A Framework for the Design Studio in Web-Based Education

Aysu Sagun, Halime Demirkan and Mesut Goktepe

Abstract

Design education should integrate design concepts and skills with practical and theoretical knowledge through collaborative learning. Computer-mediated communication systems used in web-based education systems are quite appropriate for this principle by enabling global access to course material as well as allowing interaction of participants at distributed learning environments at anytime. Course design broadly requires the organization of time, space and activities considering the tools and methods used. Based on these issues, this study proposes a framework for the design of a web-based studio course with respect to the nature of the design process. An implementation of a sample web-based course design is included to support the idea. Considering the benefits and limitations, the nature of web-based design courses is explored first. Then, the sociological, ideological, epistemological and pedagogical aspects of a design studio are examined within the framework of objectives (why), objects (what), methodology (how) and management (who) with special emphasis given to synchronous and asynchronous communication.

Introduction

Education can be broadly stated as the transmission of knowledge and skills. Education methods, requirements and needs vary for each discipline related to its nature. Design education is distinguished from other disciplines due to the nature of the design process. The first characteristic of the architectural design process is the generation of new designs from the current ones. Drawings representing the candidate solution are generated before they are evaluated. The second characteristic that guides the process relies not only on the information internal to the particular problem, but also external to it, such as cultural norms or style. [1]

Drawing as an essential tool for the designer is a type of modelling that helps the expression and the presentation of the mental concepts of the designer. [2] The tools that the designer uses for expressing these mental concepts are changing as the technology develops. [3] Computers have been recently integrated into design. Today, computer systems with their peripherals such as plotter and scanner accompany the function of the drawing boards and pencils. As a result, this alteration in equipment and platform is changing the way that designers think and work and provide accessibility to global information and collaboration. The products of the new information technology, Internet and World Wide Web (WWW), enable geographically distributed people to interact and work together.

The most important advantage of web-based design education is the diminishing of time and location constraints in teaching and learning. Both the student and the instructor are free from restricted course hours carried out in a single location. Web-based education can be conducted in two different communication models: asynchronous and synchronous. Asynchronous communication is a non-real time interaction of the participants in which information is exchanged with the use of tools like e-mail, mailing lists and newsgroups. In this system, there is no time constraint since the participants do not have to be on-line at the same time. Thus asynchronous tools enable permanent and continuously accessible communication.[4] On the other hand, synchronous communication is a real-time interaction of geographically distributed participants. Chat rooms, audio-video conference, white boards can be used for real-time interaction. In this system, there is a time constraint since a particular time should be decided to meet by the participants. Moreover, the same tools should be provided for all the participants to communicate. [5]

One of these systems may be preferred to be used in a web-based design education. Since synchronous communication provides real time interaction and asynchronous communication has no time restriction for interaction, it is advisable to apply both systems in a web-based course. In the traditional design teaching environment, the instructor has to consider different teaching and learning styles, establish learning objectives in a project, choose the appropriate learning materials, register students, provide student access to course contents, assign appropriate materials to students, manage student-instructor and student-student communications both asynchronously or synchronously. The instructor uses the portfolio assessment method to provide a basis for judging learning progress and for communicating it to students and other interested parties. All of this process has to be designed, managed, and implemented by the instructors. In today's network environment, this process can be designed by instructors but managed by software, and may actually be shared among other instructors, students, and information providers using the synchronous and asynchronous tools of the new information technology.

## Web-based design courses versus traditional design courses

Building a web-based classroom is not a simple and quick process. However, most instructors aim to use this new teaching process because it has many advantages over the traditional teaching process. Because of advanced training requirements in particular fields due to the continuous growth in knowledge, there is an increase in the

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number of dealers in education and training sectors. This causes an increase in class size, higher student-to-instructor ratio and a decrease in student-to-instructor interaction resulting in decrease in motivation and the participation of students in the course. Furthermore, expectations of students from education vary depending on their background, psychology, culture and age. Web-based education offers opportunities for various types of students due to its special characteristics in synchronous and asynchronous communication systems. [6] This flexibility is beneficial for various participants, especially for disabled students who cannot physically attend in the classroom.

Traditional methods of teaching allow teachers several active roles in a design course, such as lecturing, setting out exercises, critiques to guide students through given design problems, conducting evaluation and assessment, and guiding discussions. Traditional views of learning offer learners relatively few roles, most of which are passive as listening, note-taking, following instructions and practicing the design skills discussed in critiques.

In a web-based design course, there are many advantages over a traditional design course. Although people do not meet physically, a sense of communication is spread on the web. [7] Interaction in this community is provided by new tools and methods that are being developed everyday. The use of a shared desktop, whiteboards for project presentations, e-mail, chat programmes, or forum facilities on the Internet allows the participant to communicate with others individually or in groups. In this way questions are asked and conversations are conducted, orally and electronically. Since people find communication through the Internet more convenient than face-to-face communication, they interact with more people to share different points of view. [8] As a result, the students have greater critical access to a wider variety of design consultants.

Moreover, students have the opportunity to decide upon the subjects they want to study. The critiques in the project can be conducted through
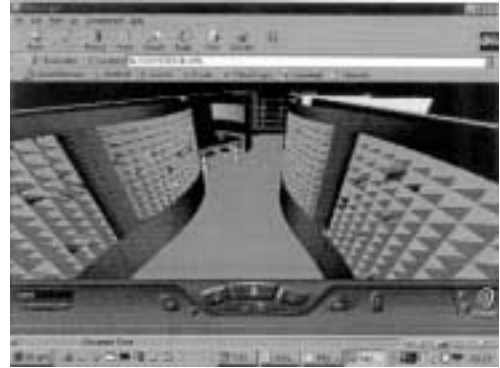
the web synchronously. In this case, students also have to anticipate and plan the content and the form of the interaction. [9] This enables the students to have more control over the education process that results in an increase in their motivation in studying and research. Sharing information between different cultures through the web also enlarges students' points of view in solving a design problem, enabling them to learn different approaches to design. A collaborative study on the web provides more information to the participants compared to two-dimensional (2D) representations of traditional studies in which various different views are generated from a single digital representation as seen in Figure 1. [10]

When the distribution of information through the web is combined with asynchronous communication and appropriate pedagogical issues, educational flexibility can be achieved to reduce the time constraint. [11] The power of the computer in storing, indexing asynchronously and searching, converting and distributing information synchronously can be adapted to improve the quality of the courses since the student can have control over the learning process contrary to the traditional design teaching process.

Bringing all these advantages together increases attention of students across the subject. However, synchronous and asynchronous tools offered by web-based education should not be considered as the solution for all problems. There are some limitations to be faced in a web-based design course. The most important problem is the

lack of face-to-face interaction. However, the lack of interaction is a result of the method of teaching. A great amount of interaction may be provided by encouraging students to hold group discussions or group work on the web.

Although it is an easy medium to use and most of the students are familiar with the Internet nowadays, the special rules, regulations and tools of the web-based education should be provided to the students who are not familiar with the Internet, so that they feel comfortable with this new virtual environment. In web-based design education, technological development should be nourished with pedagogical principles to increase the quality of the education. Both instructors and students may face problems if they are only experienced in traditional design teaching methods. While the students should be aware that they can no longer remain passive participants in the web-based design studio, the instructors should adapt themselves to technological advances for an effective teaching of design skills.

Moreover, the design and realization of the course should be as simple as possible in order to involve a large number of participants. Acquiring a computer with particular specifications having access to the Internet is not practical for everyone due to the rapid technological advances and their financial costs.

Reliability of information on the Internet is another problem that has to be taken into consideration. There is much material related to design issues but the Internet is a new medium and the reliability of all sites cannot yet be guaranteed. For this reason, the instructor has to guide the students to access reliable sources of information on the web.

In order to minimize these problems, a strategy has to be adopted to build and manage a web-based design education. The design of a web-based course is quite critical in this sense, because an inappropriate design may cause the quality of the design education to fail. Recently, there have been a good deal of research building up an evolutionary strategy to define web-based education in various disciplines. In the design field, International Virtual Design Studio (VDS) has been set up to enable a collaborative design study through the WWW and video conferencing facilities among the various universities working on the web-based education all around the world. VDS is a computer-mediated communication environment, an electronically distributed workspace, comprising teams of designers, students and staff who are geographically distributed. [12] Many universities have been involved in VDS projects such as Massachusetts Institute of Technology (MIT), University of Sydney, Cornell University, Swiss Federal Institute of Technology in Zurich, National University of Singapore and University of British Columbia. [13, 14] The interaction among the participants is conducted by synchronous and asynchronous means. The project developed by MIT in the Faculty of Architecture can be examined as a case study. It is called 'Design Studio of the Future'. [15] The project aims to do away with time and place constraints using synchronous distributed collaborative design on the Internet, WWW and other commercially available communication systems. The virtual design studio is created with network facilities that provide geographically distributed participants in a design project with access to the organization databases and computational resources, efficient messaging and data exchange, and video conference. [16] The communication between the geographically distributed students and instructors in these systems is provided via lecture notes, interactive homework or assignments, e-mails, on-line chat, virtual desk critiques and web conferences. The students may also have the opportunity to work with 3D Computer Aided Design (CAD) models and prototyping, visual reference databases and consultants on the net.

A framework for the web-based design studio

Design education involves lecture and studio teaching together to engage students with design knowledge, skills and practice. In order to improve design education and solve course

Opposite:

Figure 1
A view from a three-dimensional (3D) representation generated through VRML, adapted from Sagun's thesis Use of Virtual Environments in Interior Design Education: A Case Study with VRML.

related problems, one has to start by generating questions about the transmission of knowledge and skills, related to the nature of design education. These basic questions can determine a framework for the design studio, since produced answers will only be relevant to design education and help to define its 'objectives', 'objects', 'methods' and 'management' issues. In this sense, the objective of design education is to train designers, produce designs and provide a bridge across the related disciplines. The objects are the design products that are shaped according to the needs and requirements of the user, and the existing environmental and cultural factors. Objects can be produced through the existing methodologies or improved by employing new technologies. A change in methodology would also result in a change in the curriculum and management process, assigning more responsibilities and roles to the students.

Web-based education, as a new approach that appeared with the developments in computer technology and computer mediated communication, can be adapted to design studio education to built collaborative learning environments. A sample web-based course is designed by the first author of this paper for the course 'Modular Interior Systems' offered in the Department of Interior Architecture and Environmental Design at Bilkent University. [17] It is planned as an extension to support the traditional course conducted in the studio, using Virtual Reality Modelling Language (VRML), PowerPointÆ and Hypertext Mark Up Language (HTML). See Figure 2.

The aim of the study was to point out the use of virtual environments in interior design education with the tools that can be used to present the visual data on computer for collaborative study. The design of the course includes the definition of concepts, lecture notes, previous project samples and libraries of material, texture, detail and furniture related to the scope of the course. The Modular Interior Systems course aims to improve the understanding of the students of modular systems that include functional and

repetitive individual units, which brings flexibility to the designer in the design process, production, mounting and usage. It improves the abilities of the students in manipulating, reconfiguring and analysing properties, dimensions, details and treatments. It has been chosen to be implemented on the web since it is a course that reflects the nature of the interior design process.

The issues of web-based design education

Course planning in design is a complex process when it is to be implemented on the web. The web-based design studio cannot replace the role of an instructor but can be used as a new educational tool. The instructors design the learning experience in preparing a web-based design course with present technological means. In order to design and manage such a course, one has to make a systematic analysis of the objectives (why), objects (what), methodology (how) and management (who). [18]

The first step is the definition of objectives (why). In order to define the objects, methodology and management issues, the question of 'why' a web-based system is preferred to traditional design course should be answered. After this explanation the process of designing a web-based course starts by defining the scope of the course, in other words 'what' will be taught. The information that will be given in the course should be well defined. Lists of educational goals should be prepared because a web-based classroom should be directed to its purpose only.

The next step is for practical issues to be considered. Web-based education can be practiced in two ways: either as a support to the existing traditional teaching methods or replacement of the existing method completely with the web-based course. Some of the systems rely on real time interaction, while others can be accessed asynchronously. This difference has major implications for the design and delivery of web-based education, as well as for the study requirements of the learner. Both systems are advantageous in web-based design courses.

Tools ranging from simple programmes written by a single person, to large expensive software packages can be used in a web-based course. Examples of various tools to construct the communication between the participants are e-mails, newsgroups, FTP (file transfer protocols), audio-video conference tools and chat rooms. In a design course, in addition to these widely used tools, white boards and specially developed shareware programmes for desktop critiques can be used. There are many programmes, which use entirely asynchronous tools, or synchronous tools. However, the trend is very much towards combining synchronous and asynchronous communication in order to maximise the advantages of both communication systems.

Moreover, the instructor should decide 'how' the course will be taught and 'how' the students will follow it on the web. There are various models for web-based education implementations such as The Individualized Instruction Model, which is a text-based system; The Class Model, in which students have the chance to work together and with an instructor; The Integrated Class Model, which is enhanced with research activities and audio and/or visual conferences; The Group Model, which involves the collaboration of a small group; and The Collaborative Group Model, which includes a consortium of educators with multiple resources in addition to the activities in all previous approaches. [19]

Co-operative studies provide great potential for independent learning and enhance the individual
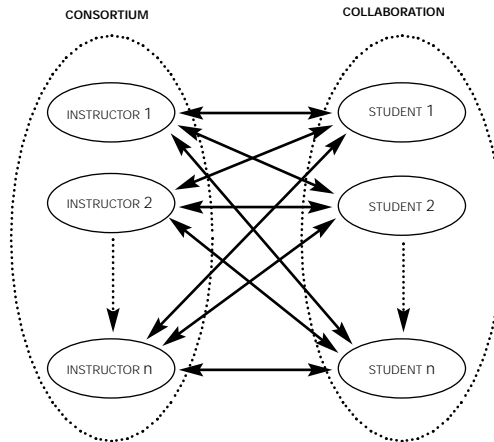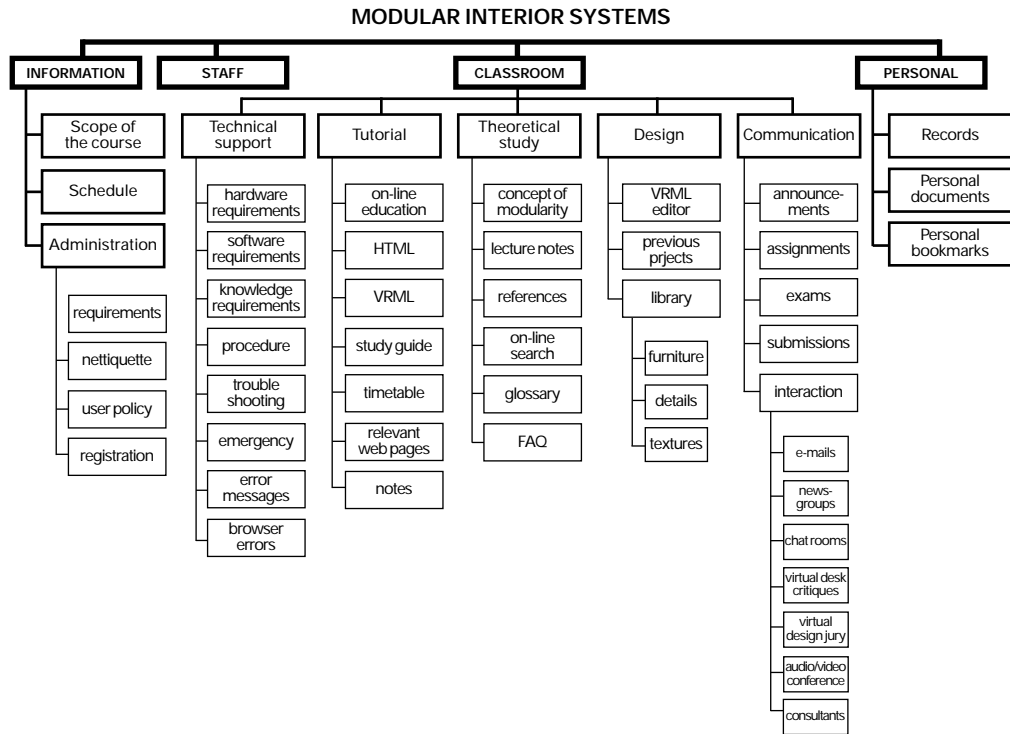
knowledge to reach a solution to a problem. [20] Therefore, the Collaborative Group Model is the one that best suits the nature of design education because it can provide use of all of the possibilities that the Internet offers. Furthermore, critiques can be conducted using this model with the instructors and consultants on design, allowing the maximum interaction on-line. See Figure 3.

Management is another issue to be considered in course design. The responsibilities in a web-based design course differ from a traditional design course because students have more control over the educational process than the instructor. The co-ordinator, instructor(s) and computer system administrator all have their own responsibilities for management. However, these responsibilities may overlap or change roles in practice. [21] Additionally, web-based education systems enable interaction with design consultants around the world and information exchange with the other related disciplines.

A model proposed by Necdet Teymur for design courses is further improved for the design of a web-based design course as depicted in Table 1, to develop an organization schema for the sample course. The contents form the necessary components of the web-based course structure. In order to construct the course, the organization schema (Figure 4) is developed by categorizing the contents that appear in Table 1.

Opposite:

Figure 2
A snapshot adapted from Sagun's thesis, illustrating the lecture notes from the web-based version of the Modular Interior Systems course offered in Department of Interior Architecture and Environmental Design at Bilkent University.

Above:

Figure 3
The collaborative group model

MODULAR INTERIOR SYSTEMS

- INFORMATION
  - Scope of the course
  - Schedule
  - Administration
    - requirements
    - nettiquette
    - user policy
    - registration
- STAFF
  - Technical support
    - hardware requirements
    - software requirements
    - knowledge requirements
    - procedure
    - trouble shooting
    - emergency
    - error messages
    - browser errors
- CLASSROOM
  - Tutorial
    - on-line education
    - HTML
    - VRML
    - study guide
    - timetable
    - relevant web pages
    - notes
  - Theoretical study
    - concept of modularity
    - lecture notes
    - references
    - on-line search
    - glossary
    - FAQ
  - Design
    - VRML editor
    - previous p001rjects
    - library
      - furniture
      - details
      - textures
  - Communication
    - announce-ments
    - assignments
    - exams
    - submissions
    - interaction
      - e-mails
      - news-groups
      - chat rooms
      - virtual desk critiques
      - virtual design jury
      - audio/video conference
      - consultants
- PERSONAL
  - Records
  - Personal documents
  - Personal bookmarks

The links in the Homepage of the course are organized according to this organization schema. The contents are subdivided under four main headings: Information, Staff, Classroom and Personal. The information page is developed to provide necessary information about the scope of course, schedule and administration. The university faculty is available under the Staff link. Classroom includes technical support, tutorial for the web, theoretical study, design process and communication. Students have the chance to keep their own records, lecture notes and design folders in a personal folder. All of these pages are further linked to sub-pages to provide a systematic study environment for both students and instructors.

The aspects of web-based design education
In the model developed for the web-based design studio, the objectives, objects, methodology and management issues of design education are analyzed with respect to the social, ideological, epistemological and pedagogical aspects, as seen in Table 1, since they cannot be observed at a single level. Availability of information, ease and control of access, group dynamics, specification of assessment, appropriateness to the needs and requirements and teachers' input are the key concepts to be considered in the design of a web-based course. [22] In order to satisfy these key concepts, one has to make a systematic analysis of each element since they all exist in social, ideological, epistemological and pedagogical levels, which are the basic aspects for education that have to be taken into consideration.

Sociological Level
The sociological level is concerned with the definition of design education, its' problems, relations and contents. In a web-based design studio, the objective is to provide computer-mediated communication among geographically distributed students. This approach also creates a training opportunity for disabled students who cannot attend the classroom physically. In this

way, design concepts, skills and practice are taught through the web by orienting students to group studies, which will always exist in their professional practice in the future. The exchange of design knowledge and information among different cultures also helps them to experience cultural facts in design. This communication among the participants can be provided by synchronous and asynchronous tools and methods as explained previously. A collaborative group study (Figure 3) using these tools on the web enables all the participants, including instructors, students and consultants to share responsibilities. This kind of approach can increase the students' control of their own education making them more aware of the responsibilities in a society.

Ideological level

The ideological level explains the relations of design education with design practice. In a web-based design studio, the objective is to educate geographically distributed students in design. In this way, it is possible to satisfy the maximum number of students demanding advanced education. Computer-mediated communication attempts to provide easy access by reducing time and place constraints. Figure 5 illustrates the on-line submissions of homework, which provides flexibility both for the student and the instructor.

Easy access with the appropriate tools to global and interdisciplinary information which was quite time consuming and economically problematic in the past, can broaden the students' approaches in solving design problems. However, there is the problem of lack of face-to-face communication found in physical design studios. Further studies in computer technology can deal with this problem so that a better collaborative learning system can be achieved. Moreover, the problem that may appear as a result of lack of face-to-face communication can be reduced by the methodology that the instructor, student and design consultant develop in design briefs and discussions. The participation of all increases the ease of control in the web-based design studio.

Epistemological level

The epistemological level involves the content and use of knowledge and its relation to other disciplines. The objective of the web-based design course at the epistemological level, stresses global communication. The traditional design studio and traditional research for design problems are limited to studio discussions and library research. The web-based design studio should aim to broaden the way the design problems are solved because it allows interaction all around the world to view the ideas and styles of various cultures, disciplines and technologies. Thus, advantages of interacting with geographically distributed instructors, students, design consultants or consultants from various disciplines should be used. In this way, advances in design technology and practice can also be learned as they appear. This interaction can be achieved in a web-based design studio with the use of web search engines, e-mails, newsgroups, audio-video conferences, white boards or desktop critiques. Figure 6 illustrates a 3D presentation of a student design in VRML, which can be submitted to geographically distributed instructors and design consultants for discussion and critiques.

Using these tools, instructors, design consultants and consultants from related disciplines all around the world, can support the design process of the students' projects.

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Opposite:

Figure 4
Table I: The framework for the Modular Interior Systems (MIS) course.

Above:

Figure 5
A view from the homework submissions of projects about 2D modular design, adapted from Sagun's thesis Use of Virtual Environments in Interior Design Education: A Case Study with VRML.

Pedagogical level

The course characteristics, various learning paradigms and professional practice are the main points of the pedagogical level. There is still opposition to web-based education but it is a fact that web-based education makes students aware of their own control of human education by giving them responsibilities and roles. They can no longer be passive participants in the studio. They can experience the problems they may face in the future and be ready for the professional life in addition to having an advanced training with different points of view. Moreover, they learn to improve themselves after their graduation, because they learn to use computer mediated communication technology. Teaching the importance of observing existing design examples and following the advances in design practice and technology are important in this sense. Figure 7 illustrates the library of furniture, which is prepared for the students to refer existing design samples.

It is also essential to discuss the role of theory and practice as high technological knowledge and techniques are introduced to students. [23] Moreover, to engage participants in the web, they should be educated in web-technology in order to become comfortable using the new medium. In this approach, a society is constructed wherein instructors, students, design consultants and computer consultants all share in the responsibility of finding solutions to design problems. In order to orientate students towards this new approach, one has to reconsider the way design is taught. [24]

As Meecham has stated, technology has had a major impact in visual arts over the last decades including terms such as VR, virtual museums and virtual designs. [25] Web-based courses, which are virtual environments for teaching and learning, are also being introduced as developing technological mediums for design education. The applications of web-based courses in various universities in various disciplines are increasing day by day. However, the use of web-based systems in design education is a new concept. For this reason, the design of a web-based system for design education needs careful attention. Related to this concept, new methods and tools are being developed. The issues and aspects indicated in this model can be a guide to the design of a web-based design course. However, technological development for computer systems and tools are needed in order to satisfy the needs and requirements related to this model.

Conclusion

In this paper, a framework for a web-based design course is suggested based on the system proposed by Teymur, [26] using synchronous and asynchronous communication systems provided with web technology. The framework and organization of a sample web-based course prepared to support the traditional design course Modular Interior Systems offered at Bilkent University is explained related to the concepts discussed in the framework. As a result of the demand for flexible and continuous education, web-based education

systems are widely used to supplement the traditional education systems in which time and location are restrictions for both students and instructors. New methods and tools are being developed for flexible and distributed learning environments. In this model, requirements for such a system are analysed systematically by discussing the objectives (why), objects (what), methodology (how) and management (who) issues related to the social, ideological, epistemological and pedagogical aspects. The case study presented in this paper includes the requirements related to these concepts for a more flexible approach to support traditional design courses. Technology does not guarantee productivity in design education, but together with the studies in pedagogy, economical use of time, and user-oriented learning trend can provide higher learning productivity, since this approach increases the design awareness of the student. The flexibility provided by web-based education systems in time, location, content and form could also be used for design education. In this way, design students can learn when, where and what they want and can benefit from the perspective of various design consultants and consultants from related disciplines. Moreover, the students can have the chance to introduce their experience or design ideas to other students by group works and discussions without the constraints of time or place. A web-based design course whether using asynchronous methods or synchronous methods, must communicate skills to both face-to-face and distributed audiences, provide the best quality of education and information in order to achieve the desired results. New tools and methods are still being developed for a more effective and easy access and communication over the web day by day. In further studies, these advances in web-based education systems might be analysed.

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Opposite left:

Figure 6
An example of 3D student projects about office design adapted from Sagun's thesis.

Opposite right:

Figure 7
A view from the library of sitting units in Modular Interior Systems course, adapted from Sagun's thesis.

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