attain a unity throughout the design.

The colors of the design elements concerning the instructional content such as typography, visual images, motions and directions were carefully chosen to be very effective, compatible and clear while background colors were as neutral as possible to focus the users' attention on the other design elements which constituted the instructional content.

A hierarchical arrangement was followed in the use of typographic elements. First and second level headings, texts, emphases in the text, typographic elements used as buttons and the directions were grouped, separated, pushed aside or highlighted in terms of some criteria such as color, font, leading, tracking, alignment and so on. All these properties were used appropriately to increase perceptibility.

Texture effect was formed with dark and light value in the background. Using texture in the background made the composition dynamic. The texture effect was employed in the design as an element of the composition. It highlighted the visuals when associated with other design elements such as visuals and typographical elements.

The pictures, graphs and photos emphasizing the content most effectively and quickly were used in visual images. The visual images were associated with direct referencing with typographic expression in order not to get ahead of the instructional content and purpose.

Motions were used in every detail to facilitate expressions especially when associated with the content. Both visual images and motions are widely used design elements for concretizing the instructional content in interactive environment designs.

The directions were intended to be easy-to-use for the target population and appropriate to the purpose of the design without being at the forefront.

Sounds and the sound-related design elements were used sufficiently to capture the attention of the user to the content.

All these design elements were intended to be appropriate to the purpose of the design and associated with the design principles.

The more interactive and direct activities regarding the subject are included; the more information can be given in the learning environments (Jonassen, Peck and Wilson, 1999). In this context, a hands-on activity was designed in every module of the design especially after the subject was presented, and the user was enabled to practice the subject he learned via this activity.

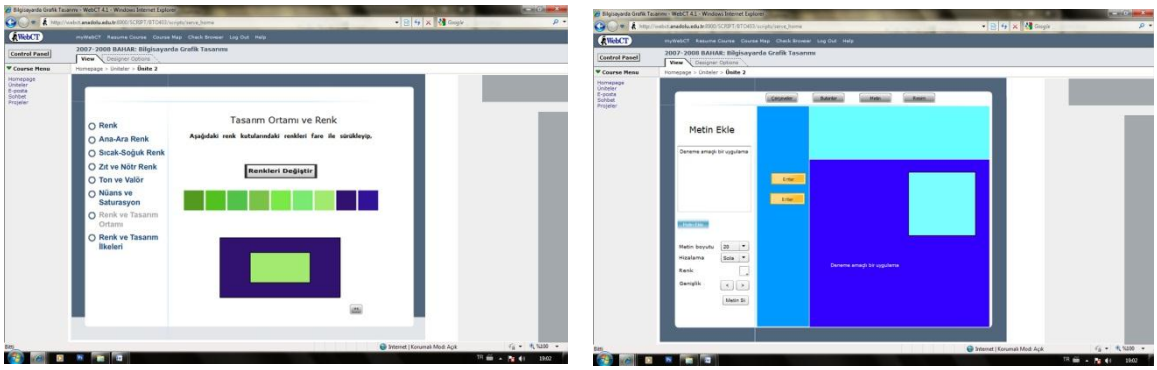

Figure 2: A Sample Hands-on Activity Regarding the Design Environment in Module 2-3

The interaction opportunities offered by the learning management systems related with the instructional content were all employed in the online environment.

"*Online Learning Environment Evaluation Form*" developed by Eristi et.al. (2010) was used for the evaluation of the online environment. In "*Personal Information*" part of the evaluation form, there were questions regarding the opportunities for students to access technology. In the second part of the data collection instrument, there were 50 questions regarding the evaluation of the online learning environment in eight dimensions, which were "Composition", "Color", "Typography", "Visual Images", "Animations", "Directions", "Content" and "Functionality". The internal consistency coefficient of the scale was (α=.961).

"*Online Learning Environment Evaluation Form*" the students completed to evaluate the online course they had taken for four weeks had four options such as "Not Appropriate", "A Little Appropriate", "Mostly Appropriate" and "Very Appropriate". The data were coded as "Not Appropriate=1", "A Little Appropriate=2", "Mostly Appropriate=3" and "Very Appropriate=4". While analyzing the data, the average scores of each sub-dimension and item of the course evaluation form were calculated. In interpretation of the mean scores, the formula of (n-1)/n was used, and a range of 0,75 was obtained. The interpretations were determined as follows: the range of 1-1,75 as not appropriate, the range of 1,76-2,50 as a little appropriate, the range of 2,51-3,25 as mostly appropriate and the range of 3,26-4 as very appropriate. The findings and interpretations were supported with open-ended questions, which were the last three questions of the evaluation form the students completed.

"Achievement Test" prepared to measure the knowledge and success of the students at the beginning and the end of the course within the scope of the learning process was composed of 7 modules and 35 questions, 5 questions for each module. The validity of the instrument was checked in line with the views and suggestions of field experts during and at the end of the question preparation process. The final version of the form was attained by doing the necessary changes based on the feedback.

Application

An intensive program was prepared considering the conditions of the academic term in the presentation and application process of the modules, and the application lasted four weeks. There was no limit regarding issues such as entry to the modules, leaving the modules or duration of using the modules. The students determined all these according to their needs. In the application process, student-lecturer and student-student interactions, feedback on design development, application and evaluation were carried out via the online environment.
"Achievement Test" was administered at the beginning and end of the "*Design Elements and Design Principles in Interactive Environment Design Course"*. When the education process in online environment ended, "*Online Learning Environment Evaluation Form*" was administered.

Findings

The analyses and findings obtained in order to find answers to the research questions are given below according to the order of purposes.

The Effect of Online Course on Students' Success

In order to answer the question of "Is there a significant difference between the pretest and post test academic success scores of the students who took the *Design Elements and Principles in Interactive Environment Design Online Course*?", the research data were analyzed with Wilcoxon test. The reasons for using Wilcoxon, which is a nonparametric test, can be explained as follows:

- The number of the participants was not adequate,
- Although the skewness (,206) and kurtosis (1,503) values were between the normal distribution values for the pre-test, the skewness (-1,489) and kurtosis (3,312) values were not between the normal distribution values for the post-test (Huck, 2000), and
- The post-test was found inappropriate to the normal values as a result of Shapiro-Wilk test of normality (p<, 05).

Table 1
Academic Success Pre-Test Post-Test Shapiro-Wilk Test Results

	D	Df	p
Pre-test	,929	14	,262
Post-test	,879	14	,045

According to the data analysis, the post-test scores of students ($\overline{X}$= 50,520) were found to be significantly higher than their pre-test scores ($\overline{X}$= 38,407).

Table 2
The Effect of Online Course on Students' Success– Pretest Posttest Wilcoxon Test

Measures	**n**	$\overline{X}$	**Sd**	**df**	**p**
Pretest	15	38,407	8,054	14	,004
Posttest	15	50,520	10,571		

The Evaluation of the Online Learning Environment

The mean values were computed in determining the attitudes of students towards the "*Design Elements and Design Principles in Interactive Environment Design Online Course*". The general mean was determined to be ($\overline{X}$ = 3,20) in line with the findings obtained from fifteen students in eight dimensions. In other words, the online learning environment was determined to be very appropriate. According to the mean values calculated in eight dimensions, the highest mean value ($\overline{X}$ = 3,27) was observed in the dimension of *direction* while the lowest mean ($\overline{X}$ = 3,04) was in dimension of *functionality*. According to the data obtained the study, learning environment was found very appropriate only in dimension of *direction*. As for all the other dimensions, they were found out to be at the level of mostly appropriate.

Table 3
The Evaluation of Online Learning Environment – Mean Values

	Mean Value
Dimensions	
Composition	3,22
Color	3,20
Typographic elements	3,24
Pictures, Graphs, Photos	3,23
Animations/Videos, Simulations	3,21
Directions	3,27
Content	3,22
Functionality	3,04
Overall Mean	**3,20**

The students were also asked to prepare minimum six-page web content as project work before and after the presentation of the instructional content within the scope of the research. These web contents were examined by five field experts, and it was observed that the designs prepared after the education process were more qualified than the ones prepared before the education process within the scope of the subject presented online.

Discussion and Conclusion

When online environments have contents directly related with the instructional purpose and the interaction opportunities are sufficiently used, they can be employed in many dimensions which can be associated with design elements and principles. Based on the results of the evaluation, it can be asserted that online environment is a factor which increases the academic success of students and that students generally have positive attitudes towards the environment. It can also be stated that students have positive views which support the quantitative data as a result of the analysis of the students' responses to the open-ended questions in the last part of the evaluation form. A great

majority of the students expressed that the design was mostly effective, appropriate to the purpose and adequate enough to offer opportunities for interaction.

The interaction aspect was placed in the design of the online environment to introduce activities which directly involve experiences about the presentation and use of the information and motivate students to learn by interacting with their peers and the lecturer of the course. The lecturer of the course emphasized that the students developed their designs according to the feedback they received and interaction achieved its goal. During the interactions, the students and the lecturers emphasized that student-student interaction and student-lecturer interaction contributed positively to the creation of designs and that testing the practicality of the information and the applied activities facilitated the intelligibility of the subjects. Although the application lasted only four weeks due to the limitation of the academic term, the online environment was found very effective by the students in terms of access to subjects, interaction, self learning opportunities, asynchronic education opportunities without any time and space limit.

According to Porter (2004), the content of an online course should be composed of well-structured modules, and students themselves should decide when these modules will start and finish. In this context, the online environment design was created within the framework of the modules, and the students decided on when to start the modules. It was observed that each student differed in terms of the duration of staying in modules, module use and interaction with the content of the modules. No time or space limit and no interaction limit with modules offered a flexible learning process, and this caused the students to have more positive attitudes towards the learning process. The lecturer of the course emphasized that the students performed better than expected although the content presented to the students was very intensive.

One of the important things that receive special attention in the design of online environments is using the opportunities of interactive environment design during the design process. In this context, design elements such as typographic elements, visual images and animations were used in every module to offer alternatives for students with different learning styles. Repeating the subjects included in the modules with hands-on activities gave students an opportunity to relate the information they learned with the real application processes. Therefore, the design of the online environment aimed at abolishing the limitations caused by different learning styles. Some of the studies in literature emphasize that students have different learning styles and that these differences affect their preferences regarding the use of online environment (Becker and Dwyer, 1998; Dille and Mezack; 1991). Furthermore, the findings of the study concerning efficacy and success of students show similarities with a meta analysis study carried out by Sitzmann et al. (2006), who reviewed 96 studies and found out that online learning was successful in conveying information to students and achieving effective learning.

One of these groups was taught in a traditional classroom environment while the other was taught online. The students in the traditional class came together for fourteen times in two weeks, whereas those who received online education came together only twice during the period of these two weeks. In the exam given at the end of two weeks, it was revealed that the students in the Internet group were more successful than those in the traditional group (20% more successful on average).

In the study conducted with 33 university students, Demirli (2002) tried to determine the effect of the material development course offered as web-based on meeting the expectations of the participating students and their motivation. At the end of the study, it was observed that the students were more active during the lesson, demonstrated better performance, and enjoyed the application. The study

conducted by Demirli (2002) is similar to this study in terms of the positive attitudes of students towards online environment and the findings regarding their performance.

In conclusion, based on the findings of the research and observations carried out during the application, it can be suggested that online learning environments are very effective in terms of design elements and principles when associated with the qualities and expectations of the students. Moreover, employing design elements and principles in online environments increases the quality of the learning environment, provides the highest level of interaction, brings different opportunities for individual differences to the learning process and boosts students' interest in the learning environment.

References

Arnheim, R. (1974). *Art and visual perception: A psychology of the creative eye*. CA: University of California Pres.

Bear, J.H. (1997). *Principles of design class on balance.* Retrieved 06.12.2010, from http://desktoppub.about.com/od/designprinciples/l/aa_balance2.htm.

Becer, E. (1999). *İletişim ve grafik tasarımı*. Ankara: Dost Kitabevi.

Becker, D., & Dwyer, M. (1998). The impact of student verbal/visual learning style preference on implementing groupware in the classroom. *Jounal of Asynchronous Learning Networks,2*(2).

Bedir, D.(2005). *Bilgisayar destekli matematik öğretiminin ilköğretimde geometri öğretiminde yeri ve öğrenci başarısı üzerindeki etkisi*. Yayınlanmamış yüksek lisans tezi, Dokuz Eylül Üniversitesi Eğitim Bilimleri Enstitüsü, İzmir.

Campbell, K. (2004). *Effective writing for e-learning environments*. PA: Information Science Publishing.

Clark, R. C., & Mayer, R. E. (2008). *E-learning and the science of instruction: Proven guidelines for consumer and designers of multimedia learning*. (2 nd. ed). CA : Pfeiffer.

Clarke, A. (2004). *E-learning skills*. NY: Palgrave Macmillan.

Cotton, B., & Oliver, R. (1997). *Understanding Hypermedia*. London: Phaidon Press Limited.

Demirli, C. (2002). *Web Tabanlı Öğretim Uygulamalarına İlişkin Öğrenci Görüşleri.* Açık ve Uzaktan Eğitim Sempozyumu. (23-25 Mayıs 2002). Anadolu Üniversitesi, Eskişehir. Retrieved 26.02.2010, from http://aof20.anadolu.edu.tr/bildiriler/Cihad_Demirli.doc.

Dille, B., & Mezack, M. (1991). Identifying predictors of high risk among communicty college telecourse students, *The American Journal of Distance Education, 5* (1).

Ergin, A. (1995). *Öğretim teknolojisi : İletişim*. Ankara : Pegem Yayıncılık

Erişti, S. D. (2005). *Grafik tasarım ilkelerine dayalı olarak geliştirilmiş etkileşimli eğitim cd'lerinin ilköğretim temel sanat elemanlarının öğretiminde etkililiği*. Yayınlanmamış doktora tezi, Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü, Eskişehir.

Eristi, S. D., Izmirli, O. S., Izmirli, S., Firat, M. & Haseski, H. I. (2010). An evaluation of educational website designs from the perspective of visual perception theories: A study on scale development, *Contemporary Educational Technology*, *1*(4), 348-366.

Gay, L. R., Mills, G.E., & Airasian, P. W. (2006). *Educational research: Competencies for analysis and applications* (8th ed.). Upper Saddle River, N.J.: Merrill/Prentice Hall.

Gillani, B. B. (2003). *Learning theories and the design of e-learning environments*. Maryland: University Press of America.

Huck, S. W. (2000). *Reading statistics and research.* New York: Longman.

Jockems, W., Van Merrienboer, J., & Koper, R. (Ed.). (2004). *Integrated e-learning implications for pedagogy, technology and organization.* NY : RoutledgeFalmer.

Jolliffe, A., Ritter, J., & Stevens, D. (2001). *The online learning handbook: Developing and using web-based learning*. London: Kogan Page Limited.

Jonassen, D.H., Peck, K.L., & Wilson, B.G. (1999). *Learning WITH technology: A constructivist perspective*. Columbus, OH: Prentice-Hall.

Karasar, N. (2005). *Bilimsel araştırma yöntemi.* Ankara: Nobel Publication.

Lupton, E., & Philips, C. J. (2008). *Graphic design: The new basics.* Princeton Architectural Press.

Miller, E. (n.d.). *The graphic design process.* Retrieved 04.12.2010, from http://graphicdesign.about.com/od/graphicdesignbasics/ss/process.htm

Porter, L. R. (2004). *Developing an online curriculum: Technologies and techniques*. USA: Infosci.

Salisbury, F. (1996). *Five technologies for educational change: System thinking, systems design, quality science, change management, instructional technology*. N.J.: Educational Technology Publications.

Schweir, R. A., & Misanchuk, E. R. (1993). *Interactive multimedia instruction*. N.J.: Educational Technology Publications.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comperative effectiveness of web-based and classroom instruction: A meta-analysis. *Personel Psychology*, *59*, 623-664.

Şahan, H., H. (2007). İnternet Tabanlı Öğretim. Ö. Demirel (Ed.), *Eğitimde yeni yönelimler* (2. basım) içinde (233-243). Ankara : Pegema Yayıncılık.

Uçar, T. F. (2004). *Görsel iletişim ve grafik tasarım*. İstanbul : İnkılâp Kitapevi

URL-1, *The Basics of graphic design, (*n.d.). Retrieved 04.12.2010, from http://online.tusc.k12.al.us/tutorials/grdesign/grdesign.htm.

URL-2, *Graphic design principles: The keys to graphic success,* (n.d.). Retrieved 04.12.2010, from http://www.adigitaldreamer.com/articles/graphic-design-principles.htm.

Watzman, S. (2003). Visual design principles for usable interfaces. A. Sears & J. A. Jacko, (Eds.), *The human-computer interaction handbook : Fundamentals, evolving, Technologies and emerging application* içinde (264-284). NJ: Lawrence Erlbaum Associates.