

ONLINE DISTANCE EDUCATION: A NEW APPROACH TO INDUSTRIAL DESIGN EDUCATION

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## **ABSTRACT**

### **ONLINE DISTANCE EDUCATION: A NEW APPROACH TO INDUSTRIAL DESIGN EDUCATION**

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Today, the impact of information technologies on education field is ever more clarified with the integration of new tools and methods to the education. Education has been becoming away from the traditional classroom environment through virtual environment. Besides education of theoretical disciplines, education of practice based disciplines, like design related disciplines are moving toward virtual environments. One of these is Industrial Design (ID) education which also has made the transition to the virtual world.

This thesis aims to explore and scrutinize the latest forms of ID education, especially the online distance ID education. In order to comprehend the technological progress of ID education and its possible future, an overview of the origins and an evaluation of the current state of distance online ID education are made. By this study, it is expected to shed light to the design educators and the educational systems' developers, for designing these environments. At the end of this research, it is concluded that it is not possible to imagine a future of ID education without technology integration. However, it would be better to apply both technological and traditional methods. In fact, the key people in the development of these educational systems and tools would be the designers themselves.

**Keywords:** Online distance ID education, traditional ID education, technology integration, design studio, virtual design studio, digital design tools

## ÖZ

### ÇEVİRİMİÇİ UZAKTAN EĞİTİM: ENDÜSTRİYEL TASARIM EĞİTİMİNDE YENİ BİR YAKLAŞIM

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Günümüzde, bilgi teknolojilerinin eğitim alanına etkileri, yeni araç ve yöntemlerin eğitime entegre edilmesi ile açıkça görülmektedir. Eğitim, geleneksel sınıf ortamından, sanal ortama doğru bir geçiş yapmaya başlamıştır. Teori temelli alanların eğitimlerinin yanı sıra, tasarım gibi uygulama temelli alanların eğitimleri de sanal ortama doğru geçiş yapmaktadır. Bu alanlardan biri olan endüstriyel tasarım eğitimi de sanal dünyaya geçiş yapmıştır.

Bu tez, Endüstri Ürünleri Tasarım eğitiminin geldiği son noktayı, özellikle de çevrimiçi uzaktan Endüstriyel Tasarım eğitimi araştırmayı amaçlamaktadır. Endüstri Ürünleri Tasarımı eğitiminin teknolojik gelişimini kavramak ve olası geleceği hakkında yorum yapabilmek için, bu eğitimin kökeni ve gelişimi genel olarak değerlendirilmiştir. Bu tez çalışmasının; endüstri ürünleri tasarımı eğitimcilerine ve sözkonusu eğitim sistemlerini geliştirenlere -bu tür eğitim ortamlarını geliştirme süreçlerinde- ışık tutması beklenmektedir. Çalışmanın sonucunda, teknolojinin entegre edilmediği bir endüstri ürünleri tasarımı eğitimi geleceğinin hayal bile edilemeyeceği anlaşılmıştır. Fakat, hem teknolojinin hem de geleneksel yöntemlerin bir arada kullanıldığı bir eğitim şekli daha yararlı olacaktır. Esasında, bu tür eğitim ortamlarının geliştirilmesinde en fazla katkısı olacak kişiler yine tasarımcıların kendileri olacaktır.

Anahtar Kelimeler: Çevrimiçi uzaktan endüstriyel tasarım eğitimi, Geleneksel endüstriyel tasarım eğitimi, Teknoloji entegrasyonu, Tasarım stüdyosu, Sanal tasarım stüdyosu, Dijital tasarım araçları

To My Father  
Metin Öztürk

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## LIST OF ABBREVIATIONS

- ALN: Asynchronous Learning Network
- CAD: Computer Aided Design
- CAID: Computer Aided Industrial Design
- CDS: Collaborative Design Studio
- FTP: File Transfer Protocol
- ID: Industrial Design
- IDSA: Industrial Designers Society of America
- ICSID: International Council of Societies of Industrial Design
- JISC: Joint Information Systems Committee
- ODLE: Online Design Learning Environment
- ODS: Open Design Studio
- OP: Omnium Project
- TDS: Traditional Design Studio
- NASAD: The National Association of Schools of Art & Design
- VDC: videoconferencing
- VDS: Virtual design studio
- 2D: Two dimensional
- 3D: Three dimensional

## CHAPTER 1

### INTRODUCTION

#### 1.1 Problem Definition

Technology is moving higher education from the traditional campus of 'brick and mortar' to the electronic classroom of 'wire and chip'. (Bender & Vredevoogd, 2006, p. 144)

Technological changes gradually affect the education system of disciplines. Even the application-based studio infrastructure of the Industrial Design (ID) education adopts the virtual world. The use of internet increased dramatically as a tool of mass communication, and this use is reflected on the design education through online design studios (Broadfoot, & Bennett, 2001). Although, the idea of making the design activity in a virtual environment or making it completely distant through Internet would have been unimaginable 20 years ago, the rapidly changing and developing technology and its applications have all proved that this could be possible. In 2000, Simoff and Maher anticipated that "the proliferation of computer media and networking has the potential to make fundamental changes in the methods, models and techniques employed to educate and train design students and professionals" (p.119) and today the effects of this potential can be observed clearly. For instance, traditional studio-based design teaching as an effective and worldwide verified design education method has started to be refurbished to adopt the features of the present time. The rapid development of information and communication technologies and social and cultural changes alter the world immediately (Budd, Vanka, & Runton, 1999). While the nature of design activity is persistent, the way to perform it and its way of education are highly open to change.

Human capacity to design has remained constant, although its means and methods have altered parallel to technological, organizational and cultural changes (Heskett, 2005, p.8).

Through history, design activity has represented itself in a variety of ways while human capability is immutable and distinctive. The alteration of variables like technology, culture and industrialization expose the design activity to changes. Fundamentally, societies adapt forms and functions of objects to their needs from the earliest time, and in the course of time, forms have been deliberately or even inadvertently adapted, or were transformed by new technological possibilities (Heskett, 2005). With these transformations, formation of many design related professions, one of which is ID, is witnessed. The role of industrial designer has been also changing with the introduction of new information applications and computer embedded products. The reflection of this situation can be observed on worldwide ID programs. The changes necessitate new methods and techniques also in design practice and education (Nagata, 2001).

In ID profession and education, utilization of computer technologies for design processes has been becoming more prevalent since 90's. Computer aided design (CAD) tools and online applications have been looming largely in the design process today. Through these applications, new research areas in design profession have appeared. Studies on the application, effectiveness and developments of digital tools and Internet applications have become critical issues on ID education. How technological transition will influence traditional methods, traditional studio environment and handicrafts became a controversial subject.

Currently, the distance education has been pervaded through the discovery of new media throughout the world, and recent communication technologies have brought new dimensions to distance education that has been also applied to the ID education. Delivery of information and distance education pedagogy have been changing year by year by mainly the development of technology which is blurring the perception of distance between learner and teacher by making the information accessible at anywhere and anytime (Beldarrain, 2006).

Today, the most distinct form of ID education is online distance ID programs of educational institutions or independent educational organizations. Recent developments in technology and access of information have offered the opportunity to improve online virtual environments and distance learning opportunities through increased communication, interactivity among participants, and integration of collaboration. Especially distance online ID programs are recently developed and it is important to explore current attempts of this kind of ID education, their viability and validity.

Whether the design education, especially studio training, can completely adapt with the swift developments and integration of technology to the discipline is argumentative. In addition; the question of what the current situation is in online design education, the discussions on its availability, viability, advantages, disadvantages, and its correspondence with the traditional ID program are controversial issues. Discussing all these would be valuable for making contribution of shaping the ideas on future of the ID education, so the profession.

## **1.2 Motivation behind the Study**

There are various researches and studies related with the Virtual Design Studios, digital tools, and online environments that are using by designers and design students. However, when the literature has been reviewed for this thesis, it has been observed that the researches and studies of entirely online distance design education are restricted. As having an educational sciences background, the author considered this thesis that emphasizes the distance delivery of ID instruction, as a valuable study because it will be one of the rare researches conducted on this issue.

### **1.3 Aim of the Study**

This study aims to explore and scrutinize the current industrial design education, especially the online distance programs as the latest forms of ID education which has gained attraction very recently.

A few examples of current online distance programs can be accepted as the important indicators for the future of industrial design education; it seems that, online delivery of instruction will have a significant place in ID education. Therefore, an overview of the origins and an evaluation of the current state of distance online ID education would be valuable in terms of comprehending the technological progress of ID education and being prepared for its possible future. In addition, such a study would give valuable clues for the design educators and developers of those educational systems.

The main research matter of this study is;

- The evaluation of entirely online distance education as a new form of Industrial design education.

This study also aims so answer following sub-questions:

- How do technological developments influence the ID profession, its education and educational environment?
- What are the current state of ID education and educational environments?
- What is the current situation of online distance ID education?
- What are the pros and cons of online distance ID education?

### **1.4 Structure of the Thesis**

In order to answer the proposed research questions, the thesis is composed of four parts.

The following chapter is about the evolution of ID education that will figure out ID and ID education first. Then, the origin and the historical development of ID education will be

mentioned briefly. After an overview of background of ID education, factors that have been affected the development of ID education will be presented. Technological developments and integration of technology to the ID education will be explicated. Moreover, changing face of ID Education will be explained. The changes in ID education from past to present will be discussed and the current trends in ID education will be presented. In addition, the applications of digital and online media and tools in ID education will be mentioned. Virtual Design Studio as an online media will be described particularly. Researches, applications and case studies on these subjects will be touched also.

Chapter 3 will present the latest forms of online ID education which are totally online ID courses and programs. Current distance online ID programs will be scrutinized. Their availability throughout the world will be searched and their structure will be presented. In addition, debates on technology integration and online distance ID education will be mentioned. Finally, the discussions on the future of ID education will be conveyed.

The last chapter will be the conclusion part. Through the light of the reviewed literature, the current situation of ID education is summarized. In addition, emphasizing the application of online distance education to current state of ID education, future of ID education is evaluated. Moreover, implications of researches and practices are denoted.

## CHAPTER 2

### EVOLUTION OF INDUSTRIAL DESIGN EDUCATION

This part will review characteristics, history and evolution of ID education throughout the world. The literature is reviewed through variety of sources which are mainly; METU Library and Texas A&M University Library catalogs, web sites of ICSID, IDSA, MIT Press Journals, ID departments of various universities and annual ID education seminars. In addition, electronic databases including, METU Library Federated Search, EBSCOhost, the ACM Digital Library, Ebrary, Science Direct, IEEE Xplore, Jstor and the Google Academic search engine were the sources mainly benefited from. Moreover; with some direct contacts, some articles were requested from the author or the universities.

While writing related with the history and development of ID and ID education, the best sources were the books varying dates from 1923 to 2009 because it is hard to find electronic articles from past and many articles mention the history of ID education very briefly. On the contrary; studies conducted from 1990s to today were good sources for the evolution and development of ID education because with the changing era the studies about these issues have gained speed and supply rich data. In addition, the proceedings about the changing face of ID and ID education have a quite contribution in reviewing the literature.

This chapter would be beneficial to be presented before dealing with the online distance ID programs because it is important to fulfill the evolution of ID education and technological developments' effects on ID education from past to present, for being able to discuss the validity, viability and future of online distance ID programs.

Following sections aims to define ID and ID education, based on a literature review study. First, the definitions of ID will be introduced. Then the origin and historical development of its education will be mentioned.

## **2.1 Opening Remarks on Industrial Design**

Design is perhaps one of the most ubiquitous activities of modern societies. Practically everything that surrounds us is the product of a design process (Restrepo, Rodriguez & Martinez, 2004, p.11).

All products we can see and use for our daily activities is the business of design. In addition, design plays a significant role in our lives and it affects us directly or indirectly, consciously or unconsciously in a way that it increases the quality of our life practically or visually. Substantial amount of people know something about design and interested with it, actually because of the usage of word “design” in many fields like fashion, interiors, industry and graphics. Unfortunately, today design has been transformed into something ordinary and inconsequential because of the absence of agreement about its significance and value. To emphasize design’s importance, Heskett (2005) states that, “... if considered seriously and used responsibly, design should be the crucial anvil on which the human environment, in all its detail, is shaped and constructed for the betterment and delight of all.” (p.1)

Most probably, many people who know something about design and interested with it have little agreement about exactly what is understood by the term design. Basically, Heskett (2005) defines design as one of the basic characteristics of what is to be human being, and an essential determinant of the quality of human life. According to him, it affects every individual in every detail of every aspect of what they do throughout each day. Design term has a wide spectrum of practice such as engineering design, graphic design and fashion design. Here the focus should be on industrial (product) design. Then, what is industrial design?

There are various definitions of ID in the literature. ID definition of the Industrial Designers Society of America (IDSA) is:

“Industrial design is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer.”

International Council of Societies of Industrial Design (ICSID) defines design as;

“... a creative activity whose aim is to establish multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange.”

Being successful in cultural and economic aspects depends on innovative design. Pioneer industrial designers started to design for styling the products. The idea was redesign the existing products in the market to create difference and competitiveness. In course of time however, the designers' role have changed and educating more competent designers has gained importance. The following sections will define ID education and its historical development.

## **2.2 Overview of the History of Industrial Design Education**

The roots of design education have been emerged at different times in different countries. Britain has been one of these pioneer countries. The early design education basis is provided by the Ecole Des Beaux Arts which refers to a number of influential art schools in France, between 1819 and 1914. Through the 19<sup>th</sup> century, movements of establishing Arts and Crafts schools pursued throughout the world. In 1896, the Central School of Arts and Crafts in Britain which is accepted as the most important educational institution of Arts and Crafts movements was opened and the school was providing instructions in those branches of design and manipulation. From 1900, these attempts were brought together with industrial production. At the beginning of the 20<sup>th</sup> century, the Central School of Arts and Crafts was divided into four schools as Architecture, Painting, Sculpture and Design. In 1915, Design and Industries Association was founded in Britain. In the following years, with the foundation of Bauhaus by Walter Gropius in Weimar, art and design education gained a different dimension. Broadbent & Cross (2003) argues that because of the perceived tastelessness of industrial products, and of concerns about the control of technology,

'joyless work', and loss of skills, Arts and Crafts movement opposed industrialization. Bauhaus was the initiator of giving a taste to the industrial products and create a style of design. Its ideals influenced design schools globally for another four decades, or more. Besides the Bauhaus as a new studio education model, the Ecole Des Beaux Arts' studio training tradition as one of the earliest models provided the starting point of a pedagogical method that is still the central part of design and architectural education that the use of the esquisse (initial sketch solution to a problem that would be further developed), the teaching of design by practicing professionals, and the final evaluation of student work by a jury are still exist in design education of today (Broadfoot & Bennett, 2001).

### **2.2.1 Re-formation of Industrial Design Profession and Education**

Baynes (2000) mentions that a common approach between design and art education: The intention of design education is that "the best way to learn about designing is 'by designing'" and in the arts "the best way to learn about art is 'by doing'". However, this familiarity has been changed over the years and in relation to the 'raising the level of demand', there has been a move to give more importance to critical understanding. For instance, as a concrete evident of the change through years; in Hong Kong, the official subject title of "Art & Craft" Education was changed into "Art and Design" Education in 1975 (Chung, 2003). During the 1990s, a considerable development in design research took place and new professional demands on design research changed the context of design (Bayazit, 2004). Since the end of 1990s, with demands of society and industrial enterprises, higher design education has changed and developed rapidly. Although the Bauhaus education has a significant role in the development of design education, design craft and traditions should be leaved because of the rapid development of industry. With the fast development of industrial production, many crafts have lost their quality and traditional value (Jun, 2001). The industrial production increased the expectation for the higher quality of product and services and these expectations have broadly cut across many businesses and industries (Tak-Chi & Kui-Chi, 2001). Therefore, beside the aesthetic and artistic side of the products; the form and functionality gain importance. The change in the expectation from the products brings the necessity of change also in the ID education.

With the developing technological era, the role and the responsibility of the traditional industrial designer have also evolved. As Wilgeroth and Pumford state in 1999, traditional ID education no longer meets the needs of modern industry and most undergraduate ID education can benefit greatly from the implementation of some of the high technology Computer Aided Design (CAD) tools; instead of traditional design studios and traditional design tools; digital design tools, Virtual Design Studios (VDS), distance online design programs through World Wide Web (www), virtual and intelligent environments have become widespread in today's design education.

In all around the world today, there are numerous industrial design schools, some of them are in schools of art, design, and architecture. Some are independent. And the most of them are part of universities or design academies and institutes. Over many years, industrial design curricula became immense in matter and manner with field studies, ethnography, and user observations; styling and manufacturing, and, user studies, sustainable and human-centered design principles, and so on. As far as can be observed, there is no school covers all of these equally. However, the extent of integration of the technological tools mentioned above in ID curricula varies significantly between different levels and qualities of ID schools.

## **2.3 Changing Face of Industrial Design Education**

### **2.3.1 Industrial Design Education as a Field of Study**

According to Danvers (2003) who studies on learning and teaching in art & design education, there are a number of characteristics, ideas and issues that are, or should be, central to art and design programs:

*Firstly*, in design education, learning is experienced as a continuum of changing opportunities for revision. Additionally, it is a renewal by trying out different ways of doing and making, and exploring different meanings and interpretations (p.50).

*Secondly*, in design education, communication between students is conducted with exchanges of experience, knowledge and ideas between individuals (p.51).

*Thirdly*, design education is a belief in learning as essentially about 'changing one's mind'. In ID education, involvement and action are prerequisites for the development of understanding. Questioning, trying things out, exploring, investigating and making meanings are all typical participatory modes (p.51).

Like Danvers' there have been many studies and researches that trying to find new methods and develop ID education to catch the rapidly changing educational, economical, industrial and technological settings. The studies mainly aim to find new ways and methods to increase the quality of education, improve students' motivation and obtain better results in their qualifications of design discipline in the professional life for keeping up with the rapid development of design field. Some of these studies try to find clues for possible future of ID education by evaluating the past and present for making contributions to its development and future studies (Baynes, 2000; Boucharenc, 2006; Davies, 2002; Eason, 2000; Findeli, 2001; Lerner, 2005; Levy, 1990; Macdonald, 1998; McMahon, 2000; Nabarro, 2001; Unlu, 2004). Some other studies that have been conducted to suggest new pedagogical approaches and new methods for ID education by evaluating the past and the current technological, industrial and economical developments of the societies (Gil, Bedolla & Lloveras, 2004; Kimbell, Saxton & Miller, 1999; Kolko, 2005; Nagata, 2001; Overbeeke, Appleby, Reinen & Vinke, 2004; Rodgers & Milton, 2000; Tek-Jin & Gill, 2001).

Considering the years that studies about ID education were conducted, some basic differences can be observed between definite periods: During a long period since 1920s to 1990s, the main sources related with ID education are the books. There are really few works related with ID education and its development that can not exceed the fingers of one hand. In 1923, Gropius wrote about Bauhaus' Curriculum and traditions. In 1948, Reynolds wrote an article namely, "Training for Industrial Design". In this study Reynolds, discusses the war effort of USA, designers' responsibilities in designing products for the war time and art educators' responsibility to provide young designers into this challenging field in war period. One of the possible reasons why there were few researches related with ID

education before 1990s is that the researchers of that time mainly deal with namely arts and crafts education instead of ID education. For example in 1962, Barkan's study, "Transition in Art Education" discusses changes and transformation in Art education. By considering the studies published, 1980s was the transition period from Arts and Crafts education to Design education. Both were discussed rigorously in these years.

In 1990s, there is an apparent increase of researches related with ID education (i.e. Eppinger, Fine, & Ulrich, 1990; Garvey, 1997; Levy, 1990; Macdonald, 1998; Owen, 1991). After 1990s, the researches about ID education changed by cultural, social and environmental changes and the rapid development of technology. Topics like sustainable design, multi-generational design, interaction design and design for all has become the forefront issues in the ID discipline. Integration of these issues to the ID education has been an intensive study area. On the other hand, technology integration and its applications in ID education include both content and content delivery process.

As discussed before; by 2000, almost all of the researches on ID education investigated the effect of technologies, new educational methods and changing face of ID education. Digital design tools, virtual design studios, collaborative design projects, multidisciplinary approaches and online applications are all in the forefront currently. There are rapidly increasing number of researches for developing these tools and applications or researches about the effectiveness, advantages or disadvantages of all new trends. The researches related with the main concerns of this thesis will be presented in the following parts.

In the next section, as it is the main interest of this study, integration of technology to ID education will be presented more in detail. A review of literature concerning current process and trends in ID education will be mentioned. In addition, the application of digital media tools and online forms of ID education will be described. The most prominent applications, case studies and researches through the world will be presented.

## 2.4 Characteristics of Industrial Design Education

The most powerful method in ID education is 'learning by doing'. This approach is traditionally the core of design education and 'design exercises' (Dorst & Reymen, 2004). ID education has evolved since the days of the Bauhaus, from being only a crafts education to including complex problem solving methods and designing for industrial production.

Due to the needs of society and the expectations of industry, industrial designers are required to be trained with a more methodological way. They learn how to solve complex problems and find answers to user needs. Beucker (2004) states that design education is responsible to adapt the designers to the changes of the world and design education should achieve this through the support of transparent methodology which has three components:

*Firstly*, generating transparent design methodology means the design students are supported with approaches of research, evaluation, creation and representation methods. In ID education these procedures and methods must be as transparent as possible to clearly understand the design process because the designers should be trained in a way that they will be capable of transforming and using the knowledge that seems to be adaptable for their tasks (p.3).

*Secondly*, studying within an industrial collaboration supports students with the practicing their knowledge under professional conditions. This collaboration enriches the classical design experience in a way that students have the opportunity to design for a realistic design process in a realistic environment (p.4).

*Thirdly*, Beucker emphasizes the importance of building ID education on scientific knowledge because training with a science based design education will both broadens the intellectual horizon of designers and gives them the possibility to review their expressions so that it can be archived and made accessible for future needs (p.6).

Chang and Huang (2002) claim that the process of learning how to design and the process of designing an artifact are similar, because both require a certain period of time and labor.

Furthermore, designers and design learners have to discover their own paths to gain the necessary knowledge and skills.

Fundamentally, design education basics composed of training students in a scientific way. Also, shape the design according to the needs of society and expectations of the industry is one of the most important aspects of ID education (Moeller, 2001).

Schön (1985) as one of the earliest theorists of design education, also implies the importance of studio education by stating that traditionally, the most important part of design education is the design studio where design students spend much of their working time talking together in their private study areas and studying for common design tasks. In the studio environment students are expected to generate ideas, find solutions to the specified design problems, present and defend design ideas, and gain new techniques and skills. In the studio environment, although students are expected to solve a series of problems, how they interact and search for solutions are also under the watchful eye of the instructor (Kvan, 2001). The ideas proposed by students are discussed and reviewed with the students and instructors together. While the instructors are criticizing generated ideas, solutions or final product, they actually give necessary feedback to prompt design process or develop the product more. The interaction is face to face in a traditional design studio, and the works are presented through two dimensional sketches and three dimensional models. In addition, in studio environment, design students are introduced to the basic principles of design.

Collaboration in a design studio is important that studying with a variety of ideas from different minds makes design learning process more affluent. Dave and Danahy (2000) assert that; "Collaboration with the other students takes the form of teaching each other" (p.1). In educational context, the students' teaching each other called peer, collaborative or cooperative learning which support the students to develop of learning skills and outcomes related to collaboration and teamwork, to develop enquiry and reflection skills, and to develop communication and learning skills (Boud, Cohen, & Sampson, 1999).

Thus, the main difference of design studio from a usual classroom environment is that there is a constant communication and collaboration between design students in design studio. Moreover, the design studio courses involve practical skills as well as the theoretical knowledge. The studio courses have developed their own language; tools and techniques that are used for the studio courses are different from the ones that are used for classical lecture-based courses (Oztoprak, 2004).

Indeed, design education is not just composed of studio practices, discussing concepts and drawing, it is about experiencing all the outstanding opportunities that the world offers (Moeller, 2001). One of the other most important aspects of ID education is the classroom environment where students get the necessary background of design literature and history, theoretical and technological basics, interdisciplinary studies and many other skills. Design courses are important to make the students think analytically, scientifically and to expand their intellectual horizons.

#### **2.4.1 Curriculum of Industrial Design Education**

Most ID programs throughout the world focus on the learning of basic design principles through the first year. The courses and design studios aim to develop the students' understandings of geometry, structure, composition through observing and experiencing. In the early times of ID education, learning the basic design principles switch to learning specialized principles and abstract ideas are moved to real-world project (Shankwiler & Schaar, 2008). Throughout the undergraduate programs of ID, it is important to give students general knowledge of ID and to teach how to do research and how to observe. In addition, it is important to nourish design students with theoretical and technical knowledge and high levels of practical skills.

In order to present the general overview of the process of ID programs, Undergraduate Program at METU Department of Industrial Design will be described. It is worth to give METU as an example and discuss the consistency of traditional campus education with the online form of ID education over METU exempli because it is one of the programs that

established through the support of U.S. In addition, ID program at METU has close contacts with design schools from Europe and through its 30 years experience its curriculum is similar with a majority of qualified design schools through the world.

#### **2.4.2 Industrial Design Education at METU**

ID education attempts started at METU in 1979. The department aim to develop strong relations with the local industry and therefore it supports students with an interdisciplinary and multicultural ID program through various elective, technical, theoretical and studio courses.

The first year aims to introduce students with the discipline. To give the basic design principles, basic design studio Introduce students with the basic concepts of design, visual thinking, nature of materials and structural principles. Sketching, drawing, and modeling skills are first taught during the basic design studio. The studio courses of each year cover three half day of the week. That means the big proportion of the program composed of studio practices. In addition to this condense studio training, various courses support design students with various skills, practices and knowledge. Through these courses, students are equipped with design communication skills through basic information of perception and composition. In addition; basic communication skills, basic physics for nonscientists, introduction to information technologies and applications, origin and development of ID are offered to design students during the first year of their education.

Second year is basically continuation of the first year with the difference of content of design studios. In the second year studio courses, students are introduced to the basic ID rather than basic design principles. In the second year studios, the focus is on finding producible and usable design solutions with a conceptual approach. Students are directed to work on physical and functional requirements of a product with the support of Issues of innovation, styling, redesign and human-product interaction. In addition, through the second year students are introduced with production, manufacturing, and ergonomics. Students are firstly introduced with the basic computer literacy in design in this year.

During the summer workshops, they are introduced to CAD for drawing of objects involving sectioning, dimensioning, assembly drawings. In addition, it is aimed to develop practical skills related to the use of basic workshop tools including exercises on metals, wood, paper and plastics.

Design students are supported to define themselves more and find their individual methods for design processes in the third year of their undergraduate education. In the studio courses, Issues of corporate identity, product identity, system design, interface design, and new technologies are the main concern. In addition, students are encouraged to develop their individual methods and style. Moreover, students are introduced with the professional practices and the computer applications for design. The students are introduced with three dimensional modeling, material editing and rendering using Rhinoceros, 3D Studio Max and Alias Wave-Front (Design Studio). In the third year summer practices, students experience a modeling program for production establishment, making observation, and reporting its main production processes.

During the last year, students are equipped for being ready to the professional life. The design studios focus on the cultural issues more. Life style, ecology, future forecasting, globalism, and design for export are the main concerns of fourth year design studio. Students are dealing with solving design problems through social and market values of a particular culture. Students are working in a design office for six weeks participating to the designing activities, and reporting/presenting them to the department. At the end of this four year undergraduate ID program, students are expected to prepare their portfolios including collection, documentation and presentation of physical reference materials in relation to their design works, either in the form of print, or in the form of electronic media. Before graduation, it is expected from their portfolios to reflect the student's style, design character and corporate identity in accordance to the target audience. In addition, at the end, the students involve in a collaborative design project with industry, synthesizing real-life design problems.

Besides all these four year must courses, there are plenty of elective courses that students have to take during the program. Through these courses, students can develop their theoretical and practical skills and knowledge more in accordance with their choices and pursuits.

## **2.5 Industrial Design Education in Transition**

Design education is very simple. Gather a bunch of students around a table and add a bunch of excellent teachers. This is the traditional 'master-mate' model from the guilds. (Overbeeke, Appleby, Reinen & Vinke, 2004, p. 3)

However, with the alteration of the world; a more structured ID education with a set of courses and various methods have taken the traditional and simple model's place. In the 1950s, "design methods" and "design theory" were for simple cases but not for complex problems that they comprised slightly more than checklists or theoretical exercises (Owen, 1991). In fact, design profession is shifting from an imaginative discipline to a discipline that pays attention to solve complex problems and meets the needs of society.

The development of information technology has practically changed almost every part of our daily life and environment. ID education is also no exemption in this case. Integration of technology to the ID discipline and education has been the most dramatic change since its origins. Considering the past, the real change is that the accessibility of information is at hand today, bringing a chief change in the way design thinking is done (Fuentes, 2001). Correspondingly, ID education has been changing in various dimensions these changes are explained briefly in the following paragraphs.

### *Changing Design Paradigms*

With rapidly changing economy, design paradigms are changing to affect the whole society, and design thinking and actions are transformed rapidly within these circumstances (Fuentes, 2001). It is inevitable for ID education to change while design thinking and actions, actually design culture have been changing. Cramer (2005) states that:

Managing change is where it's at for today's leaders. This is true in professional practice as well as for deans and faculty in architecture and design schools. Leaders understand that change is about renewal, growth, and relevancy. Change in some places is radical, in others gradual. Change may go unnoticed by some but, in fact, change happens constantly in every firm and in every program. Organizations continually struggle to remake themselves. (p. 1)

As Cramer discusses, change happens constantly in every program to remake itself. ID is a dynamic profession for keeping up with this dynamism, ID education has been changing. Cramer (2008) notes three significant paradigm shifts in design:

- First, design is rapidly becoming both a team activity and a social art on a global scale.
- Second, technology enhanced the display of designer's thought processes and decision making options in three or four dimensions very quickly.
- Third, everything is faster with the advanced travelling options, communication and manufactory.

These paradigm shifts in design have influenced ID education directly. Tauke, Story, and Ostroff (2004) state that digital media, with the developing technologies, has affected the delivery of ID education in two important ways:

1. The role, value, and skills of the instructors have been changing;
  - Their role becomes facilitator and moderator to structure and organize the available online knowledge and to guide online collaboration and interaction
2. It is possible to study and make the instruction worldwide through internet and wireless technology;
  - It brings freedom of movement by extinguishing the physical restrictions (p.14).

### *Designing Collaboratively*

In addition to the changes mentioned above, ID education is currently heading toward studying collaboratively with the industry. There was constant collaboration with the industry in the past for sure. However, today the collaboration of ID education and industry gains importance because in the past; customers just wanted ideas, commitment, clarity and conciseness for unique and special designs even they do not really read the proposals

but currently, customers are paying attention as never before; they want more visualization, they need presentations and communication (Martin, 2009). Therefore current ID education emphasizes the increase in innovation, style, functionality, and aesthetics. Furthermore, today it is more important for design students to be able to express their ideas clearly and present the ideas with various up to date tools and materials. Developing communication skills during ID education is also important because the changing world outside the design practice. Today, communication with industry is important than ever before. Therefore, good communication skills and self-expression have gained significance.

Working collaboratively with industry during ID education has many advantages today. First, ID students have the opportunity to explore the professional world. They are introduced with the real complex problems and real expectations of the industry. In addition, because there is no concern of losing the position on the firm, students can be more creative and independent. Additionally, in these stress free working environments, talented students can stand out and be eligible to be a good designer. The evidence of changing corporate thinking about design is that many companies in the world are allocating a larger split of their research and development funds to shared projects with design schools, sharing innovation strategies and research findings, not work for hiring (Breitenberg, 2006).

In addition to the collaboration with the industry, collaboration between design students, instructors, and experts also gain a significant importance in the field of ID education. To emphasize the change toward giving more information to collaboration between students, Dave and Danahy (2000) state that;

Whereas the early efforts in design computing concentrated on the immediate activities of an individual designer, the new developments allow us to situate activities of an individual designer in the larger collaborative context. These developments are reflected in a growing number of virtual design studios in which students from geographically separated institutions work together using digital media as if they were virtually part of one design studio (p.2).

Correspondingly, Kolarevic, Schmitt, Hirschberg, Kurmann, and Johnson (2000), studied on a one week long, design collaboration activity and concluded that;

- In a collaborative online design environment, designers are able and willing to develop the best design solutions, rather than continuing on their own, sometimes weaker solutions.
- Studying collaboratively online for the design projects could bring an improvement to project development and to project management as well.

The other change in ID education is that the importance given to working with other disciplines. Today, most ID education programs are interdisciplinary. Designers are both expected to be innovators of products, construction and marketing. Since the designers have to take all these responsibilities of the designed product, design is considered as a discipline that is able to moderate within multi-discipline areas of product development (Beucker, 2004). Social sciences are also included in the ID curriculum. This allows design students to have a deeper understanding on problem solving strategies during their design activities.

Today, ID education is a combination of design education and knowledge of the world. It is important for design students to be aware of other cultures and to be able to communicate by different languages. Currently, there are various exchange programs in ID departments throughout the world. Studying in a different country with the students and designers having different cultures and point of views make design students broaden their horizons and gain different perspectives. It is important for design students to discover different parts of the world by means of diversity, prosperity and quality.

#### *Integration of New Tools and Methods*

Design awareness and design culture in ID education have been changing swiftly because of the reflection of new tools and methods accessible for designing, such as: information technology, simulation, prototyping, construction and production of objects (Fuentes, 2001). In addition, Tauke, Story, and Ostroff (2004) claim that the integration of digital

media to the ID profession with the developing technologies change the ID profession in two ways;

1. Digital media has replaced many manual representation techniques;

- Graphite pencil is replaced with the mouse for sketching
- Felt-tip markers' rendering replaced by complicated software programs
- Models are made by computer aided design (CAD) tools and prototyping machines instead of using hand to make models from foam, wood, plastic or metal.

2. Digital media has extended the definition of product;

- The physical product is no longer just one part of the product practice. It includes the systems required for using, supporting, and tracking the product, and providing added value through downloadable upgrades and product extensions (p.14).

To catch up with the technological developments, ID profession should put new approaches and methodologies into. Currently, designers require considering dynamic interactions between products and users within convenient user interfaces. Thus, today it became significantly important to train qualified industrial designers who can cope with the rapidly changing world products and user expectations. However, traditional ID education could not be able to meet the needs of modern industry and modern world's users' expectations anymore.

As a consequence of the development of computer graphics and imaging process, internet applications, communication tools, virtual design studios (VDS) and collaborative learning environments, ID education has evolved within its delivery methods. Design process has been revolutionized by the internet which allocates designers to do researches of new products, to access the regulations and information, to transfer data and drawings, and even synchronously work together with colleagues from around the world (Bender and Vredevoogd, 2006). Today, computer technologies and internet access is ubiquitous in design schools and they have been recently impact on design studio courses. The following part will present current trends in ID education in detail.

### 2.5.1 Trends in Industrial Design Education

Although world changes quickly, some trends come forward in different periods of time with the social and environmental factors. The trends play important role today and over the coming years for ID profession and ID education.

**Personalization** of products is one of the trends in ID. The consumer products are not only functional anymore but also original and individualistic because users prefer products that are unique to them and manufacturers are trying to produce low quantities of specific, high quality products (Butcher, 2008).

Other key trend in ID is related with **globalization** that provokes diversity in the needs of society (Sherman, 2007). Additionally; with globalization and opportunities provided by technology, designers from all over the world can participate in the same design course and process collaboratively through online virtual environments. Development of interactive multimedia technologies intends to blur the distinctions between distance and customary education through online collaborative environments which are also integrated in ID education. In recent years, almost all countries are influential on each other in many subjects. In such an era, vouching a global connection within information technologies, it is possible to combine ideas of remote countries that are having common complex problems. Globalization also introduces contemporary issues and new problem areas to ID education and a multidisciplinary character of the design field is combined with virtual environments. Hence, ID students from different countries can be able to work with the students both from different disciplines and from design field. In addition, pervasiveness of internet technologies, digital and virtual environments introduces new environments and tools to design education. The tools and modeling media that designers and design students use also change in recent years. In fact, digital technologies have taken the place of hand sketches and handmade models.

Recent popular format of design education includes both traditional studio environment and online environment. This kind of learning is called blended or hybrid learning which

involves both traditional face-to-face studio instruction and instruction via the Internet. Blended learning with the integration of technology to the traditional methods, will be advantageous for the time spend in the studio to wait for all the critics and feedbacks to high number of design student in one studio such that the students can catch more sufficient criticisms in less time (Bender and Vredevoogd, 2006; Şenyapılı and Karakaya, 2009; U.S. Department of Education, 2009).

Furthermore, as it will be explained in detail in the following Chapter, one of the prominent technological applications of the educational practices today is online distance education that is on the agenda at many institutions. For many areas of interest, education through internet enables learning without being in the real classroom environment. Distance education makes remote data and tools accessible for users and it entails to take the users' background, technical experience, technological equipment, and physical/cognitive abilities into consideration (Ardito et al., 2006). It is required to recognize the context of the field so as to comprehend how distance education has adapted (Mclsaac, & Gunawardena, 1996). In this current period, sort of distance education is applied in various lecture based courses. However, the situation is a little bit different for design courses because nature of studio based design courses involves much more practical skills as mentioned in the section 3.2 As Schön (1985) argues; the teaching of design practice is different from the teaching of other disciplines. Therefore, more complicated software applications of the virtual digital environment have been developing for implementing design activities, like concept generation and presentation.

### **2.5.2 ID Education through Digital Media and Tools**

Digital media have been using in almost every kind of higher education today. In design field, digital media has been proposed new identity of design space and design tools; various digital modeling media and tools supporting design process has been introduced to the design profession and education. Basically, there are many digital representations of design description such as; digital images, Computer Aided Design (CAD) models, digital text and hypermedia that is a general form of hypertext implying that various media can be

included in the document. The development of technology and communication possibilities caused the design education swiftly integrate with computer technology applications in the design curriculum and facilitate collaboration of design courses (Sagun, 2003).

The breakthrough of design process has taken place with the introduction of Computer Aided Design (CAD) and Computer Aided Industrial Design (CAID) packages to ID profession and ID education. CAD system has been evolved through the improvement of computer graphics. The origin of the field of computer graphics comes from the Automatically Programmed Tools (APT) project of Massachusetts Institute of Technology (MIT) in the 1950s (Groover & Zimmer, 1984). CAD packages has been using in some design schools and workplaces more prevalently since 1990s. Presently; in nearly every stage of design process, digital and online media sources are used. Digital technology can be applied in many forms, including representation, modeling and prototyping. In Table 2.1, Öztoprak (2004) outlines the use of computer tools in accordance with the design phases.

Table 2.1  
Use of computer tools at different design stages (Öztoprak, 2004, p.17)

	Research	Concept Generation	Concept Refinement	Presentation & Evaluation
www	✓			
Online Databases	✓			
Image Capture	✓	✓		
Image Editing		✓		✓
3D Modeling		✓	✓	
3D Rendering			✓	✓
Solid Modeling			✓	✓
Rapid Prototyping				✓

When the developments in digital technology since 2004 are taken into consideration, if the same research had been conducted today, the table above would most probably have more boxes with tick. Even the results of the research of Öztoprak (2004) which was conducted six years before indicate that, in each design phases at least one technological application is used. However, some designers, students and instructors prefer using traditional methods or both. For designers, the most important thing through the design process is being able to convey the ideas through drawings. To convey ideas of a problem solving activity “active drawing” is required which occurs when a designer try to explain something, understand something, or resolve a problem (Loewy, 2008). However, through digital technologies, active drawing may not meet the purpose by means of communicating the active ideas. Moreover, CAD models do not serve the sense of touch, which gives the actual facts of products’ physical characteristics like its texture, weight, and relative size. Besides their quality visual expression, 3D CAD models have the limitations of ergonomics and product-user interaction, which is significantly important for users to interact with proposed product (Wilgeroth & Pumford, 1999). On the other hand, especially in the conceptual generation cycle of the product design on which the ideas for innovative products are generated or new design solutions to the existing products are found; digital tools would be supportive through collaboration (Wang, Shen, Xie, Neelamkavil, & Pardasani, 2002).

Beside above arguments; in practice, the students or instructors may have different ideas about the practicality, time, and effort issues of using digital tools in design process or presentation. For example, in 2006, Şenyapılı and Basa studied with a group of architectural design students to observe their tendencies in choosing hand or computer for preparing their drawings, and presenting their design ideas. As they stated, the aim of their study was to discuss and underline the preferences of computerized age design students in choosing hand or computer in conveying the design ideas. At the end of their research, Şenyapılı and Basa (2006) concluded that a majority of the students have accredited the advantages of drawing by computer over drawing by hand especially in terms of practicality, sparing of time and using less physical effort.

During the past two decades, the CAD industry has experienced some major technological innovations and paradigm shifts that CAD systems support designers through a more developed technology for a collaboration of globally distributed colleagues and other disciplines via the Internet/intranet (Li, Lu, Fuh, & Wong, 2005). Digital technologies bring some significant changes to the design process. Min and Hao (2008) assert that designers have more time and energy to concentrate on problem solving with the integration of digital tools and they list considerable changes that digital tools bring to the design profession:

1. Proposing new tentative alternative solutions are more convenient,
2. It is more flexible to modify alternatives and design process itself,
3. The representation of design outcome is much better,
4. Design process management is more rigorous with the advanced storage and retrieval capabilities.

While discussions on advantages and disadvantages have been continuing on the one hand, using digital tools in ID profession and ID education through design process has been becoming more prevalent because swiftly developing products and services bring flexibility and diversity to ID profession for satisfying demands. Since 1990s, researches about integrating digital tools to ID education have been discussing. Although debates on using traditional methods and integration of digital tools are never terminated, it is understood that integration of technology into the ID profession and ID education is inevitable within this technology driven era. Digital technology deeply changes how people effort, learn and produce, it brings an unrestricted creation, distribution, and sharing of information, and new way of designing through technology has caused major changes in design education (Eun-sook, 2001). Expressive possibilities of digital mediums facilitate students to convey their ideas to others through various options of design ideas without spending additional time. In addition, digital tools make industrial designers and ID students explore the diversity and complexity of form of products. In fact, today technology is always sustaining the design process. Hence, further researches and studies will continue to support development of digital design actions.

Technological applications in ID are not limited to the CAD applications and digital tools. Integration of technological devices into the design studios also gives a different dimension to the design process. In Table 2.2, Sener (2007) lists future digital ID tools ideas for concept generation: 'workspace and form creation concepts'.

Sener (2007) summarizes the ideal and desired objectives of integration of digital technology to ID processes in the future. These developments will bring the necessity for design students to learn required computer skills for design applications. According to Marx (2000) although digital tools give the students the ability to design in a highly effective simulated 3D environment expressing the quality of the students product, students are generally struggling to learn how to design through digital tools and the process becomes difficult and time consuming. Therefore, more time is needed to adapt many of these technologies to the ID education. The ID students must be trained for gaining the skills of using new technologies through special courses.

Table 2.2  
*Chart of concepts for future digital industrial design tools (Sener, 2007, p.202)*

<b>Workspace Concepts</b>	<b>Brief Description</b>
Desktop Computing	This concept enhances the sensory information experienced by designers within a present-day office environment, and especially utilities multiple and interchangeable input devices.
Immersive Room	The idea behind this concept was to set an immersive theme and mood, in a similar way to desktop themes and wallpaper in Microsoft Windows or Apple Mac OS. The environment can be instantaneously switched from project to project.
Intelligent Screens	The technology embodied in this concept allows designers to move away from desktop cubicles towards systems that facilitate collaboration and sharing of information with colleagues. Touch screens and finger-based Haptic devices are predominant.
Advanced Wireless Virtual Reality	The idea behind this concept is a fully programmable VR system based on non-invasive technology that is wireless, miniaturized and lightweight. It represents a logical progression of current VR and Haptic application.

Table 2.2 (continued)  
*Chart of concepts for future digital industrial design tools (Sener, 2007, p.202)*

Form Creation Concepts	Brief Description
Dual Co-located Haptic Devices	Two-handed Haptic feedback is the essential feature of this concept, which combines SensAble Technologies' FreeForm software with Reachin Technologies' hardware, specifically addressing the absence of two-handed control and tool movement within present systems.
Smart Material	The intention behind this concept was to make form creation with digital tools as interactive as the manual shaping of workshop materials. It relies on the use of material impregnated with particles that can be position detected in 3D space.
Haptic Holographic Representation	This concept represents a form of non-physical rapid prototyping, allowing visual and haptic evaluation of an emerging product form. It is entirely waste-free and instantaneous modeling system.
Sequential Scanning	The premise behind this concept is that organic and texturised forms are easy to create in non-digital media (e.g. blue foam, clay); the concept builds on this and includes intelligent software to create high quality surface models through intelligent software.
Squidgy-sponge	Squidgy-sponge is a highly interactive conceptual input device that can be manipulated and deformed in 3D, with the resulting deformations mapped onto a digital model. The device can be twisted, indented, squeezed, tapered, stretched, squashed, folded etc.
Verbal/ Gestural Input	This concept focuses on the use of personal expression, allowing designers to 'talk through' and 'act out' their ideas for product form and is an extension of gestural sketching.
Automated 2D-to-3D Translation	The familiarity of paper-based sketching is harnessed in this concept and augmented by intelligent software to create high quality surface models. Designers' enaction in sketching out product form is therefore harnessed.

In addition to digital technologies, online applications and interactions are on the agenda of ID education. Today, World Wide Web (WWW) takes the place of books and libraries in many phase of research. Internet applications have been also using in ID education for design related researches, design applications and online design courses. In addition, digital media that are noted above may also be used in current online applications of ID education. Next part will present these applications more in detail.

### **2.5.2.1 Web-based Collaboration: Virtual Design Studio (VDS) Applications**

History of integrating computer technology in education incorporate a change from using computers as an assistant on drill activities to integrating technology into education directly (Franklin & Bolick, 2007). Since 1960s, technology has been playing an important role in the development of distance education and this has been always a controversial subject since that times. With the widespread use of computer and internet technologies, many educators and researchers have been interested in online distance education which has a long and distinguished history laying the foundations of current internet based education (Morabito, 1999). Today internet is the most accessible tool used by all individuals around the modern world. Draves (2000) asserts that, half of all learning will be conducted on the internet and there will be great opportunities for online education in the 21<sup>st</sup> century.

In every field of education, including ID education, WWW is used as the major source of all kind of information through its unlimited accessibility. In design activities, internet applications have been using in different ways:

1. Internet has been using for making basic design researches like finding design solutions and looking for current designed artifacts and applied solutions to products.
2. Internet supports designers and design students with VDS where design process is reinforced by discussing and studying with remote colleagues or experts through collaboration.
3. Moreover, there are online ID programs that aim to prepare design students to their professional career through distance education.

With globalization and increasing number of ID students who desire to be more and more inventive in design profession, collaboration between colleagues and experts of different fields in distant locations has become important. Working with diversity of people is one of the most important aspects of today's ID profession. Because design activity is related with the human capacity and a combination of various individuals means an extension of the

capacity; and, design education must be promoted with new knowledge that adopts diversity, multiculturalism, and collaboration (Coker & Coker, 2009).

Applications of VDS aim to include diverse students from different countries for sharing ideas and ideas for solving design problems through an online collaborative environment. In a virtual environment, by being able access to other students, instructors, and learning materials; these environments are learner centered, instead of focusing on the supervision of learning materials (Maher, Simoff, & Clark, 2001). Design colleagues or ID students who are working in distinct locations can be able to participate in a joint environment and work autonomously at the same time or to keep in contact asynchronously through message boards or electronic mails. The basic idea of asynchronous communication is that the communication can be conducted without meeting at the same place and time, as opposed to face-to-face traditional studio or classroom. These collaborative but; at the same time, individual environments make designers or students aware of the shared work and discover a particular subject in a private space (Kvan & Candy, 2000). Maher, Simoff, & Cicognani, (1996) mention the basic characteristics of VDS;

- In a VDS, people from various locations situate in the design process,
- VDS broaden time and space restrictions,
- Students communications in a VDS are, computer-mediated and computer-supported,
- The process and products are represented with electronic forms,
- VDS can be accessed through internet,
- Students can be supervised by professional practitioners

Therefore, there are two main types of commonly used web-based virtual collaboration tools; asynchronous and synchronous collaboration (Broadfoot & Bennett, 2001; Levis & Allan, 2005; Maher, Simoff, & Cicognani, 2000; Maher, Simoff, & Cicognani, 1996; Sagun, 2003; Sagun, Demirkan, & Goktepe, 2001):

- Asynchronous communication enables people to communicate at a time that suits them and takes place over time rather than at the same time. For example e-mail, bulletin boards and mailing lists.

- Synchronous communication enables people to communicate when they log on the same system, at the same time that this type of communication is immediate and live. For example conference or chat rooms, instant messaging, internet telephony and video conferencing.

Chen and You (2007) studied on the differences between the influences of synchronous and asynchronous communication on collaborative ID projects. In the project while one group of students study collaboratively on an asynchronous system, the other group work through a synchronous system. According to the results of the study, there are various differences between asynchronous and synchronous modes of participation (Chen & You, 2007):

- While the participants of synchronous mode log in the system at the same time periods, the students in asynchronous mode the frequency of log in was distributed
- The statement and the contribution of words of synchronous mode are more stable than asynchronous mode because of the time period they log in to the systems.
- In design communication level, while more design ideas sections contributed in synchronous mode, more design task sections was dealt in asynchronous one
- In synchronous mode, there were fewer text segments.

Although they found differences between participating through asynchronous or synchronous communication according to the results of their study, Chen and You (2007) state that the results may be effected from the participants' attitudes or planning and setting the project. They support that there must be more precise studies on this issue to give concrete decisions about the differences of effects of two types of communication modes.

#### **2.5.2.2 Pedagogy of Virtual Design Studios**

Many research and projects of VDS have been conducted for working on the design and development of VDS, studying its pedagogy or implementing it within design programs' collaborative design courses. The proliferation of VDS is a controversial subject because the

debates on replacing face to face interaction with virtual interaction will never end in educational settings so in the ID education.

Kvan (2001) studied the pedagogical issues of VDS by means of the difficulties and opportunities arise in VDS. While design students and teacher gather to discuss the design problems and solutions face to face in traditional design studio, they can be included in the design process from remote locations in a number of formats in VDS. Kvan advocated that the essential contact between teacher and student, which occurs in traditional studio environment does not change when the sides situate remotely. In addition, one of the most prominent attributes of virtual design studio projects are the convenience to ID students to work with colleagues and experts from different countries or work with students from different disciplines. Online collaboration adds different dimensions to students' design projects by allowing students to broaden their viewpoints through working with students from other institutions or disciplines, using up to date technologies and giving opportunity to use a structured/managed approach of design process (Ion, Thomson, and Mailer, 1999). In addition; through collaboration with other students, they learn from each other and this can be described as "peer assessment and learning" which is an educational method providing students to act as both reviewers and authors, evaluating the work of their colleagues. Additionally, this collaboration enhances the quality of their work (Ioanna, Ioannis, Vladimir, and Vassili, 2010).

### **2.5.2.3 Traditional vs. Online Collaboration**

In virtual design studios while students are studying collaboratively they can send voice mails or electronic mails to each other that the data and conversations can be stored to revise. On the other hand, in traditional ID studios, the words of critiques and discussions fly away. Much computer supported collaborative work field studies focuses on providing media that imitate face to face interaction but the success of e-mail is an evidence that there is more to do with good communication support than emulating face to face communication (Fischer, Grudin, McCall, Redmiles, Reeves, & Shipman, 2001).

While in some ways communication is inhibited by online environments, in some ways it is facilitated. For example, the extensive availability of e-mail makes it more convenient to keep colleagues contacted for process and facilities but on the other hand, it is harder to get and keep someone's attention without interacting face to face (Maher, Simoff, and Cicognani, 2000). On the other hand; according to Simoff and Maher (1997), the advantages of the Web-based VDS as an environment include:

- Open design towards increasing the functionality of the environment;
- Open design towards the incorporation of additional media types either in plug-in or helper format, which enhances the expressiveness of design information representation.
- On-line archiving of design information and keeping track of past experiences to be accessible for other Web-based studios (p. 424).

There are three different way of collaboration; (1) within the university, (2) between students and instructors, and (3) between universities or student groups from different countries. These may all include interdisciplinary approach (Sagun, 2003). As noted before, collaboration in design education is important for both traditional ID education and online ID education. The important thing is that the collaboration differs in some ways in traditional and online modes of ID education. Öztoprak (2004) created a table indicating the differences between traditional and online based collaboration in different design process phases (p. 38):

In a traditional studio environment, students observe all the communications, critics, and discussions between the participants and instructors. Every individual can examine each others' progress. Although in the Internet environment the transparency of studio environment is not available, collaborative online environments support much more variety of disciplines and individual to monitor and share ideas. Through the online collaboration, major amount of information and idea of colleagues become more convenient and accessible. In addition, it is more likely to get critiques and feedbacks from various designers and instructors from different countries. Online collaboration can become an effective way for design education as long as they are established through well structured and organized systems.

Table 2.3  
*Comparison of collaboration in traditional design studio and virtual design environments*  
 (Öztoprak, 2004, p.38)

<b>Collaboration in Traditional Design Studio (TDS)</b>	<b>Collaboration in Virtual Design Studio (VDS)</b>
<b>1. Design Brief</b>	
Design Brief is introduced and discussed in the course.	Design brief is published in the web and discussed via computer media
Design brief in TDS generally encourages seeking of individual solutions to the design problem	Design brief in VDS is generally intended for group-work.
<b>2. Design Process</b>	
Face-to-face meetings of instructor(s) and students.	Meetings using high-bandwidth video conferencing or desktop video.
Variety of media used including computer tools	All media is converted to one digital medium
Informal gatherings of students to discuss the design problem during studio hours.	Asynchronous communication via e-mail, forums and discussion boards and informal chat-line instant messaging
Desk-reviews on rough freehand sketches which are usually multiple in intent.	A more structured communication on computer generated models and images, which are more concrete.
Learning from peers by helping each other	Learning from peers by observing the others' contributions.
<b>3. Evaluation</b>	
Juries on models, drawings and renderings	Online synchronous and/or asynchronous juries
Juries with the contributions of local experts and instructors	With the participation of distant experts and instructors.
Presentation medium is generally paper and models	Presentation medium is computer generated images and simulations

#### **2.5.2.4 Researches and Applications of Collaborative Virtual Design Studio**

Although it is for architectural education, it is worth to mention the first major VDS here; in 1992, 'Distance Collaboration' was established in which students and tutors from The University of British Columbia, Canada (UBC) and Harvard, (Cambridge, USA) collaborated to design a small, prefabricated warehouse. Following to that project, in 1993, the 'Virtual

Village Project' was initiated by the 'Distance Collaboration', ran for three weeks between 54 students and tutors of architecture from the Massachusetts Institute of Technology, USA (MIT), Harvard (Cambridge), Hong Kong University (HKU), UBC and Washington University (Broadfoot & Bennett, 2001). Broadfoot and Bennett (2001) assert that participants of the 'Virtual Village Project' were asked to design the modernization of a traditional Chinese walled village and the project was considered successful as an exercise in collaborative design and online communication.

In 1994, a collaborative design project was conducted between Architecture and CAAD Swiss Federal Institute of Technology, Zürich and School of Architecture, National University of Singapore. This project aimed to test the potential of Computer Supported Collaborative Work (CSCW) technology in distributed design development and communications tasks (An Exhibition Pavilion, 2010). The project concentrated on an exhibition to display some cultural objects specific to Switzerland and Singapore. It is reported that the participants were mostly satisfied from the project besides some complaints about the limitations like being far from the teaching sources and group members.

In 1996, 'ID-Online', an Asynchronous Learning Network (ALN) was developed for ID education at the University of Illinois at Urbana-Champaign, USA (Budd, Vanka, & Runton, 1999). The ID-Online project aimed to discover the potential to provide improved access to design-related resources and an online communication between students and instructors. Budd, Vanka, and Runton (1999) state that "from an administrative perspective these systems seem to work well and from the student perspective they seem to have little value beyond the academic requirements of the isolated class they relate to" (p.207). When Budd, Vanka, and Runton (1999) evaluate the ID-Online ALN system, they draw the following conclusion (p.213):

- It takes a considerable time and effort for developing pedagogically reasonable ALN supported courses.
- ALN methods are useful for most courses that require collaboration, information sharing, and exchange of multimedia materials.
- ALN facilitates teamwork, especially the cross-disciplinary team-work.

- ALN expands the formation of the design studio beyond its traditional boundaries and therefore it trains students to work collaboratively with the other disciplines in an online environment engaging in contemporary design challenges.
- Although ALN methods do not take the place of traditional ID education methods, do expand and develop instructional delivery formats swiftly.
- The enhancement of access of information and instructional delivery formats enable instructors to offer information and skill intensive courses such as, materials, manufacturing and computer-aided design.
- The increasing access to people makes the project-based studio studies stronger.
- Complex design issues can be solved more effectively because of the highly interactive sharing of idea with the design experts and fellows.
- The increased level of interaction of the ALN stimulates a productive critical dialogue among the faculty and the students.

In 1998, the VDS project called 'Multiplying Time' was conducted between Hong Kong University, Bauhaus University (Weimar), ETH Zürich, University of British Columbia, Vancouver and University of Washington (Seattle). Participants were asked to design individual places for a Chinese painter and a Swiss writer (Multiplying Time II, 2010). Participants from three different time zones work on a same design and the aim was expending the working period to a twenty four hour period with this time differences. The project composed of phases which are introduced everyday along with a new design issue and the last day, the final design proposals are evaluated through a video conference between three locations. The individual designs and design problems are discussed between participants and design experts and it was realized that although the participants did not know each other before, they can communicate through a common language (Kolarevic, Schmitt, Hirschberg, Kurmann, & Johnson, 1998). During the project, students were expected to share their design solutions through their digital 3D modeling, digital drawings and text explanations. Students could use any numbers of representations and additional images to present their design solutions. After sharing the works, students had to choose one work of another student and continue to develop that project rather than their own design. By this method, students were implicitly formed design teams (Kolarevic,

Schmitt, Hirschberg, Kurmann, & Johnson, 1998). At the end of this project, it was concluded and proved that students from geographically different places can collaborate through VDSs using the advantage of different time zones. In addition, Kolarevic, Schmitt, Hirschberg, Kurmann, and Johnson (1998) concluded that:

- Sharing design solutions and working on the others' designs decrease the competitive environment in design projects,
- in VDS environment, designers are able and willing to choose and continue to develop the best solutions, rather than continuing on their own,
- project development and management can be strengthened and improved by this kind of collaborative design environments (p. 7).

Zimring, Khan, Craig, Haq, and Guzdial (2001) have developed a collaborative online studio project (CoOI Studio project) expecting to be helpful for students in four ways (p.676):

- The students would be able to acquire a broader range of information and representatives of their designs.
- Students were encouraged to share their design ideas and explanations more clearly and articulately.
- Wide range of expertise and stakeholders' perspectives would be more accessible for students without sharing the same studio environment.
- Students had the chance of share ideas and information, and comment on each others' work asynchronously (without being available at the same time) through online collaboration.

Although CoOI Studio Project could not answer 'how does the online studio helps the students improve their skills in designing?' directly, Zimring, Khan, Craig, Haq, and Guzdial (2001) concluded that it has a positive influence on the students' and design teachers' perception of improving their design skills through online communication tools and using digital media.

In 2002, Boghetich, Ciuccarelli, Innocenti, and Vidari studied on, 'Design\_net' which was an information-based system for ID education and research. This system was working for the

online digital display, recovery and archiving of media sources of ID which are typically 2D graphics and 3D models. The project concentrates on the needs of instructors, students, researchers, and content providers interacting with the School of Design of the Politecnico di Milano, Italy. In addition, Design\_net aims to promote exchanging documentation and experience and creation and offers an open, integrated and collaborative environment to the users (Boghetich, Ciuccarelli, Innocenti, & Vidari, 2002). Project researchers state that “the system is deeply connected to the dynamic structure and organization of teaching of the Industrial Design Degree: experimental research on new didactic methodologies and tools and a systematic weaving of relationships with professionals, companies, associations and design-related institutions” (p.1). However, they argue that the complex features of ID projects related researches like; 2D and 3D files and diversity of content providers do not allow the system to be used easily, transfer and visualization of design knowledge. It seems that Design\_net project may have an advantage that the users work collaboratively through periodical face-to-face meetings and online chat rooms.

Sagun (2003) studied on collaborative design studios in her doctoral dissertation through an offered conceptual framework considering architectural elements, accessories, and their design elements. In study; an asynchronous Collaborative Design Studio (CDS) that engages information and a collaboration web site, is constructed and applied. The students are required to work on “Design for Disabled” course through benefitting from the information and experiences of the “design studio” courses. She states that; “the collaboration of two courses is a necessary issue in design curriculum since it would increase students` attention and understanding in using the knowledge and requirements in both of the design courses for their design projects” (p. 132). Students were also taking face to face critiques from other design instructors in design studio during the project development. These courses are all studio courses offered in the Department of Interior Architecture and Environmental Design at Bilkent University, Turkey. During the design practices, the participants were expected to submit design diaries as a brief explanation of the phases of the design of the object they work on. By this way, the students` progression on the project was observed and analyzed. According to the results of Sagun`s (2003) study, during the collaborative design, the issues on architectural elements, accessories, and the design elements are all

discussed on the Internet. Along with the participants' responses, solution spaces rather than the problem spaces were much more referred. Sagun (2003) interprets from this result that the participants do not have much difficulty in communicating design through the Internet. In addition, she observed that the students had a similar approach in the online practices with the face to face design studio during the project that they developed their projects in considering the features of their solution space based on the critiques. The results of the study (Sagun, 2003) indicate that all of the matters discussed in a traditional design studio are also discussed on the internet environment during the collaborative study with a different emphasis on the design issues varies.

As another example from Turkey, Öztoprak (2004) conducted a study to evaluate the utilization of online collaborative environments in design education through an online design studio course carried out with the cooperation of Middle East Technical University (METU), Turkey and Delft University of Technology (TUD), the Netherlands. The study was conducted as a nine weeks collaborative online design studio course between two remote universities. The ID students from METU were meeting the participants from Delft, in a video conferencing room providing a working area. At the beginning of that study, it was observed that students can not get rid of their traditional practices at first. For example, although students were using digital media on this collaborative online study, they used traditional media for sharing their hand sketches, and then they scan their sketches to share them. The evaluation jury of the project was held in a video conference room. Öztoprak (2004) observed some problems during the jury that the image quality of the representations was very poor and understanding the dialogues was hard because of the crowded environment. It was difficult to comprehend where to look, to projected image of the computer screen or to the camera. Students of this collaborative study were mainly communicating each other asynchronously and synchronously. They were sharing files through MSN or e-mail. Öztoprak (2004) concluded that opposing to the literature he reviewed, the number of sketching, design concepts and solution alternatives had not changed significantly in the VDS and VDSs are useful except necessity of desk reviews and critics. However, it is not consistent to concede that VDS must completely take the place of traditional studio environment because real time face to face interaction is completely

different from synchronous or asynchronous communication within virtual digital environment. Therefore, it is an arguable subject that VDSs are effective or not and whether VDSs will completely take the place of traditional studio environment or not. Though, VDS projects and researches has been conducted for developing software and content to make the application as effective as probable because in today's technological world, it is not possible to ignore the integration of digital and communication technologies to educational settings for ID field that is implicit in the development of technology itself.

In 2008; Blevis, Lim, Stolterman, and Makice studied on online design studio called "design eXchange" through "wiki" software that can support online collaboration. The motivation of the research was creating and supporting design tradition in the framework of design in general and human-computer interaction design in particular. In fact, the first iteration of "design eXchange" was in 2005 and the first Design eXchange system as wikis was used as a course management system to provide a sense of virtual design studio space for Human-computer interaction course. In the project conducted in 2005, it was aimed to mix the physical properties of the design studio and virtual support of wiki. They print wiki articles as cards and give each card a barcode. Then, the barcodes of the physical cards are programmed to match the associated virtual article and its illustration. After these studies, Blevis, Lim, Stolterman, and Makice (2008) decided that much more things are needed to be done to develop a virtual design studio. They studied on the second iteration of "design eXchange" to make the students be interested in sharing and reviewing design works collaboratively with the design experts, instructors and fellows through the world. The results of the second iteration of "design eXchange" prove that the second one more effective that the first "design eXchange". While the students in the first study claimed that it was embraced, in second one most of the students find the virtual studio "Design eXchange 2" natural (Blevis, Lim, Stolterman, & Makice, 2008).

In 2008, Gül, Wang, Bülbül, Çağdaş, and Tong study on a collaborative design learning activity between the University of Sydney (Australia) and the Istanbul Technical University (Turkey). In this collaboration, students from these different countries are expected to work on designing collaborative virtual environments. The tasks were; developing, analyzing, and

constructing a web application for design collaboration. With this project, the students practiced asynchronous and synchronous collaboration and learn from their own collaboration processes (Gül, Wang, Bülbül, Çağdaş, & Tong, 2008). The project aimed to support design students to develop an understanding of using collaborative virtual environments as the new kind of design and communication environments.

In 2008, Syracuse University, (New York, USA) has established a collaborative design laboratory called “COLAB” to initiate interdisciplinary collaboration and visual thinking for students and faculty members from various disciplines through the world to solve complex, real world design problems. Although establishment of COLAB is new, its idea has been in consideration by IDSA President Arthur Pulos and Chair of the university’s Department of Design since 1960s by considering that design should act as a bridge across disciplines and across colleges within the academy (Core77, 2010). To solve variety of problems, COLAB works on a charrette format, which means working within an intensive design project collaboratively in an intensive effort for completing the projects before waiting the deadline that it offers flexibility in length, depth and scope. For COLAB activities which are very dynamic and intensive, a suitable place is allocated which is the new home to all of Syracuse University's design programs’ students, instructors and the other participators. Figure 2.1 presents the COLAB space and in figure 2.2 students are working together at COLAB.

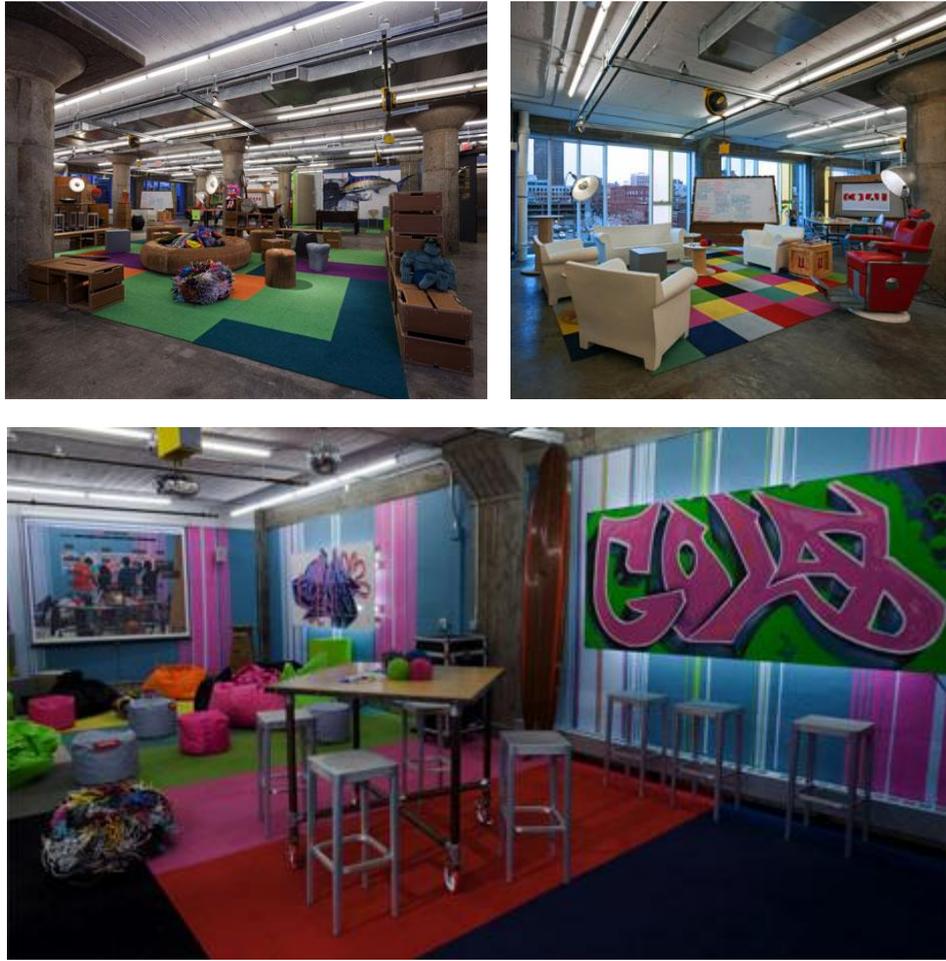


Figure 2.1 the COLAB space. (Core77, [http://www.core77.com/blog/featured\\_items/colab\\_a\\_laboratory\\_for\\_collaboration\\_and\\_serious\\_play\\_by\\_shoham\\_arad\\_\\_16513.asp](http://www.core77.com/blog/featured_items/colab_a_laboratory_for_collaboration_and_serious_play_by_shoham_arad__16513.asp))

In an article posted by Core Cloggers (Core77, 2010), it is stated that the COLAB projects represent effective, relevant and critical model for education which is nourishing by a broader academic level and an intense collaboration of students and instructors.



Figure 2.2 Students working together at COLAB. (Core77, [http://www.core77.com/blog/featured\\_items/colab\\_a\\_laboratory\\_for\\_collaboration\\_and\\_serious\\_play\\_by\\_shoham\\_arad\\_\\_16513.asp](http://www.core77.com/blog/featured_items/colab_a_laboratory_for_collaboration_and_serious_play_by_shoham_arad__16513.asp))

In 2008, Achieving Transformation, Enhanced Learning & Innovation through Educational Resources in Design (ATELIER-D) project has been established. ATELIER-D is a two year project that is still continuing by the time this thesis has being written. The project aims to transform the design curriculum delivery of the Open University (OU), UK that will be described more in detail in the section 4.3.1. ATELIER-D's main objectives are; to develop and enhance online delivery of design courses, to explore the potential of various virtual studio tools, and to define what skills these lead to. Basically, the project will look at the

development of a VDS space to support student learning throughout the design program. As the program is currently continuing, not yet a conclusion is drawn.

Recently, Chen and You (2010) conduct a study to scrutinize students' attitudes towards and perceptions of using the Internet and information technologies to mediate a design studio course. They state that "the students thought that using the Internet to mediate design studio learning had positive influences on course objectives, content, activities, and delivery methods, on instructors' pedagogies, teaching strategies, students' evaluations, and course organization, and on the learning motivation, course participation, performance, and learning process of students" (Chen and You, 2010, p.168). However, as Chen and You (2007) proposed after their research on synchronous and asynchronous communication, in 2010 they again suggest that further researches are needed to draw a conclusion about this issue because although the results of their study are positive, some aspects should be clarified that using internet technologies have many advantages and great potential in design education, but they are not exclusive of risks.

Other than online collaborative VDS, a new trend has arisen that carrying the students completely away from school environment, namely online distance ID education. This kind of design education is different from design curricula including VDSs since there are no any face to face design studios or other courses in traditional means. Whole design training is through distance online courses and online educational environments. As discussed previously, there has been a tremendous transition from traditional design studios to virtual environments. However, it is arguable that whether it is possible to carry ID education completely away from the traditional design studio in the future or not. "What future will bring?" is a key question for industrial design education and there are always predictions and discussions on the future developments and trends. Before starting to explore the main issue of this study which is online distance ID education, it would be beneficial to overview the discussions and comments on the future of ID education and look for whether online ID education discussion has a place in the future of ID education debates. The following part will present arguments in future of ID education.

## 2.6 Future of Industrial Design Education

How design education evolves in the future is the common important question between designers and design educators. In this rapidly changing world; the question of what the future products will look like and how industrial designers will keep pace with the changes, gain importance. For this study, it is important to discuss whether online distance education is a subject that is being considered for the future of ID education or not. There are various arguments on the future of ID education. These arguments include values, and global and environmental issues on ID education. After mentioning these generally, as the main concern of this thesis it is worth to mention the arguments and predictions related with the development of information and communication technologies.

In 2006, Janet Abrams, University of Minnesota (USA), and David Kelly, IDEO and Stanford's Design School (USA), debate two perspectives on the future of design education, Productive Design and Design Thinking (National Design Museum, 2010). According to Abrams, design is a system of values. These values are various predetermined ideas and options described that we were subjected to. It is important to make design students aware of these values because they are also pushed into these ready formed design ideas. Abrams (2006) asserts that "design is a form of political engagement because it is about shaping the systems of living and in so doing, we are shaping possible, probable, and preferable futures". Because of these defined patterns, a new paradigm called "productive design" appears. Here, design can be sit between art and engineering for creating how to design rather than reshaping the existing ideas. The design might affiliate in mechanical engineering, computer science or other technical fields. On the other hand, Kelly mentions that a new program called "Pratic Design" which is a joint program between engineering school and art department pioneering the combination of art and engineering. For the future, Kelly (2006) thinks that the thinking notion will change as design thinking. It will be important for all disciplines to develop design thinking. According to Kelly, therefore, all students from all disciplines should be trained through design thinking that is developing empathy for people. Through this discussion, future will bring educating designers through productive design without hanging out to the existing norms, and educating the designers and other disciplines'

students through design thinking are discussed. However, the other developments and evolution in the design field and education are not adverted.

In 2008, in a dialog on the future of design education between Naomi Gornick from University of Dundee (Scotland) and Ian Grout from The Glasgow School of Art (Scotland), it is stated that it is required to look on the world itself to be able to make predictions about the future of design education. According to Grout, the future is increasingly unstable and less easy to predict but unavoidable from new challenges. Gornick states that the design education is very rooted while other areas can easily adapt to new global conditions (Gornick & Grout, 2008). However, the main idea behind their dialog is that, there will be a continuous exchange in ideas through culturally diverse collaborative network, the awareness of global changes in industry and society will be a critical concern, and sustainability and making sustainable design will be more common in the future. In 2009, Andrew Caruso who is the director of a design firm with 32 worldwide offices asserts that curiosity is the greatest road map for the future of design profession and therefore educating designers in a way that increasing their curiosity towards the world gains importance. Design students should be trained relying on developing the confidence in exploring the unknown with a creative curiosity. In addition, According to Caruso (2009), design education should not be clicked on the walls through design studios but the students should study while experiencing other cultures, broad collection of interests and ideas, opportunities and the world itself. Design is a collaborative activity in its nature and therefore, collaboration in a network composed of people, disciplines, resources, economies, culture, and histories. In the future, design education must support these collaborations to design and produce meaningfully, thoughtfully, and reasonably (Caruso, 2009). As Abrams (2006), Caruso (2009) state that design education should break the walls and trust the instincts arise from the curiosity. It is argued that if the design students are free to create their own projects, they would be more successful. In addition, future of design profession and design education makes necessary to discard from very traditional ideas and focus on new perspectives (Caruso, 2009).

Varghese (2009) writes about “What will the education of 2050 in the classrooms of 2050?” Although it is difficult to find a definite answer to this question; Varghese (2009) states that: “

All that can be projected is the possible creation of configurations of space and spirit whose inhabitants will be caught in the gap between past and future and perhaps gain experience in how to think and to accept and cope with ‘mutations’ that are the result of increasing mash-ups powered by technologies (p.1)

Mash-up technologies are the technologies that include various things and a derivative of joint of programs to create different digital media. Here, Varghese means that the predictions of future of design education can be made through catch up the configuration of gap between the past and the present and dealing with experiences resulted from the deep change in the technological applications. It can be imagined that in the classes of 2050, the students and instructors will be studying and formulizing, finding the ways of world making and ways of knowing that the working environments might be “configuration of spirit” (Varghese, 2009). Varghese claims that the emphasis will be expected to be on the process rather than products as a part of a ‘methodology of hope’ that looks for models or approaching.

Future interpretations of Kwon (2009) are rather different from the ones mentioned above. He introduces three possible future scenarios, “Design Odyssey 1.0, 2.0, and 3.0”, to define the possible position of design education in the future:

#### *Design Odyssey 1.0*

Currently the world has been going in an unpredictable future that natural sources has been swiftly distorted and consumed. It is time to educate design students in a way that they will be willing to explore new types of design knowledge for achieving to solve complex design problems to develop renewable energy, restore our infrastructure, and repair the educational system. Design collaboration with engineering, technology, and business management will support sustainable studies through integration of interdisciplinary, collaborative, active, participatory, situated, and constructivist learning will introduce a new paradigm in design education (Kwon, 2009).

### *Design Odyssey 2.0*

Kwon (2009) states that “we are entering the “Renaissance Era,” where information goods can be created, distributed, consumed, and shared with people” (p.5). Through the internet technology and communication tools, all people can reach all kind of information through the world and the boundaries between places and time restrictions disappear. Sharing ideas through collaboration is important for design education and through this way design education will enter the Renaissance Era mentioned above because of its nature including interactive, integrative, and creative thinking.

### *Design Odyssey 3.0*

For this scenario, Kwon (2009) states that; “we are entering ‘Transcendent Era of Designocracy’” (p.5). According to him, design industries have to search for non-economic systems because of the prevalence of digital life style and weakening mass market. In the future, because designing for people and communities has evolved, people will have a democratic right to contribute to the new design system of world. Therefore, a change in design profession and education requiring authenticity, empathy, collaboration, and transparency will be necessary

Kwon (2009) claims that this model of three future scenarios is a multi –layered contextual paradigm model for design education. That is, if the first scenario does not come true, the future versions also do not upgrade. This means most important scenario is the first one which is related to the sustainable issues that is capable of changing the design industry, policy, and education totally.

As another different point of view, Choi (2009) defines and summarize the future of design education by emphasizing the components of design education of past, present and future (Figure 2.3).



Figure 2.3 Evolution of design education components (Choi, 2009)

As Kwon (2009), Choi (2009) also thinks that the most striking changes in design education will be related with the changes in values, world resources and global interactivity.

In addition to the future arguments related with values, and global and environmental issues, there are also predictions about the development of information and communication technologies. For instance, according to Boycott (2009), in 40 years, technology will allow delivery of design education to be outside the classroom or studio environment. There are great possibilities for online distance design education like the programs in Open University because internet allows for huge interconnectivity in the society and this will be developed in the future more. And this interconnectivity will allow design education to evolve through new trends and applications. Boycott (2009) states that;

“In 2050 the world will be a place where design knowledge has spread to all corners of the earth. Designers from developing countries will have reaped the benefits of interconnectivity and will be avoiding the mistakes that developed countries made while they became industrialized” (p.3).

However, Boycott (2009) believes that, for design discipline, it seems it is impossible to replace instructors with videos of lectures like other disciplines because a design teacher must be able to give feedback on numerous different aspects of their student’s projects, face to face or through internet. Furthermore, he also believes that developments in

information and communication technologies will harm the globe when the societies become more connected. Therefore, it is important to take environmental issues like sustainability into consideration more and the development of technology must be adapted to use for saving the globe. In the future, all disciplines, economies, and societies have to change towards supporting the world to become a sustainable place (Boycott, 2009).

Haats (2009) advocates that; the power of technology will be effective in the future. According to him, in order to predict the future of ID education, it is important to evaluate the future of ID profession. Haats (2009) thinks that, in the future, design profession will become a co-operational discipline that users and designers work together to find design solutions, and technology will be a key tool for all level of design practice. Therefore, according to Haats (2009) design education will evolve in a way that students will learn how to design collaboratively with users and usage of digital tools, communication and information technologies will be unlimited in ID education. Likewise Haats, Baek (2009) emphasizes the importance of virtualization of design education that place and time limitations disappear through online technologies. Therefore, the possibilities of online learning environments will be developed more in the future and online learning communities will be the main driver of virtualization of design education. In the future, design students, instructors and experts will be collaborating through online virtual environments more commonly (Baek, 2009).

The future arguments related with technology integration or VDSs were most prevalently made between 1990s and beginning of this decade. The future mentioned in those arguments claimed the present and the subject of discussions on future of design education shifts from technology to global issues. For example, in 1997, Simoff & Maher mention VDS as the trend of future and they state that VDS is most likely to evolve in the following directions:

- Type and effectiveness of web tools will be extended
- There will be additional design supporting systems like web-based design supporting interaction through the web

- VDS will give a sense of place like studying on the same studio with fellows collaboratively
- Online educational materials will generate dynamic interactions according to the requirements of design students.

In addition, Dunn (2000) writes the predictions about higher education and asserts that, in the future, the traditional campus will be replaced with online universities. Dunn's prediction has gained a speed in coming through for many disciplines. Currently, the content of the future arguments on design education seems to be changing because completely online distance delivery of ID education have not been matured yet and they are tried to be developed and enhanced. The next chapter will present the structure, mechanism and presence of online schools or programs of ID.

## CHAPTER 3

### ONLINE DISTANCE INDUSTRIAL DESIGN EDUCATION

#### 3.1 Distance Education

Distance education in different forms has been in the field of education for a long time and it has a long and prosperous background of over several decades. The starting point of many distance education program throughout the world depends on the need for education in rural or inaccessible areas (Jonasson, 1997). During the course of time, newer technologies like the radio (1920s), instructional television (1950s), satellite downlinks (late 1970s and early 1980s), cable TV (1970s), and videoconferencing (VDC) through interactive compressed video (1980s), have come into play to offer unique opportunities for distance education (Monolescu, Schifter, & Greenwood, 2004). Recent form for delivery of learning materials and communicating is online (Web-based) which enable students to be completely away from the school environment while studying through a freedom of time and space restrictions.

The most important advantage of online distance education is that both students and instructors are free from restricted course hours and space; and, this way of learning and teaching moderate time and location constrains in education (Sagun, Demirkan, & Goktepe, 2001). The 'Virtual Classroom' project has been the first wholly online undergraduate classroom, which was launched in 1986 by Murray Turoff at the New Jersey Institute of Technology (USA). In addition, the first large scale online courses, Open University (OU), were developed in the United Kingdom (UK) by the end of the 1990s (Shao, Daley, Vaughan, & Lin, 2009). Although distance education is not a very new experience, in recent times there has been increasing number of novel higher educational institutions offering online distance education especially in USA.

Distance education has been highly transformed over the past few decades through the swift advancements in technology which recently enables online virtual environments for teaching and learning (Adrian, 2000). Many forms of distance education in which communication provided through video or telephone conferencing can be thought as different from online distance education. For example, online distance education can be thought as a medium that students are mostly study individually and distance from the source of information or school environment. On the other hand, in other forms of distance education, a group of students can be given some courses by a distance instructor through video conferencing tools. Traditionally, distance education environments were based on the communication through passive media like paper, audio and video broadcast but through the developments in network and communication technologies, distance education can reach excessive amount of individual with online courses (Schrum, 2000).

In the online form of distance education, the opportunities of multimedia and interaction capabilities of World Wide Web are unlimited to support the most feasible distance communication. According to the literature researches of Russell (2008), universities supporting distance learning have been taking the advantages of new technologies for students and have a faster progress than the traditional campus universities. This situation might be different for the disciplines like design that involve a complex blend of physical and theoretical skills.

### **3.2 Online Distance Design Education**

As explained in the previous chapters, design studio is the indispensable of ID education and it makes ID education considerably different than other disciplines' education. For example, in ID process the usual end products are represented by 3D models or 2D drawings rather than plane texts and plain representations. It is not simple to transmit design knowledge to the students in the same way as regular theoretical course contents because design process mainly depends on problem solving activities that design content must be shared and discussed with other individuals from both the design field and the other disciplines (Chen & You, 2010). Therefore, the online ID education is seems to be as it must be developed

differently than other courses offered online throughout the world (Broadfoot, and Bennett, 2001).

Online learning environment for design education is expected to both include the basic requirements and elements of an online distance education platform and additional properties like virtual design studio applications and various computer-mediated design tools. Chen and You (2003) proposed a framework for the development of the online design learning environments (ODLE):

- The course, instructor, learner and internet are the four basic components of ODLE.
- Three-level platform is proposed for an ODLE: Community, classroom, and Studio.
  - With the community platform of ODLE, design students can be able to exchange their ideas through an open space.
  - Classroom component of ODLE provides a range of asynchronous design courses.
  - Design activities and discussions of design studios can be conducted synchronously in the online environment through virtual studios of ODLE.

Chen & You (2003) also concluded that the course, instructor, learner and internet components had three key factors by considering the relationship between four components and ODLE. Figure 3.1 visualizes the ODLE's four component and their key factors.

To revise, because ID education has many variables depending upon the nature of ID education which based on studio practices, and visualization and presentations of design ideas, when an online design program is established all the following listed components and their factors must be taken into consideration;

- Objectives, materials, activity and delivery of the course content;
- Evaluation, strategy, pedagogy, and organization for the Instructor;
- Cost, limitation, capability, and accessibility of Internet;
- Performance, participation, motivation, and process of the learner.

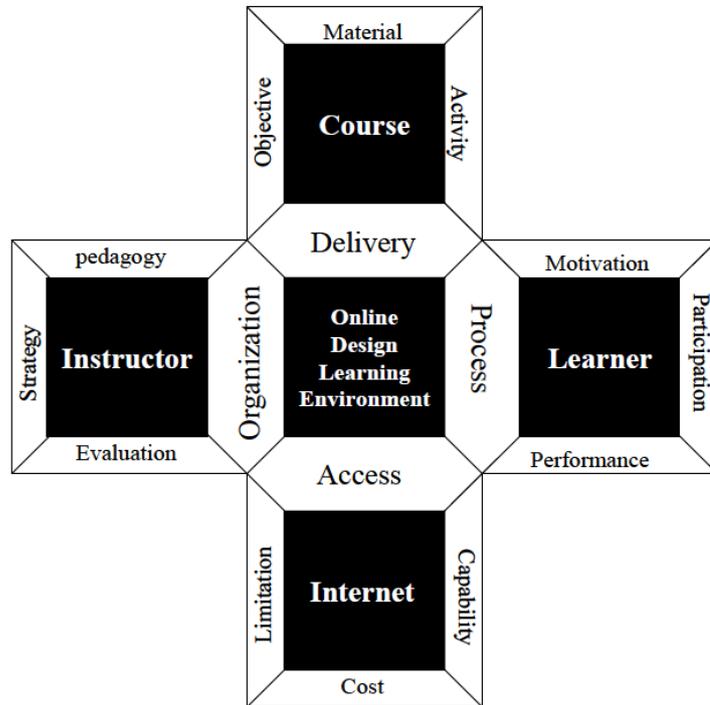


Figure 3.1 the framework of online design learning environment (Chen & You, 2003, p.4)

### 3.3 Researches and Applications of Online Distance Design Education

Researches on the applications of online tools for ID education have been conducted to shed light to the design profession and its education. For example, in 2001; Sagun, Demirkan, and Goktepe study on proposing framework for the design of a web based studio course with respect to the nature of the design process. To support their ideas, an implementation of a sample web-based design course is prepared at Bilkent University, Turkey. Sagun, Demirkan, and Goktepe (2001), examine the sociological, ideological, epistemological and pedagogical aspects of a design studio for the management of the web-based studio:

1. in sociological level (p.338);

- Web based design course support communication between geographically distributed students and this also create opportunities for the disabled students who cannot attend the classroom.

- Communication between the students on different locations or on different countries supports the sharing of knowledge between a diversity of cultures that develop the cultural experiences in solving design problems

2. in ideological level (p. 339);

- Education geographically distributed students satisfied the maximum number of students who demand higher education.

3. in epistemological level (p. 339);

- The web-based design course aims global communication
- Instructors, designers, and consultants from whole over the world can support the design process of the students in web-based design courses.

4. in pedagogical level (p. 340);

- The characteristics of the design course, various learning paradigms, and professional practice are the main points.
- In web-based education, the students are no longer passive participant. They are aware of their self-control and responsibilities.
- Using computer mediated learning environment during the undergraduate level, make the students improve themselves in the professional level.

Sagun, Demirkan, and Goktepe (2001) conclude that, the design of a web-based system need very careful attention. They thought that their framework for designing of a web-based design course would be a guide for web-based course designers and developers. In addition, Sagun, Demirkan, and Goktepe (2001) define models of online education;

- The “individualized instruction model”, is a text based model on which learner and instructor interact one-to-one.
- The “class model” of web-based education support students work together and with the instructor like a real classroom.
- The “integrated class model” is a model which class model is enhanced by the research activities and audio, visual conferencing.
- The “group model” supports groups of students work collaboratively.
- The “collaborative group model” is a model in which groups of students can interact with groups of instructors with collaboration with other experts.

Park (2008) have studied online visual design course from a different point of view; through the pedagogy of design studios on which the students actively work on design problems, share ideas and get face to face feedbacks from the instructors. According to him, to achieve a successful online design studio, it is very important to correlate the design studio education with the online studio environment appropriately. Park (2008) state that although it is possible to communicate through web-cam technologies or video conferencing technologies, there are still concerns that whether current online learning technologies are functionally able to alternate for face-to-face experiences of learning or not. The study aims to make students understand principles and elements of visual design and how these can be applied in digital environments. Students were expected to develop innovative design solutions which combine form and function. The feedbacks from the students were mostly positive however there are also complaints about the different levels of computer literacy that causes students to have some difficulties in their learning and communication. In addition, Park (2008) concluded that, the online courses changed the role of instructors that they became a moderator that guide the students to uses the system and to communicate because all the interaction, discussions, critiques and sharing ideas eventuate in the online environment. However, it is important to take the course content into consideration that the expected projects was visual design but not a product design that is necessitate 3D models or handcraft activities.

Today, although the number of online distance ID programs is determined as four, this type of education delivery has begun to be more widespread in higher education for many fields of studies one of which is ID field. Following part will present the current situation of online ID schools or programs.

### **3.4 General Overview of Current Online Distance Design Programs**

United States (U.S) has been the pioneering country in the web-based applications and course delivery of design courses, and availability of sources, programs and applications of online distance design education of U.S are more accessible. Therefore, in this study; almost all the country's ID programs have been scanned and the available ones are covered. American schools will be more denoted because of being numerically dominant.

According to the recent findings, there are 95 featured Art Schools and Design Colleges in U.S. (Learn 4 Good, 2010). In addition, Industrial Designers Society of America (IDSA) listed 59 academic ID programs which have been evaluated and accredited using the standards and guidelines adopted by The National Association of Schools of Art & Design (NASAD), as of May 2009. Moreover; today, NASAD has approximately 297 accredited design schools, colleges, and universities throughout the world.

Considering the overall picture of the availability of ID programs, presence of online ID programs are not as much common as traditional ID programs because giving ID education to the distance learners through internet is a recent activity in design profession. Although there are many wholly online distance designs course activities like graphic design, 3D modeling and animation, multimedia design, web design, digital arts, interior design, and architectural design; there are few online ID programs most probably because of the nature of the ID education.

#### *Higher Education Institutions Supporting Online Distance Education*

Recently, there are 26 featured online art and design school divisions of universities and colleges.

These online divisions of higher educational institutions offer various design degree programs in graphic design, web design, fashion design, floral design, interior design, design management, animation and visual effects, architecture, photography, and ID. These programs give student the opportunity to decide when and where to attend classes as long as the students have the internet connection.

The basic aim and objective of online design divisions of the universities and colleges are similar; to access more people without bringing them to the campus, and give them flexibility in their schedules. In fact, one of the main purposes of these programs is making money through a cost-effective design education. Although there are financial aids for students, most participants pay a certain amount of money to get all of these programs.

In addition to the higher education institutions, there are four conspicuous online organizations or programs that give online art and design training which are;

- Session College/ Sessions College for Professional Design
- Studio Sessions
- Designboom Design Education Online Courses/ Design Aerobics
- The Omnium Project

These programs are independent programs. They are not an online division of any university but they have established online design education courses. Structures of these programs are briefly defined below:

America originated **Sessions College** is the first accredited online design school which has been established in 1997. It is accredited by the Distance Education and Training Council (DETC) and the Middle States Commission on Secondary Schools. Moreover, the Sessions College is licensed by the Arizona State Board for Private Postsecondary Education. The online college offers Associate of Occupational Studies (AOS) degrees in Graphic Design and in Web Design. AOS is a condensed two-year professional degree for preparing students to be graphic or web designer. This condensed program mainly focuses on design courses rather than general education courses. The proposed courses are prepared and presented by design professionals. Students are expected to make a portfolio until completing the two-year concentrated program.

In addition to AOS, Sessions College offers certificate programs in graphic design, Web design, multimedia arts, digital arts, marketing design, game art, and fine arts. Moreover, four-year Bachelor of Science in Design Management (BSDM) degree is proposed through an educational alliance with Aspen University. Sessions College for Professional Design offers more than 80 courses that students have to pay for.

**Studio Sessions** is another online design training program which is one of the numerous programs giving various kinds of visual design trainings like graphic and web design. Studio Sessions is a free program offering professional design critiques, portfolio-building projects,

and design tips and techniques to graphic and web designers from over 100 countries. These kinds of free tutorial based visual design training programs are not for getting professional academic degrees but for self-improvement.

***Design Aerobics*** is also non academic online design training program. Its approach is different than the others. In fact, Design Aerobics concentrates on online ID courses by offering different kinds of ID course concepts like; on the move, revisiting history, technology gadgets, sports, food, and spirituality. Because Design aerobics offer completely distance online ID courses, it will be scrutinized more detail in the next part.

***The Omnium Project*** is an online project that support design students to study collaboratively in the virtual environment. The Omnium project is a relatively big project than others because it also supports many major projects like Creative Waves (CW) COLLABOR8 that will be described.

A group of artists and designers around the world carry out the Omnium Project through Online Collaboration and Creativity (OCC). Figure 3.2 represents the independent fields of references that have been identified by The Omnium Project (Bennett & Dziekan, 2005). The technical system in this project is formed by integrating three fields of reference to encourage collaborative online creativity for visual artists and designers. Omnium has attempted to remain in 'sync' with the many ways that creative professionals now embrace and incorporate collaboration and online technologies into contemporary working practices (Omnium Research, 2009).

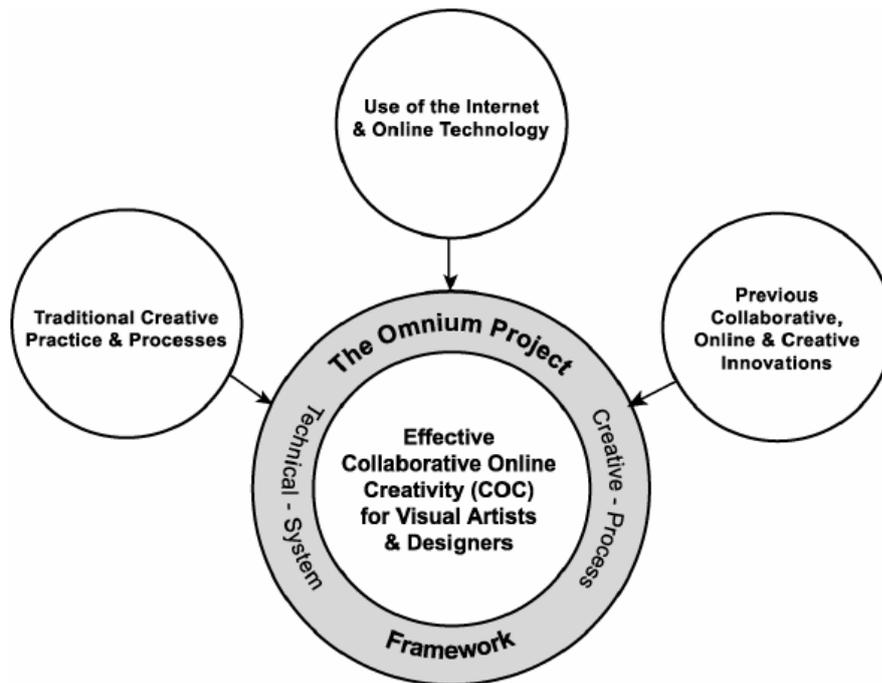


Figure 3.2 The Omnium Project framework (Bennett & Dziekan, 2005, p.3)

Omnium has conducted a series of fully online projects involving researchers, academics, professionals and students from all around the world. Creative Waves (CW) is world's largest international online students design project forming an online community of students, educators, and design professionals to explore collaborative online creativity (COC) that is lead by Omnium. CW is arranged every year in different countries with different concepts since 2005. For example; in 2008, CW COLLABOR8 is conducted as an eight week online art and design projects between universities in Australia and China. COLLABOR8 aimed to create awareness about the importance of cross cultural design practice and sustainability in design. In that project, the students worked collaboratively to design graphics for contemporary, environmentally friendly and sustainable ceramics, textiles, products and environments. The program was composed of online lectures, discussions and forums for design students to discuss their ideas and produce design concepts and practical design solutions. Figure 3.3, 3.4, 3.5, and 3.6 show some students' products from COLLABOR8.

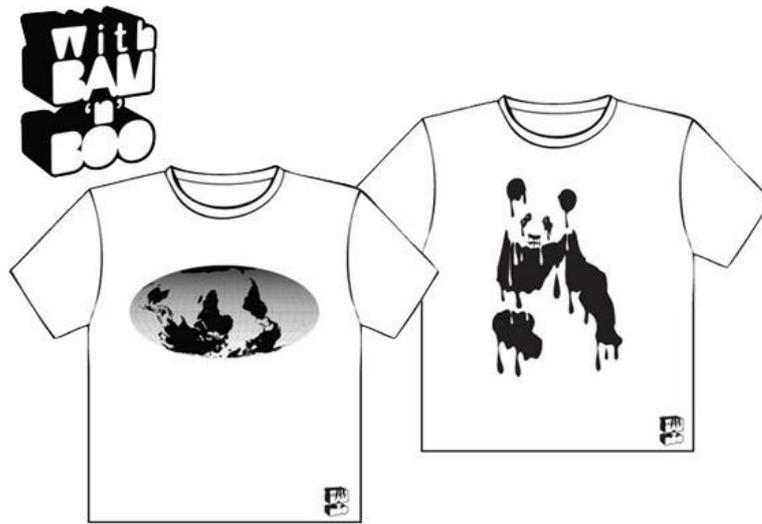


Figure 3.3 A T-shirt designed by a participant of COLLABOR8, 2008 (Collabor8 - Creative Waves - 2008/2009, <http://omnium.net.au/research/projects/>, retrieved on May 28, 2010)



Figure 3.4 A Visualization created by a participant of COLLABOR8, 2008 (Collabor8 - Creative Waves - 2008/2009, <http://omnium.net.au/research/projects/>, retrieved on May 28, 2010)



Figure 3.5 A Graphic design by a participant of COLLABOR8, 2008 (Collabor8 - Creative Waves - 2008/2009, <http://omnium.net.au/research/projects/>, retrieved on May 28, 2010)

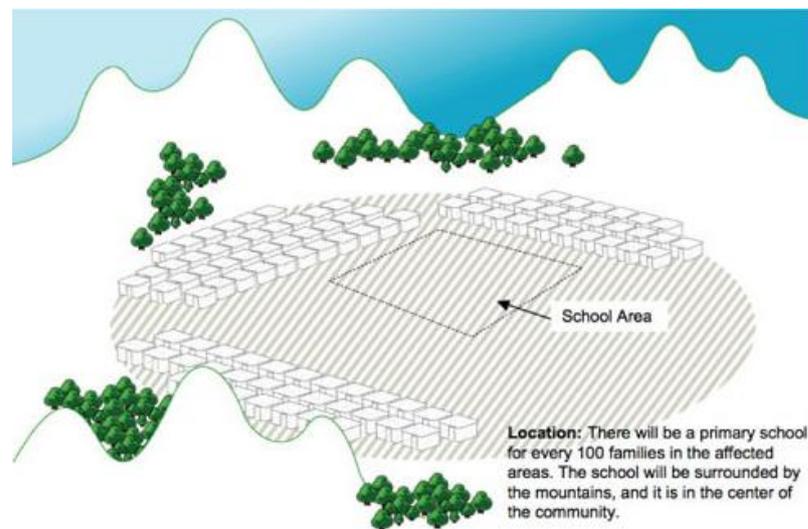


Figure 3.6 Design of an environment by a participant of COLLABOR8, 2008 (Collabor8 - Creative Waves - 2008/2009, <http://omnium.net.au/research/projects/>, retrieved on May 28, 2010)

According to Bennett and Dziekan (2005), Omnium Project explores the potential to comprise the internet technologies with collaborative creative applications and to launch new opportunities for visual artists and designers to work collaboratively despite the boundaries of culture, language, time and different disciplines. They highlight the importance of working with people whom normally might not meet. Therefore, Bennett

and Dziekan (2005), affirm that creative process and technical system of Omnium make the project a practical software package for artists and designers.

Bennett (2003) questions whether the Omnium Project achieved its aim to produce a user-friendly interface (system) and effective online collaborative working process (approach) for designers or not and he states that “the Omnium Project takes comfort in the fact it is not merely replicating or copying what has gone before in a ‘real’ world context, but thinking about the Internet’s unique potential to be an exciting and enjoyable environment and more importantly, actually making it happen” (p.12).

Up to this part, researches and studies on online distance design education are presented. The studies and applications mentioned were basically distance but they were a part of a campus based program or they were related with any other design subject but not ID. In this thesis it is aimed to make the emphasis on the entirely online distance design programs that offer ID related courses. In fact, the main focus is on the programs that are completely irrelevant to the campus environment and established for completely away participants. Following part is presented this kind of programs that are explored during the researches of this thesis.

#### **3.4.1 Entirely Online Distance Industrial Design Programs**

To summarize the information given above, totally three of 26 online art and design universities or divisions and one independent online program offer wholly online ID training. These four programs can be accepted as the first four of their kinds;

- Online Industrial Design Program in the Academy of Art University, USA
- Kaplan University, Singapore
- The Open University, UK
- “Design Aerobics”, Designboom Design Education Online Courses

The Academy of Art University and Kaplan University are basically campus based universities that also offer online programs. On the other hand, Open University is online

university serving distance programs to the students. Unlike others, Design Aerobics is an online program that offers concept ID programs. In this section, current conditions and characteristics of these four programs will be presented. All are recognized and prominent entirely online design schools' serving students who require or desire to take ID degree distance from a campus environment.

*Academy of Art University, USA*

The School of Industrial Design of the Academy of Art University is basically a campus based program. Beside its traditional course contents, it also offers online degrees of MFA, BFA, and AA degree programs.

In the MFA online degree program, 78 credits are needed to be completed. In this degree, Students work independently or in groups for the projects under the guidance of the instructors who are professional designers in the field. The online ID program is like the traditional ID program that both have instructors, advising, and staff. The only difference is the way of interaction that is through the web where students interact via e-mail. The communication is asynchronous and students are free to get the courses whenever they want. The course content, discussions, lectures, and assignments are always available. There are time intervals to complete and submit assignments. Participation is necessary and the students around the world can participate but this has been exceptional so far. For graduation, students are expected to propose a project for their thesis to a review committee and after the approval of their projects; students continue the program for three semesters of Directed Study with faculty mentors and experts in industrial design or fields relevant to the student's research. During the master program, design students are offered courses in; design aesthetics, digital technology, critical thinking, and communication fields.

For the BFA degree, initially students have to take fundamental design skills courses which are drawing, model-making, and digital media. After completing the first semester with these courses, the students are assigned to projects in which they apply their knowledge and skills attained from previous semester. In BFA degree, students are expected to

complete 132 credits before graduation. At the end, they are expected to do final projects including the design phases of market research, concept development and refinement, aesthetic perspective, design finalization, and final presentation.

The BFA program concentrated on furniture design, product design, toy design, and transportation design. Figure 3.7 shows some examples of online ID students' projects.



Figure 3.7 Sample Projects Created by Online Students (Online Student Art Gallery, Online ID Program, Academy of Art University, <http://media.academyart.edu/online/>, retrieved on May 1, 2010)

For the fall 2010 Semester, online ID school of the Academy of Art University offers 33 courses which are; Form Development, Design Problem Solving, Perspective for Industrial Design, History of Industrial Design, Design Drawing, Model Making, Computer Drafting, Product Design, Digital Imaging, Digital 3D Modeling, Transportation Design, Materials and Processes, Transportation Drawing, Graphics & Portfolio, Design Project, ID Drawing, Digital Design Tools, Intermediate Digital 3D Modeling, Introduction to Digital 3D Modeling, Advanced Digital 3D Modeling, Directed Study, and Internship. The courses that will be taken in that semester are presented in the Academy of Art University Online web site and

students can reach all the information about each course by clicking it. The following information about the courses is given in each course's web site:

- Description of the course
- Course learning outcomes
- Sample outline of the course
- Necessary supplementary books' information
- Necessary materials for the course
- Ordering instructions for the materials
- Workspace definition
- Required software and hardware
- Media needed to be downloaded
- Grading Policy
- Discussion

First two years of the BFA program is similar the AA program in The School of Industrial Design of the Academy of Art University. In this AA degree which is composed of 66 credits, students are introduced to the field of ID.

As seen from the course definitions, all the necessary variables and factors are defined in detailed under the titles above. For example, model making course focuses on basic model making skills and it is expected to teach students about model making materials, shop tools, hand tools, measuring, basic drafting and layout techniques. In addition, there are some online videos showing students the techniques and tricks of some activities like drafting or templating the foam mold. Figure 3.8 and Figure 3.9 are screenshots from the drafting and templating the foam mold videos of learning by watching part of online ID program. Although the digital imaging and modeling courses introduce basic digital tools commonly used in the field of ID, through the program students use these tools just for that courses' projects. Actually, the most surprising thing related with the model making activity in an online course is that students are working with wood, acrylic, rigid foam and casting resin to make projects of their own design instead of using digital imaging and modeling software. Students are expected to order the desired materials from various vendors and

are suggested to access to a well-ventilated working space for making the necessities of the course. However, the expected materials are not very easy to handle and afford. There are big and heavy pieces that it will be difficult to find a place to work with and store them, and they are expensive. For example; a disc sander, a band saw, and a bench drill press are some of the required items for the model making course.

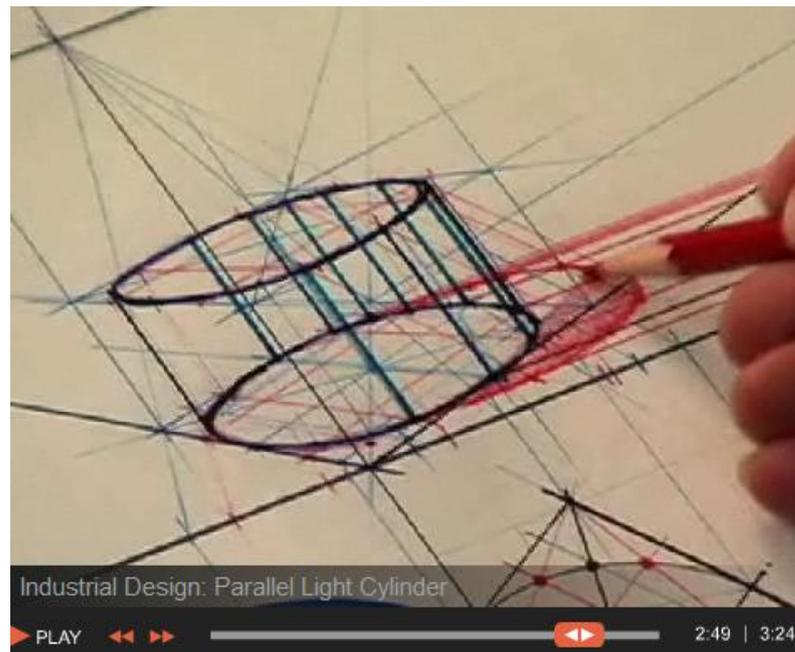


Figure 3.8 Screenshot from Drafting Video, Parallel Light Cylinder (Learning by Watching, Online ID Program, Academy of Art University, <http://media.academyart.edu/online/>, retrieved on April 29, 2010)



Figure 3.9 Screenshot from Beginning Shop Video, Templating the Foam Mold (Learning by Watching, Online ID Program, Academy of Art University, <http://media.academyart.edu/online/>, retrieved on May 1, 2010)

Although the distance ID courses of Academy of Art University are actually online distance education, the students are trained with traditional methods remotely. They are still using their handcraft skills while learning how to design and solving design problems. In addition, using CAD tools in a VDS is required an extra effort because the students who will use these technologies must be trained to use them before beginning the ID education through these tools. Then saving time and money, and reaching many students approach of distance learning becomes pointless. However, although the mechanisms of the courses are same as the traditional ones except being far from the teaching sources and studios, the most important thing is missing which is working, designing and sharing ideas in a collaborative environment. Of course, communication and discussion is possible in the online environment however in this program discussions are asynchronous. This means students can participate in discussions, ask questions or get feedbacks but not simultaneously with the instructors or other students like in the collaborative VDSs. In addition, while working or making models or drawing; the students are working individually in their specific places. Şenyapılı and Karakaya (2009) studied the classroom preferences of design students in the

project lifecycles. They have concluded that although the design students recognized many advantages of web-based communication in the virtual classroom, students specified that they are reluctant to be far away from face-to-face interaction with the instructors and fellows in the physical environment. Therefore, here blended learning seems much more advantaged so that both traditional and technological methods are experienced by design students.

At this point, distance ID education became disadvantaged because it is tried to be offered a program as same as the traditional campus course program. However, there are big differences. First, the students of the online form are totally distance from the studio environment, which is an important part of ID education. Secondly, the students have to pay lots of money for attending these programs. In fact, these students have to pay more than 2000 dollars (at rates of 2010) per undergraduate courses and around 2500 dollars per graduate courses. In addition, although the students and instructors all communicate through internet, they are isolated while they are working on design solutions. In fact, in distance ID education the students are out of reach to the real studio environment where the motivation is high. In the VDS or CAD applications which are applied as supplementary to the ID education, students have the opportunity to attend also the campus courses or design studios. This is an advantage for the students who experience the blended ID education.

#### *Kaplan University, Singapore*

Kaplan University defines itself as one of the world's larger education company. The Bachelor of Technology in Product Design and Innovation program is offered as part time distance education program consisting eight courses which can be completed in 20 months. The program is divided into four terms. Table 3.1 shows the terms and the courses offered in each term.

Table 3.1  
*Courses offered in Product Design and Innovation program (Kaplan, 2010)*

Term 1	<ul style="list-style-type: none"> <li>• Product Costing and Economic Decisions</li> <li>• Conceptual Design and Innovation</li> </ul>
Term 2	<ul style="list-style-type: none"> <li>• Aesthetics and Ergonomics in Product Design</li> <li>• Material and Process Selection in Product Design</li> </ul>
Term 3	<ul style="list-style-type: none"> <li>• Product Design Communication</li> <li>• Mechanical Design Simulation</li> </ul>
Term 4	<ul style="list-style-type: none"> <li>• Rapid Manufacturing and Tooling</li> <li>• Product Lifecycle Management</li> </ul>

The program at Kaplan University has some requirements for participating in the program. First, the participants must have a valid diploma in engineering, technology, or related technical areas or equivalent qualifications. Second, participants have to be good at English Language. Furthermore, participants are expected to have relevant industrial experience of at least one year. In the program's definition, it is stated that the program heavily rely on the use of digital technologies of product design and manufacture in the form of educational software packages and the teaching mode for all subjects will be through modular or intensive methods of delivery. After completing the program the graduates have a right of using the award title BTech (Product Design & Innovation) after their names. The information related with the online distance Technology in Product Design and Innovation program is restricted with this. It is observed that the detailed information about the program can be acquired by arranging an appointment with a consultant from the university.

*The Open University, U.K.*

The Open University (OU) is the United Kingdom's only university dedicated to distance learning. The research and teaching in the OU ranges from design thinking, product and information design, through engineering design, to architecture, transport and town planning. Design Thinking and Innovation: Designing for a Sustainable Future are two ID related online courses. OU offers full-time and part-time online degrees. The minimum period for part-time study is two years and the maximum is four years. The minimum

period for full-time study is three years and the maximum is six years. For full-time research degrees the students have to be based on campus and for part-time degrees the students are based off campus but are required to visit it from time to time (Open University, 2010). The offered online programs in OU are not completely distinct from the school environment. However, these face-to-face meetings between the students and part-time tutors are generally limited to a short time occasion per year. Therefore, new materials are created that students can study while they have limited access to the resources and face-to-face interaction, in their individual environment.

Distance design education has been evolving for thirty five years at OU. Early forms of delivery mechanisms were mostly broadcasts than opportunity of using rapidly diffusing DVD ROM technology came across and finally course delivery will be entirely virtual. As the distance courses have evolved they mostly concentrates on skill development, refining and developing the instruction (Holden, 2009). Currently, second level of “Design and Design Thinking” course –which was first launched in 2004- focuses on a user centered design model to design. In this form of this course, case studies are more diverse that the previous versions enabling a discussion of the changing contexts of designing as globalization, evolving technologies and economic and environmental challenges which are explored more deeply in the third level course, “Innovation: Designing for a sustainable future” (Holden, 2009). In this third level course, the students are strongly encouraged for studying related with the sustainability and renewable energy. In the new distance courses of OU, the students will be given a chance to create their own narratives and ways of understanding design issues and processes through three tools (Holden, 2009):

- The first tools is “compendium” which is an online concept mapping tool enabling to bring together many different kinds of resources like videos, photos, and documents on a map. By this tool, students can reflect their ideas and design processes clearly. Figure 3.10 present a screen shot from compendium.
- The second tool is “Jing” is an animated screen capture software enabling students to present their work to their distance fellows and instructors assisting the development of important communication skills.

- The third tool is a VDS space called “Open Design Studio (ODS)” on which the students can work by posting their works to each other, communicating through message boards, and commenting and discussing upon one another's through audio or video comments. Figure 3.11 indicates a screen shot of ODS.

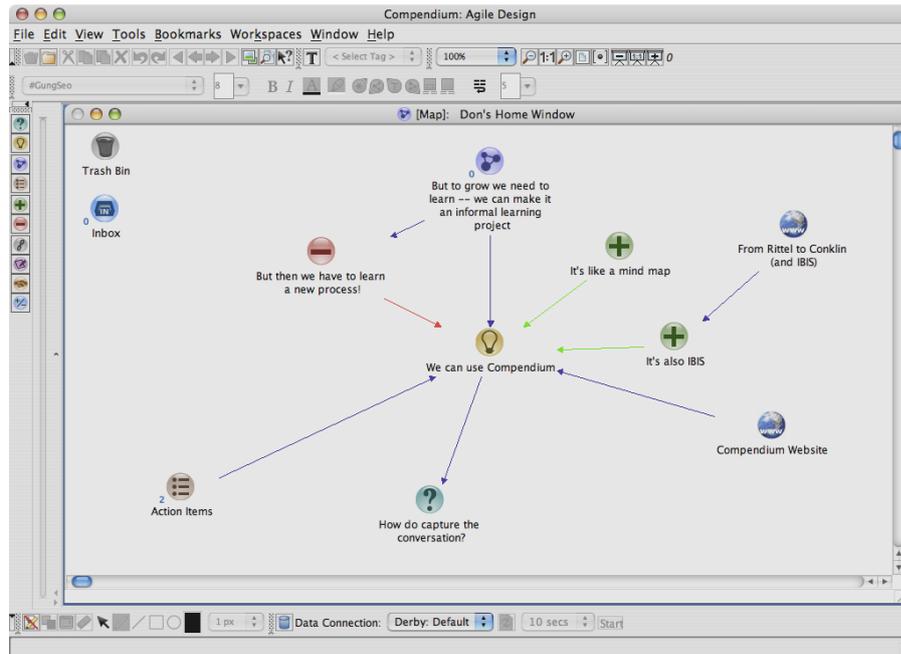


Figure 3.10 Screen shot from “compendium” software  
([http://www.sos.net/~donclark/agile/agile\\_planning.html](http://www.sos.net/~donclark/agile/agile_planning.html), retrieved on June10, 2010)

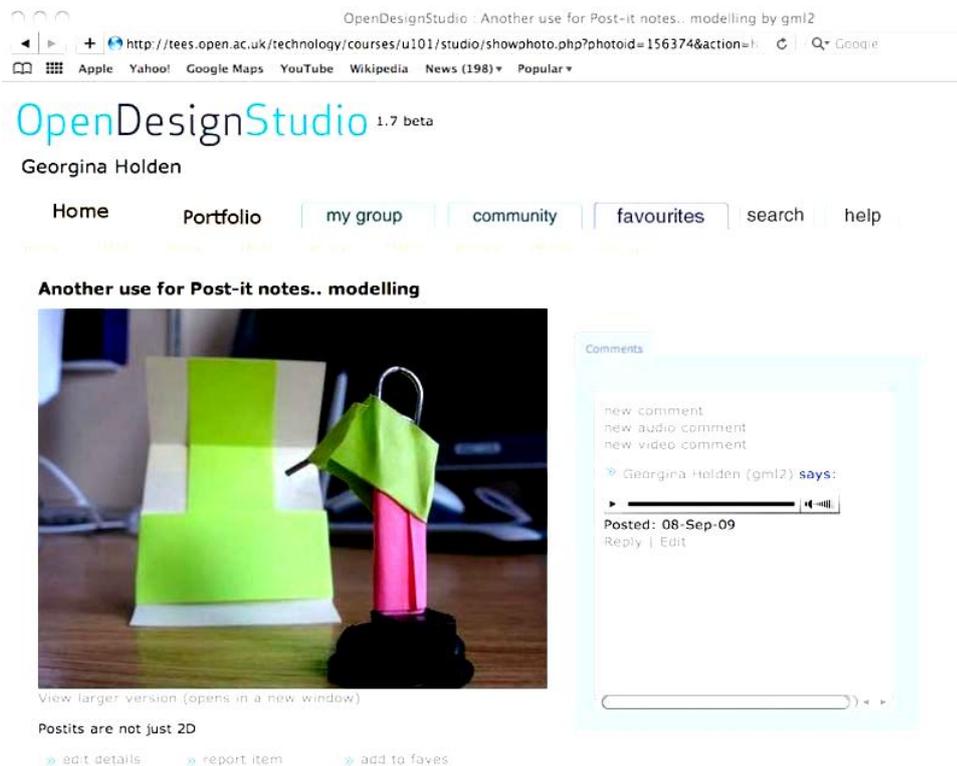


Figure 3.11 Screen shot from “Open Design Studio”  
 (http://designthinking.typepad.com/atelierd/cdi-1-open-design-studio/, retrieved on  
 June10, 2010)

In addition to these three tools, students also communicate and discuss through forums on ODS. Through ODS, Students will be expected to prepare an online portfolio including their digital images of preparation and inspiration process to share with others. The property of ODS that enabling students to comment by both text and audio will allow students to reflect their ideas more clearly and effectively (Holden, 2009). For being able to conduct these activities through ODS properly and effectively, the course team of OU prepare “how to” guides for students to help students use cameras, scanners and screen capture software. Holden (2009) assert that “whilst the ODS will not have the tangible immediacy of a live design studio, the advantages are that students will have a record of comments and suggestions and they will easily be able to visit significant numbers of fellow students to talk to about their work” (p.5).

In OU, the communication and discussions between students during the online courses has increased from 2000 significantly. Currently, students are continually sharing their both positive and negative experiences in general forums and social networks like Facebook that students are also self-organized and establish discussion groups for their social interaction including their studies. According to Holden (2009), the capacity of both older and newer students in self-organization through these domains is swiftly developed. In addition to these tools, voice over internet protocol (VOIP) technologies such as Skype became more common and increases the potential of collaboration in online design education. Holden (2009) states that; for the first time in 2009, OU uses these technologies for online design courses, tutorials and group projects.

#### *Design Aerobics, Designboom*

“Design Aerobics” which is the Designboom Online ID education program, has been created by Birgit Lohmann who is the chief editor of Designboom. Online lessons are developed with the collaboration of world-known designers and published by Designboom Team. Each course includes 30 lessons lasting two months and offers certificates but not an academic degree. This certificate program has a different concept that there are different themes of trainings for every two-month period. Basically there are five categories of courses which are; history and future cycle, body and mind cycle, spring courses, summer courses and fall courses. There are also sub-types of these categories. These course subjects are changing; each year may have its specific concepts. Figure 3.12 is a representation of the “Design Aerobics” web site including the announcements “history and future cycle” and “body and mind cycle” ID courses.



[courses](#) | [how courses work](#) | [FAQ](#) | [success stories](#) | [disclaimer](#) | [contact](#)

[NEW COURSES FOR 2010 ANNOUNCED](#)  
[SEE BOTTOM OF PAGE FOR SPECIAL OFFERS](#)

### history & future cycle NEW COURSES

ONLINE INDUSTRIAL DESIGN COURSES 

**on the move**  
march 8th - may 8th, 2010  
(course finished)  
**design-aerobics 2010**

ONLINE INDUSTRIAL DESIGN COURSES 

**revisiting history**  
june 8th - august 8th, 2010  
**design-aerobics 2010**

ONLINE INDUSTRIAL DESIGN COURSES 

**tech gadgets**  
september 08th - november 08th, 2010  
**design-aerobics 2010**

### body & mind cycle

ONLINE INDUSTRIAL DESIGN COURSES 

**sport**  
march 8th - may 8th, 2010  
(course finished)  
**design-aerobics 2010**

ONLINE INDUSTRIAL DESIGN COURSES 

**food**  
june 8th - august 8th, 2010  
**design-aerobics 2010**

ONLINE INDUSTRIAL DESIGN COURSES 

**spirituality**  
september 08th - november 08th  
**design-aerobics 2010**

Figure 3.12 Representations of History & Future Cycle courses (Designboom “Design Aerobics” Courses, <http://www.designboom.com/aerobics/index.html>, retrieved on June 6, 2010)

To attend these courses, the basic requirements and skills that are expected from the participants are; basic computer graphics, the ability to scan the drawings, take photos and upload them, etc. Everybody around the world with these capabilities is acceptable to the courses with paying 69 dollars to 169 dollars for each course of two months period. Design Aerobics is also an asynchronous online ID training that students are free in time and place. The training is for the people who wants to develop themselves and their skills or just for fun. They are making projects during the trainings. Participants are communicating via e-mail and they acquire course materials or materials' information from Designboom website. At the end of each course, participants are expected to finalize a project related to the course subject. In order to give an idea about the qualities of works done by the online ID training participants, Figure 3.13, Figure 3.14, and Figure 3.15 are presented as some of the best examples from the final projects of Design Aerobics.

Figure 3.13 is a project of the Design Aerobics 'ecology' course in 2006 by a participant from Thailand. Her project 'christies' are the recycled glass tea lights were exhibited at the 2006 Designboom Marts in New York and Tokyo.



Figure 3.13 a student project from Thailand (the Design Aerobics 'ecology' course cycle 2006, <http://www.designboom.com/snapshots/mart06/eamumpai.html>, retrieved on May 2, 2010)

The project in Figure 3.14 is designed by a participant on the design-aerobics 'light' course cycle in 2004 and this project went on to participate at the Designboom Marts in Tokyo 2005 and New York 2006.



Figure 3.14 a student project from Spain (the Design Aerobics 'light' course cycle 2004, [http://www.designboom.com/martokyo\\_d/bringas.html](http://www.designboom.com/martokyo_d/bringas.html), retrieved on May 2, 2010)

The folding chairs in Figure 3.15 were designed by a student Radu Comsa from Romania, for the Design Aerobics 'folding chair' course in 2003. Then this online course participant won the international design competition with these chairs and exhibited his work in London.



Figure 3.15 a student project from Romania (the Design Aerobics ‘folding chair’ course cycle 2003, <http://www.designboom.com/london03/11.html>, retrieved on May 2, 2010)

Design aerobic courses are different from the Academy of Art University online ID program because while Designboom gives short concept trainings and certificate at the end, Academy of Art University aims to train industrial designers and gives diplomas also. However, they are both distance and the participants are working on their own spaces at their preferred time in both. While this can be acceptable for the short self development trainings like in the Design Aerobics, for training professional being away entirely from the real studio and classroom environments is troubled though these are debatable subjects and because the online Distance ID education is new, there are restricted researches and studies.

To summarize the properties of the entirely online ID programs’ that are offered through various ways, a table (Table 3.2) is constructed to give a general overview of all these four programs.

Table 3.2  
*Properties of Entirely Online Distance Industrial Design Programs*

	<b>Academy of Art University (USA)</b>	<b>Kaplan University (Singapore)</b>	<b>The Open University (UK)</b>	<b>Design Aerobics (Designboom)</b>
<b>Type of program</b>	MFA, BFA, and AA degrees in ID	The Bachelor of Technology in Product Design and Innovation	product and information design	Short term concept design courses
<b>Courses offered</b>	<ul style="list-style-type: none"> <li>• Form Development,</li> <li>• Problem Solving,</li> <li>• Perspective for ID,</li> <li>• History of ID,</li> <li>• Design Drawing,</li> <li>• Model Making,</li> <li>• Computer Drafting,</li> <li>• Product Design,</li> <li>• Digital Imaging,</li> <li>• Digital 3D Modeling,</li> <li>• Transportation Design,</li> <li>• Materials and Processes,</li> <li>• Transportation Drawing,</li> <li>• Graphics &amp; Portfolio,</li> <li>• Design Project,</li> <li>• ID Drawing,</li> <li>• Digital Design Tools,</li> <li>• Intermediate Digital 3D Modeling,</li> <li>• Introduction to Digital 3D Modeling,</li> <li>• Advanced Digital 3D Modeling,</li> <li>Directed Study, and Internship</li> </ul>	<ul style="list-style-type: none"> <li>• Product Costing and Economic Decisions</li> <li>• Conceptual Design and Innovation</li> <li>• Aesthetics and Ergonomics</li> <li>• Material and Process Selection</li> <li>• Product Design Communication</li> <li>• Mechanical Design Simulation</li> <li>• Rapid Manufacturing and Tooling</li> <li>• Product Lifecycle Management</li> </ul>	<ul style="list-style-type: none"> <li>• Design Thinking and Innovation</li> <li>• Designing for a Sustainable Future</li> </ul>	<ul style="list-style-type: none"> <li>• On the move</li> <li>• Revisiting history</li> <li>• Technology gadgets</li> <li>• Sport</li> <li>• Food</li> <li>• Spirituality</li> </ul>
<b>Structure</b>	Same as a complete ID degree program	part time distance education program	full-time and part-time design programs	The courses are offered as short cycles
<b>Length</b>	MFA: 2 years at least BFA: 4 years at least AA: 2 years	2 years	Full-time: 3-6 years Part-time: 2-4 years	2 months
<b>Type of certificate</b>	diplomaed	the graduates are awarded wih a title BTech (Product Design & Innovation) after their names	Full-time: diplomaed Part-time: certificate	No certificates

### **3.4.2 Online Distance Industrial Design Education vs. VDSs**

Online ID education is different from applications of other technologies like VDSs or using CAD tools because in online distance education, the programs aim to offer the same education as the campus program but away from the original environment, while the other technological applications are using for blended ID education. In entirely online ID courses, students are expected to work on everything that originally done in the studio environment with the fellows, by themselves in their personal spaces. It is really debatable that doing the same studio activities in a personal place alone is an effective method or not.

Design studio pedagogy is based on constructivism that students actively construct an internal representation of knowledge. Today constructing knowledge requires collaboration among the students which is one of the most essential elements of design education (Simoff & Maher, 1997). In addition, as Kvan (2001) asserts, design students learn much of their studio activities from the desk criticisms which are gone through in open studio environment and encouraging the students by observing another's reviews and ideas.

In brief, using VDS or digital design tools in the design education; integrating technology and creating blended ID learning environments are different from online distance ID learning environments because in online programs there are no traditional face-to-face environments or other courses. Online programs are only in the internet environments through synchronous and asynchronous communications. Distance learning concept is not a new activity but it is new for ID profession. It is observed that online ID education is now in a trial period because its validity, viability, effectiveness and success are debatable subjects and although there are numerous researches and case studies related to the technology integration in ID education, researches or studies about online distance ID education are available but still restrictive.

### **3.5 Debates on Technology Integration and Online Distance ID Education**

The discussions about the effectiveness and development of online form of ID education have been arisen through the changing methods and mode of design courses' delivery. While some researchers and educators claim that the developed technologies and online applications on ID education will provide an opportunity in solving complex design problems and delivery of design knowledge, some believe that technology should not completely take the place of traditional methods and cannot be as effective as the face to face interaction in design education.

Some of the current debates are based upon the experiences of design students through technology integration or online applications. Budd, Vanka, and Runton (1992) state that the experiences of design students and instructors with computer-based learning technologies are an evidence to believe that the support of online communication and applications to the students and instructors with handling complex design problems. Chen and You (2010) agree that the internet and instructional technologies may alter the mode and environment of design, but not the nature of design and design education. Integrating technologies and using the technology for online delivery of courses may help to overcome some restrictions with an appropriate approach to design teaching and learning (Chen & You, 2010). Online delivery of design education has advantages on design education by using the information technologies and the Internet. There is a potential on sharing the information, on communicating opportunities between students, instructors and design experts and so, there is an opportunity for students to learn from other fellows and experts around the world (Chen & You, 2010). As a result of the research that Chen and You (2010) conducted, using the online design studio had positive effects on course content, activities, learning and teaching. In addition, in an online mode of design studio, the course content becomes richer and the course objectives can be more reachable because of the abundance of information and accessible of data through the Internet (Chen & You, 2010). In the research of Chen and You (2010), students who participated in the study comment that their learning motivation and behavior change positively through online design courses. Moreover, result of the study indicates that the interaction, the role of students and

instructors are also changed through the communication in the Internet environment that some of the students who are normally passive became more active (Chen & You, 2010). Besides the attitudes to the Internet applications, Pektaş and Erkip (2006) studied on the attitudes of design students on the usage of computers, digital tools, in design education and they concluded that the students' attitudes toward the use of computer in design process had been positive. On the other hand, Şenyapılı and Karakaya (2009) assert that the students prefer face-to-face communication with the instructors and fellows instead of web-based communication in the virtual classroom. In addition, beside the opportunities and advantages that virtual environment provide, these technologies also have risks for design education that the students may access incorrect information through Internet or the convenience of use of the digital tools may confound the students by means of the products functionality, form and reasonability (Chen & You, 2010; Sagun, Demirkan, & Göktepe, 2001). In addition, students may not practice and develop their design skills and problem solving abilities because of excessively relying on the digital tools, and spending redundant time with these tools (Chen & You, 2010).

There are many debates on whether integration of technology to ID profession and education will be always supportive for design profession and education, or not. For example, Min and Hao (2008) agree that the development and integration of technology to the design profession and education will support the design process and the development of design practice continually. However, from another perspective, with the more and more development and integration of technology, and therefore development of design will run into various kinds of challenges, and the new requirements of appropriate design supporting tools to solve the emerging problems will advocate the new direction of technology research and development (Min & Hao, 2008). Guerrero (2009) also asserts that there are risks and challenges in transition of design education to the virtual environment. However, according to Guerrero (2009) also, this transition has many advantages like supporting cultural diversity, implement new creative approaches, and social development of participants.

According to Sagun, Demirkan, and Göktepe (2001) web-based design courses have many advantages over traditional ones because today there is significant increase on class size, higher student to instructors ration and the interaction between students and instructors decreases so that the motivation of students and class participation loose importance. With the increasing number of students, the diversity of students in a class increases by means of culture, age, educational background and psychology. Therefore, web-based education becomes more advantageous than the traditional classroom that internet offers more opportunities for a large number and various types of students due to the various features of synchronous and asynchronous collaboration and these specialties of online environment offers chance also to the disabled students (Sagun, Demirkan, & Göktepe, 2001). According to Sagun, Demirkan, and Göktepe (2001), online communication through the online tools which are developing everyday is more convenient that face to face interaction because it is possible to interact with more and more people from different points of views, different cultures, and different countries and the students can access various experts throughout the world. However, Sagun, Demirkan, and Göktepe (2001) think that there are disadvantages of interacting through web rather than face-to-face interaction because to be able to communicate through internet students must be directed and trained for using these tools effectively and the technological applications for design training must be nourished with the pedagogical aspects of design education to increase the effectiveness of online education. Beside all these arguments; Sagun, Demirkan, and Göktepe (2001) claim that “the web-based design studio cannot replace the role of an instructor but can be used as a new educational tool” (p.336).

In addition, Sagun (2003) asserts that advancements in digital technologies for image processing, 3D modeling, wireless communication and online collaborating provide a variety of possibilities for design teaching and learning by quick, everywhere, every time access to the information and communication. In addition, virtual learning environments can offer the collaboration that is a nature of design process (Sagun, 2003). However, according to Min and Hao (2008), except digital representations, digital technologies do not contribute much to design thinking and methods, and significance of 3D perception of design.

Min and Hao (2008) argue that computers have the potential to be developed to create an environment that have the capabilities of creating an effective design and communication tool but it is still need lots of work to make computer as a real tool which can promotes design thinking and communication. Şenyapılı and Basa (2006) agree that the computers have big potentials and advantages but they did not achieve to completely take the place of traditional methods. It is difficult to have an accurate idea and decide which arguments are really reliable because there is a fact that both mode of education have different strengths and weaknesses (Şenyapılı & Basa, 2006). Simoff and Maher (1997) state that design education through internet and computer technologies can be as effective as the traditional education only if;

- Appropriate method and technologies to the instructional tasks are used
- Students and instructors actively interact
- There are periodical feedback by the instructors

According to Owen (1991), the evolution and integration of online and digital technologies to the design profession and education make it possible to extend the designer's mental and physical capabilities. This is important also in design education because extended mental and physical capabilities during design education means delivering and taking much more effective knowledge and practices. Through the web-based design education, the restrictions of time and space is removed and availability of resources and multimedia content in increased offering a advancement potential for design education (Chen & You, 2010).

Shao, Daley, Vaughan, and Lin (2009) think that, although the developments of online design studios provide possibilities for design teaching and learning, for designing the virtual design studios, it is necessary and critical to think deeply the core of traditional studio teaching because currently most of the virtual design studios do not entirely address the characteristics of studio teaching because design studio includes practice based activities and face-to-face discussions and critiques which are making the design studio different than the other conventional classrooms. However, in the online form of design

education the design process and communication is totally computer based and so, the representation of design undertaking will be restricted with the digital format (Shao, Daley, Vaughan & Lin, 2009). Supporting these arguments, Bennett and Dziekan (2005) complain about the lack of specific software or systems for artists and designers enabling exchange of working large files, feedback, discussion, critique and project management resembling to the original design studio. Existing online tools like e-mail, chat rooms or file transfer protocols are not sufficient for supporting the design process and therefore, there is a need of researches and studies to enhance and test new framework and online systems (Bennett & Dziekan, 2005). In addition, studies are conducted for developing framework for online virtual environments specifically for design teaching and learning, and for testing these systems (Blevis, Lim, Stolterman & Makice, 2008; Boghetich, Ciuccarelli, Innocenti & Vidari, 2002; Chastain & Elliott, 2000; Chen & You, 2003; Dave and Dahany, 2000; Öztoprak, 2004; Sagun, Demirkan & Goktepe, 2001; Shao, Daley & Vaughan, 2007)

Moreover, there are also arguments that online delivery of design education has limitations and disadvantages. For example, Park (2008) lists the limitations of current online design learning systems in terms of delivery;

- The current systems are not capable of substitute for face-to-face interaction.
- Transmitting demonstrations of a design technique or process to the design students may not come true for a real time interaction.
- Instead of in depth and interactive communications, the communication through internet are being carried out mostly with text based discussions. Synchronous and asynchronous communication tools are also limited for practical demonstration.
- The teacher's role in the online environment is less dominant than the role in the traditional studio which assists students' working process constantly.

Park (2008) summarizes these limitations of online design education: "the limitations indicate that the main barriers to performing high interactive learning and teaching for online design course are the three followings: disconnected structure, unorganized and unarranged communication channels, and undeliverable and unmanipulable learning content" (p.14).

To summarize, the debates and arguments are mainly related with virtual design studios, using digital tools, and collaborative online studies but not the programs that delivering ID education completely online to the distance learners.

In addition to the debates mentioned above, some discussions about online ID programs have been held in the online education forums. One of these discussion forums is scrutinized that belongs the Core77 which is a designers' web-site consisting of publishes articles, discussion forums, an extensive event calendar, hosts portfolios, job listings, a database of design firms, schools, vendors and services. In that discussion forum, there are discussions about attending a totally online ID degree in the Academy of Art University. A student "kdb31" (2010) states that before a complete participation to an online ID degree, s/he desired to try taking some online distance courses (art history, geography, colour theory) from the online ID program and s/he defines this short experience as a "disappointment". S/he states that:

The classes just didn't even come close to replacing a real classroom experience. I couldn't have a fluid conversation with professors (ie they couldn't just sketch something on your page to explain a concept, I had to wait a day for a short reply), students seemed to be there either for the sake of taking the easier route or seemed less driven in general, and trying to learn and participate in a web based classroom was both cumbersome and unnatural. The larger problem I'd argue is you also have no access to school facilities (print, prototyping & machine shops) which is essential for ID and as many have mentioned here, you learn the most from your peers and being in the studios which you won't have. I can see taking math or history classes where all you're doing is reading, writing essays, and filling in multiple choice tests but I can't imagine doing something as hands on and visual like ID online (msg 2).

Another student "p waddy" (2010) agrees the idea that s/he states "I actually went to the Academy of Art University in San Francisco to enquire about the master degree in ID. I never got chance to look at the actual design studio and workshops but there is some information on the website and images about it" and s/he argues that this issue is very critical and important because being in the university is very important because an important part of the studio learning in the university is with the peer than from instructors. One other student "mpdesigner" states that:

I think ID isn't something you learn online. You need to be immersed and go through it with classmates to really get the full experience and benefit of school. Also the connections you make there will last a lifetime and crucial for your career. I got a lot of jobs through classmates I knew in school. I also picked up and shared skills and learned teamwork with other classmates (msg 7).

A student who is currently attending the online distance ID program of Academy of Art University shares her/his experiences and observations in this discussion board. S/he lists the experiences and observations (thirdnorth, 2010, msg 8):

- Although the program is online, the workload is very intense. For example in the drawing class it is needed to draw 20-25 pages per week. For completing the assignments the students need traditional materials but not digital tablets. The assignments are expected to be post with high resolution photos or scans format
- Feedbacks for the assignments come mostly from fellows rather than the instructors.
- Because of the heavy work load of the students had to drop “advance ID” course that concept models are expected per week and it is expected to download photos of the completed model from all angles. Making model process is required to be completed the students’ own space which is mostly home.
- There is no too much difference between learning ID from online distance programs and learning from books by self.

The common point the students argue that the online ID courses are too expensive and there has to be a great self motivation to complete these programs. In addition, performances of all the participants of the program are also very important that if there are continuous and efficient collaboration and online discussions it can be more bearable and achievable.

Up to this part of the thesis, definitions of key terms of the ID education, its history and development have been studied. In addition, integration of technology to the ID profession and its education has been explored. Finally, the current situation of the most recent online form of ID education as the main concern of thesis has been scrutinized. Next Chapter will make a précis of the reviewed literature and so the answers of the research questions of

this thesis and will conclude by discussing the viability, validity, and future of online distance ID education.

## CHAPTER 4

### CONCLUSION

The rapid changes in the last two decades affect the context and delivery of design knowledge swiftly. Therefore, many novice applications are introduced to ID profession and education causing various researches and applications. The opportunities that are brought by these novelties have the potential to broaden the scope of design teaching and reshape the social and physical structure of design education environments in a way that they may enrich the design education. The changes in design education that create new content, methods and practices, may not come easy. In the course of time, design education has been affected gradually from the technology and it continues to be affected.

This chapter presents an overview of the answers to the research questions of this thesis which are acquired through the literature review study and the Internet search study conducted through the related educational institutions' Web Sites. Revisited research questions are followed by the concluding remarks. The chapter closes with the implications for research and practice.

#### **4.1 Research Questions Revisited**

The foremost question of this study was about the evaluation of online entirely distance education as a new form of Industrial design education. In order to find the answer of this main question, following are examined also:

- How do technological developments influence the ID profession, its education and educational environment?
- What are the current state of ID education and educational environments?
- What is the current situation of online distance ID education?

- What are the pros and cons of entirely online distance ID education?

*The influences of technological developments on ID profession, education and educational environments?*

Despite all changes and affections from the origin of ID education until today, regardless of what the reason is, the essence of design education has been preserved in one way or another. In fact, in the course of time ID education tools and environments changed however, its face to face interaction based studio education method remains unchanged.

In 90s when computers are introduced into our lives, the interpretations regarding the effects of rapid changes were mostly about the importance of hand skills, as well as the need for protection of traditional teaching methods in ID education. Therefore, the changes and technology integration has been adapted to design education without replacing the interaction between students and instructors. However, the swift change in information and communication technologies by 2000's has created some concerns on preventing the spirit of design education, Despite the concerns, it has been observed that integration of technology to design practice and education brought various advantages. In fact, all these factors can become the advantages of technology integration to ID education as long as they are established through well structured and organized systems.

*What are the current state of ID education and educational environments?*

Today, technology is pervasively used and for industrial designers using technology and designing for technology are usual activities. For transition of ID education also, technology has been playing an important role by means of supporting each phases of the design process. It seems that it is important to integrate these technologies to traditional design education rather than separating them from traditional environments and methods because combining digital media, online communication technologies, and traditional methods in a design process may make students feel more comfortable because by working through both, the deficiencies of each can be remedied. On the other hand, when the design activity is walked out of the design studio and face to face interaction is completely disappeared through online communication technologies, the supportive way of technology

integration may become restrictive. Therefore, alternatively, to be able to use these technologies as also supportive tools for design education, VDSs enabling communication and collaboration between students with the support of traditional design courses and studio courses have been appeared and applied.

VDSs provide students collaborate with other colleagues and design experts from various parts of the world providing cultural diversity and sharing of various levels of design knowledge. By working on a design solution with a culturally diverse group of designers and students, and various disciplines, the perspectives of students seem to be extended and they could be able to become worldwide designers who can cope with a wide variety of design issues. In addition, increasing multidisciplinary knowledge and social interactions will most probably increase the self confidence and sociability of the students that are some of the key elements for being successful designers. Working with a variety of culture and disciplines may indicate design students that there are different kinds of design solutions for different cultures and various design problems can be solved by the support of other disciplines. These advantages of collaborative technologies seem to be achieved through the support of traditional design studios and courses. Through the literature review of this thesis, it is observed that beside the interactive, multicultural, and multidisciplinary online design collaboration, the face to face interaction between students and tutors in a traditional design studio is the indispensable part of design education.

*What is the current situation of online distance ID education?*

As observed through the literature review part, academic researches and studies on totally online ID programs are not common, may be because of the low number of programs and their availability through the world. In addition, recently online distance ID education approach is received hesitantly by educators. Especially, it seems that it will take time to impose online distance ID education approach to the traditional method favorable design educators.

It is examined that entirely online ID education is very limited throughout the world by the time present; four featured program have been found and scrutinized within this thesis.

While searching the properties of these programs, other key question of the thesis that “What are the pros and cons of online distance ID education?” also tried to be answered.

*What are the pros and cons of entirely online distance ID education?*

Considering the discussions and the overview of entirely online distance education programs, it seems that there are some deficiencies of these programs by means of being unable to recompense the expected advantages of online technologies and to support the significant features of campus based ID education by means of its delivery and structure.

Considering four programs that are studied through this thesis, only the online ID degree programs at Academy of Art University can be entirely compared with the campus based programs because the others are not a complete ID degree program. In fact, they offer ID related courses or short term concept ID trainings. To be able to make comparisons and make inferences about pros and cons of entirely online distance ID education, Table 4.1 is created to summarize the sample structure of campus based ID program generally as being a guide for the evaluation of online programs.

In a campus based ID curriculum, it is observed that there is a progressive introduction and integration of students to the ID field. During the program, design studios have the big proportion of time covering every half of three days a week in each semester. Each year, the level and content of design studio are gradually changing through the benefits of design students. At the beginning, students are supported with basic principles and skills. After gaining necessary knowledge and skills students are encouraged to apply these basic knowledge and skills to ID field for solving design problems of various products. In two years students are integrated more to the ID profession through internships in design firms and courses related with production, manufacturing, and ergonomics. Meanwhile, design students are introduced with up to date design related computer tools and software through supplementary courses and summer practices. Towards the end of their undergraduate program, students are supported with a design education. Especially the last year courses and studio develop individual styles of students to make them more distinctive designers who can solve complex design problems including the cultural issues, ecology,

future forecasting, globalism, etc. At the end of the program, the students work on their graduation projects for solving real life design problems through industrial collaboration. To summarize, all these studio and other courses are conducted in collaborative and active environments by using all the opportunities of design school including materials, studios, and equipments during both the semesters and the summer periods. To set out of these general properties of campus based ID curriculum, it can be more convenient to evaluate the current forms of entirely online distance ID programs.

Table 4.1  
*Sample Structure of Campus Based ID Program*

1 <sup>st</sup> year	<ul style="list-style-type: none"> <li>• Introduction to design discipline</li> <li>• The studios focus on basic design principles and concepts</li> <li>• Sketching, drawing, and modeling skills</li> <li>• Design communication skills</li> <li>• origin and development of ID</li> </ul>
2 <sup>nd</sup> year	<ul style="list-style-type: none"> <li>• The studios focus on basic ID principles</li> <li>• Concentrates physical and functional requirements of a product</li> <li>• Introduction to production, manufacturing, and ergonomics</li> <li>• Introduction to basic computer literacy in design</li> <li>• Introduction to CAD for drawing</li> </ul>
3 <sup>rd</sup> year	<ul style="list-style-type: none"> <li>• The studios focus on corporate identity, product identity, system design, interface design, and new technologies</li> <li>• students are encouraged to develop their individual methods and style</li> <li>• introduction to the professional practices and the computer applications for design</li> <li>• Introduction to Rhinoceros, 3D Studio Max and Alias Wave-Front for three dimensional modeling, material editing and rendering</li> </ul>
4 <sup>th</sup> year	<ul style="list-style-type: none"> <li>• The studios focus on the cultural issues, life style, ecology, future forecasting, globalism, and design for export</li> <li>• Six weeks internship in a design office</li> <li>• Portfolio presentation</li> <li>• collaborative design project with industry, synthesizing real-life design problems</li> </ul>

Firstly, the major problem of these programs is that all practice and theory based courses are tried to be delivered through the same way. For example, at Academy of Art University (USA), the students are expected to work traditionally in their individual spaces and upload the photos of their works for sharing the design solutions instead of working on all these collaboratively and actively with the support of necessary environment and materials that design schools provide. In addition, this condition creates a conflict that while there is a technology integration enabling students to be away from the traditional studio by using digital design tools or software; the students are studying with traditional tools in their individual spaces being away from the design studio environment. This way of teaching design process and teaching how to solve design problems seems to be more primitive rather than more technological as expected.

Secondly, the students are isolated from all the blessings of design school's environment and working with others in this environment. As discussed in the previous chapters of this thesis, the most dominant part of design education is the design studio. Therefore, being completely isolated from this environment will most probably decrease the effectiveness of design education. In addition, although introducing the students with the industry through related courses can be possible in the online mode of ID education it is difficult to integrate them to the industry through internships, observe and evaluate their progress during their professional practices are lack in these online programs.

Finally, when the campus based program is explored it can be seen that the program is loaded and affluent with a variety of studios, courses and practices. Although the distance online Id curriculum can also include variety of courses and applications, it appears to be emotionless within every levels of learning the design process. In addition, this way of design knowledge delivery seems to be relatively static because interaction between students and instructors during the design processes are limited when it is compared with the traditional delivery. That is to say, the students are always away from the dynamism of design studio activities which enable students present and monitor each others' design solutions through a chain of design critics necessitating the five senses of all participants.

On the other hand, the other design programs which are training designers through online media, expect students to deliver their design solutions through digital technologies. This way of training also restrict the design students' development of design perspective and skills by taking students away from using their hands, and observing and discussing the design process of others in the traditional studio. In fact, the students get the ID training isolated from school and fellows. Although the students share the design process or discuss on the participants' design ideas through asynchronous or synchronous communication tools collaboratively, it might be difficult to simulate the traditional design studio perfectly.

#### **4.2 Concluding Remarks**

As cited before, according to the definition of ICSID (2010), "ID is the establishment of multi-faceted qualities of objects, processes, services and their systems in whole life cycles". Therefore, all these factors and combination of human factors, materials and technology form ID education, as a complex combination. This combination has always changing opportunities, affluent experiences and a continuous active involvement of students and designers. In addition, when the campus based ID program is scrutinized it is observed that it is conducted actively and it is a condense program. There are various theoretical courses and design studios that cover a large proportion of the program. As argued, design studio has been one of the most vital aspects of traditional ID education. In addition to the studio practices; other courses like materials, marketing, manufacturing, communication, physics, and psychology compose the real sense of traditional design education, with a combination of the applied knowledge of these subjects on the design studio where the design process is materialized. All the courses offered on ID education and design studio are significant for design process because this process is nourished by various disciplines and composed of skills in every mode including cognitive skills and hand skills. Nevertheless; in the online form, the students are getting all these kind of courses and studio courses through an isolated way and they are working individually. During a design process, user researches and field studies, selecting the appropriate material, working on the physical properties of the product should be done collaboratively and actively. In addition, there should be a continuous face to face sharing of ideas, discussing and critics in

the design studio. Although there is online collaboration in the distance form, when students are studying on their own places, they are kept away from all these necessary steps.

In addition, design education without real interactions seems to be pointless because each phase of design process is related with the all five senses. Touching the product while working on it gives the actual clues about the physical characteristics. Its size, texture, weight, even some times its smell or sound seem to be understood best by working in actual contact. Moreover, active hand drawings convey the designers' ideas on the design problem as live as in the designers' mind but digital technologies may restrict communicating the active ideas which active drawings provide (Lowey, 2008).

Beside the disadvantages mentioned above, using the computer and digital tools can be advantageous to some extent in a way that the students who are not able to be trained in the campus environment may have chance of taking design degree since the time and place restrictions are disappeared. Moreover, presenting ideas can be sometimes more convenient through digital media tools. However, as stated, these advantages are thought to be available to some extent because there might be misconceptions while presenting and sharing ideas in the online environment. Not being face to face may cause some misunderstandings while sharing of design solutions and discussing the design critics. Additionally, although some software can support finding the best of the possible 3D mode of the product and its materials characteristics, handling the product and touching it give the real sense and idea about it.

To sum up, it seems that the four programs that are scrutinized for this thesis are substantially similar with the traditional design education including its studio courses and other supplementary courses. The only and basic difference is being completely away from school environment, fellows and instructors. Distance education of other disciplines has the same attitude towards their traditional methods that the students are given the learning material, they prepare the necessary assignments in their own space, they submit their works and they communicate through online media. However, although this procedure

should not be the same for ID education, it seems to be the same. As stated before, regarding the entirely distance design education, the procedures in the studio courses are transmitted to the online environment as same as how it is applied in the real school environment. It seems that there are no innovative instructional solutions of transforming traditional design education into a suitable form to the online environment. In addition, it is observed from the current online ID education programs that, although there is an interaction and collaboration between physically distant participants, the using technology for the design process is restricted by means of taking the advantages of the web utilities for increasing the effectiveness, and supporting the design process and functionality of design environments.

It would easily be said that it is really difficult to conduct ID training entirely online by keeping its traditional form which is the most widely accepted throughout the world. For the time present, online technology seems not to be able to carry ID education beyond the imitation of traditional delivery. To recompense design education for making it online and distance, there should be plenty of properties to be developed and worked on. It is not possible to say that the only way of design teaching must be in a traditional studio but blending the technological applications and traditional methods might be more effective for current situation. In the following part, implications and suggestions for online distance ID education will be stated.

#### **4.3 Implications for Practice**

In today's world, integrating information and communication technologies to the traditional design practices can influence social interaction positively. In addition, through this technology integration, students are provided a productive and effective space. Moreover, the communication and data transfer between different levels of designers and design students from various countries would be more convenient. To make the design education more effective, it is important to support design students with collaborative environments that can enhance creativity and critical design thinking for distinct design solutions. As stated before, it is important to sustain traditional methods with digital tools,

and information and communication technologies. This kind of ID education can be achieved through blended learning which combines traditional methods and developing technologies. Students can access the necessary knowledge and they can work collaboratively with other students and disciplines through internet while they are working on their design solutions in the traditional active design studios.

If there is a need to deliver ID knowledge entirely online to a certain group which may have restrictions to exist in the campus environments, the delivery method must be developed to meet the requirements of design education as comprehensive as possible. Otherwise, the degree taken after completing an online training period should not be an equivalent of a degree taken after the graduation from a campus based university. Instead, these kinds of online distance ID programs may give certificates after short design trainings. Therefore, international accreditations might be needed because online trainings are mostly global. Present entirely distance design programs can be acceptable only if they aim to support design students or designers with short concept courses because it is obvious that the design students who are graduated from campus based universities or are given blended design education should be different from the design students who are delivered the design education entirely online. This kind of design programs can be accredited internationally only if definite criteria are determined and guidelines are developed. This can be done through attentive international researches and studies.

Last but not the least, for the effective management of web based design education environments, proper tools, methods, and interfaces should be developed through deeper interdisciplinary researches. As noted in the previous parts of the thesis, Sagun, Demirkan, and Goktepe (2001) suggest that all the sociological, ideological, epistemological and pedagogical aspects of a design studio must be taken into consideration for designing a web based design learning environment. Suggestions for further research on these issues are discussed in the following part.

#### **4.4 Implications for Further Research**

It is examined that, online distance delivery of ID knowledge could not skip the crawling stage yet. It is also realized that this kind of ID education will remain weak or will completely disappear unless it is enhanced not to be such primitive. On the other hand, more comprehensive researches and studies to develop distance ID education should be conducted that many researchers from related disciplines like; educational psychologists, educational technologists, interface designers, and interaction designers, as well as industrial designers should work on the development of such critical establishments in ID education.

It is realized that all most internationally recognized design schools did not sign such a way of design education yet may be because of their reputation. That means it is difficult to expect the equal quality of design solutions from the students of the traditional and online design education. To understand what should be done to make this way more affective and to understand what future will make with the entirely online distance ID education, more researches and studies should be conducted. Beside literature review, overview and evaluation of distance design curricula; case studies, empirical researches or usability researches of the programs and course delivery methods should be significant for understanding the effectiveness of this way of design teaching.

In addition, researches on the perceptions of design students and teachers who are participated in an entirely online distance design course would be important to understand the users concerns or satisfaction. Their perceptions might be significant by means of making development of each fragment of these online systems much more productive and effective. On the other hand, for the same sake, it would be valuable to conduct interviews with designers and design students who are not introduced such online distance environments before, would be helpful to gather their ideas. Moreover, to go further, the situation of the graduates of traditional and online distance design programs can be searched on their working places and insights of their employers can be scrutinized to observe the differences in the professional life.

To conclude, although it is inevitable to apply online technologies for design education, its entirely online form seems to be deficient. To be able to call “online distance industrial design education” as a “technological revolution in industrial design education”, more advanced applications and more developing technologies are needed. This means; whether the technology is completely take the ID education in its effect, it would be developed more and there would be more researches and studies on corresponding the demand of newly developed ID knowledge delivery. As it is observed, the four online distance ID related programs seem to be replications of the traditional programs for being able to access more and more students without extra effort and cost.

Designing innovative educational environments, tools and methods for industrial design education is a reciprocal activity. In other words, designing tools and methods for the online distance delivery of design instruction is also the job of industrial designers besides the other related professions because they are the primary stakeholders of these new applications, they may have ideas to designate the problems and find designerly solutions and they can contribute to enhance the educational methods. So the industrial designers are among the most influential people who will make online distance ID education more effective.

If the development of online distance design education tools and environment is considered as a complicated scenario; the designers have the large portions of the work; they should be writer, designer, director, actor, and audience.

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