ARCHITECTURE STUDENTS' PERCEPTIONS OF DESIGN AND ITS TRANSFORMATIONS THROUGHOUT THEIR EDUCATION

A Thesis Submitted to
the Graduate School of Engineering and Sciences of
İzmir Institute of Technology
in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

in Architecture

by
Batuhan TANERİ

July 2013
İZMİR

We approve the thesis of **Batuhan TANERİ**

Examining Committee Members:

Assoc. Prof. Dr. Fehmi DOĞAN
Department of Architecture, Izmir Institute of Technology

Assist. Prof. Dr. Deniz HASIRCI
Department of Interior Arch. and Env. Design, Izmir University of Economics

Dr. Tonguç AKIŞ
Department of Architecture, Izmir Institute of Technology

11 July 2013

Assoc. Prof. Dr. Fehmi DOĞAN
Supervisor**,** Department of Architecture
Izmir Institute of Technology

Assoc. Prof. Dr. Şeniz ÇIKIŞ
Head of Department of Architecture

Prof. Dr. R. Tuğrul SENGER
Dean of the GraduateSchool of
Engineering and Sciences

ACKNOWLEDGEMENTS

First of all, I would like to express my sincere gratitude to my supervisor Assoc. Prof. Dr. Fehmi Doğan for his patience, guidance and help through this study. It would have been impossible for me to produce this work without him.

Thanks to jury members Tonguç Akış and Deniz Hasırcı of dissertation committee for their constructive criticisms.

I would like to thank my mother, my father, my sister for supporting and caring in the every step of my study.

I would like to thank Deniz for her patience, encouragement and for believing in me till the last second of my study, for her endless support even in the worst times.

I would also like to thank my dearest friend Sertuğ Tanrıverdi for his support and for the long hours of informative discussions in company.

Thanks to Levent Gaşgil for his support and guidance with statistical analysis part of the study.

My thanks to my office mates at IEU for their tolerance and support.

Thanks to research assistants at the room 105 at IZTECH for their support and for their tolerance.

I would also like to thank Mikael Akerfeldt and Jonas Renkse and their friends for their music.

Last but not least, I would like to thank the wheels of my old and faithful VW Polo, and the tea in my glass for its warming support.

ABSTRACT

ARCHITECTURE STUDENTS' PERCEPTIONS OF DESIGN AND ITS TRANSFORMATIONS THROUGHOUT THEIR EDUCATION

This study explores how students of architecture characterize design. It focuses on the transformation of students' conception of design as they move from first year to fourth year in their undergraduate education. The study employs surveys and in-depth interviews with selected groups of students from all four levels among the students of architecture in Izmir Institute of Technology and Dokuz Eylül University. It was found that characterization of design as problem solving is the dominant preference among the students of architecture because design studio pedagogy imposes a conception of a more linear design process which corresponds to design as problem solving. Nevertheless, the students are aware that design process is not as linear as it is taught in the studio. It can be said that the strategic approaches the students developed are caused by this contradiction between the nature of design process and the current applied pedagogy.

Keywords: *Design cognition; Design Studio; Architectural Design Education.*

ÖZET

MİMARLIK ÖĞRENCİLERİNİN TASARIMA DAİR ALGILARI VE BU ALGILARIN EĞİTİM SÜRESİNCE DÖNÜŞÜMÜ

Bu çalışma mimarlık öğrencilerinin tasarımı nasıl tarifliediklerini araştırmaktadır. Lisans eğitimleri boyunca birinci sınıftan dördüncü sınıfa kadar tasarıma dair algılarının nasıl değiştiği konusuna odaklanılmaktadır. Çalışma kapsamında İzmir Yüksek Teknoloji Enstitüsü (İYTE) ve Dokuz Eylül Üniversitesi'nde bulunan mimarlık öğrencileri ile anket çalışması ve takiben öğrencilerde oluşan odak gruplarıyla görüşmeler yapılmıştır. Çalışma sonucunda problem çözümü olarak tasarım tarifi en çok tercih edilen tasarım tarifi olmuştur. Buna sebep olarak ise tasarım stüdyosu pedagojisi öğrencilere lineer bir tasarım süreci sunması öne sürülmektedir. Görüşmeler sonucunda öğrencilerin, tasarım sürecinin lineer bir süreç olmadığının farkında oldukları halde uygulanan pedagoji yüzünden böyle bir tarifleme yaptıkları sonucuna varılmış olup öğrencilerin tasarım eğitimi sürecinde başarılı olabilmek için geliştirdikleri stratejik yaklaşımların, tasarım sürecinin doğası ile uygulanmakta olan tasarım stüdyosu pedagojisi arasında var olan çelişkiden kaynaklandığı öne sürülmektedir.

Anahtar kelimeler: *Tasarım kavram; Tasarım Stüdyosu; Mimari Tasarım Eğitimi*

TABLE OF CONTENTS

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1. Problem Statement

Regardless of differences in methods of design teaching, students of architecture almost never formally learn what the design process is. Kowaltowski et al. (2010)indicate that design instructors apply methods mostly informally. Learning about design and design process occur often through what is called “learning-by-doing”. Students are expected to acquire an understanding of design and design process through designing rather than formal methods of teaching. In this method of learning, the tutor is a facilitator rather than a transmitter of knowledge.

The way the studio instructors design and develop instructions sets the stage for informal learning. Design studio instructors often use previous instructions they have implemented and have experience of (Rowland, 1991). Duffy and Jonassen (1992) state that these previous experiences becomes the main source for specifying content and determining instructional strategies. However, the pedagogy derived from those experiences remains as behavioral activities (Duffy, 1992).

This application of informal transfer of knowledge in education takes its roots from Ecole des Beaux Arts in the nineteenth century. Given the studio tradition's historical link to the master-apprentice model, this pedagogical format has been characterized as the "mystery-mastery" approach (Argyris, 1981). Groat and Ahrentzen (1996) state that the instructor has mastered the craft of architecture, yet the process by which the instructor arrives at this mastery remains a mystery. In addition, although the devices in this type of teaching that instructors use are defined, what is learned about design and design process is not clearly defined.

Schon (1987) defines and focuses on two main devices in this type of teaching. These are “coaching”, which designates guidance by the studio instructor, and “learning by doing”, which emphasizes student-oriented learning by getting directly involved in what is being learned. According to Schon, these two devices complement each other as

what instructors convey about designing and its essential features is graspable by a student only as he/she begins to design (Schon, 1987).

Conceptually, the studio is a process of learning by doing, in which students are given a series of design problems to solve. Thus, they learn how to design largely by doing it, rather than by studying it or analyzing it (Lawson, 1997).

Webster (2005) states that it has long been recognized that there are two aspects of any curriculum of architectural studio. First, there is the explicit or declared curriculum that maps out the cognitive student learning, i.e., knowledge, skills, and abilities to be acquired (Webster, 2005). Second, there is the tacit or 'hidden curriculum' (Dutton, 1987) that is concerned with inculcating non-cognitive dispositions such as values, tastes, and beliefs. It can be said that the explicit and the hidden curriculum contain the body of knowledge to be taught to the students of architecture.

The question of what is taught in architectural design studios remains unanswered although these two aspects of any curriculum of architectural studios are defined. The institutional procedures require well-defined learning outcomes. However, design studio pedagogy is derived from instructors own pedagogical beliefs of instruction. It can be said that there are traces of both the objectivist tradition of instruction and the constructivist approach to instruction in the instructors' teaching strategies.

According to objectivist understanding, the world is structured in terms of entities, properties and relations (Lakoff, 1987). In the objectivist tradition, the instruction aims to guide the learner to "acquire the entities and relations and the attributes of each - to build 'the' correct propositional structure" (Duffy, 1992). Duffy and Jonassen (1992) states that this approach demands the identification of the entities, relations and attributes that the learner must know. Thus, it is assumed that everyone has acquired the same basic information. On the contrary, constructivism holds that there are many ways to structure the world so there is not a correct way that one looks for. According to constructivists, one does not comprehend an external reality and develop an unchanged, exact mental copy of objects or events (Piaget, 1971). According to Piaget (1997), the essential building block for cognition is the 'scheme'. Individual schemes become modified, combined and reorganized to form more complex cognitive structures. These cognitive structures serve as filters for all new experiences and since

each individual filters and interprets the information through a different cognitive structure, there is not a correct way to structure the world.

Compared to education in other disciplines, design does not seek a single correct answer. During the design process, it is rather expected that the student will make propositions which are often speculative and exploratory in nature (Roberts, 2006). In comparison to the features of professional technical education, the students' responses to design situations tend to be unique and individualistic, and owe more to interpretation and intuition than to a logical or formulaic process or the application of a rational body of knowledge (Schon, 1985).

According to Winograd and Flores (1986), teaching involves guidance for the student building "unformalized" background that can be used to create representations. Design studio pedagogy is mainly based on learning by doing. It aims to build such an unstructured library of experience since this type of learning is a constructive process in which the learner is building an internal representation of knowledge, a personal interpretation of experience.

Sachs (1999) states that the students are expected to acquire information about many new concepts and ideas and in addition they are asked to perform two tasks simultaneously to design and to learn to design. In this regard, the characterization of design becomes crucially important in terms of describing the nature of design as a process for teaching it to the students.

Bamford (2002) states that design method became prominent in architecture at a time when design education was disconnected from the practice. There was a strong belief to the capability of design methods to demystify the design process. Thus, design methods seemed to be able to provide an ideal framework for the teaching of 'how to design'.

Design as a form of thinking has been described by many theoreticians with various definitions since 1970s. Simon's (1969) definition of design as problem solving, design as conjecture and trial by Hillier et al. (1972), Schon's (1987) view of design as construction and Akin and Akin's (1996) view of design as insight problems has been the dominant views of design in the field of research in design cognition and design learning.

There are many ways to study design activity like protocol analysis, verbal analysis, experimental studies and etc. Lawson (2004) presents ways of uncovering

design knowledge and gathers them under five different methods. One of them employs simply asking the designers to tell the researcher what they know. In this study, the researcher assumes that by asking students what they know one can acquire in-depth knowledge about how design education changes their conception of design and how it is transformed through their education under the light of design characterizations described in design studies. This inquiry is executed under three sections focusing on students' conception of design, students' conception of design process, students' conception of design education respectively.

1.2. Aim and Scope of the Study

This study explores how students of architecture characterize design. It focuses on the transformation of students' conception of design as they move from first year to fourth year in their undergraduate education. The study employs surveys and in-depth interviews with selected groups of students from all four levels among students of architecture.

The questions below are inquired throughout the study:

1. How do students of architecture characterize design throughout their education?
2. How does architectural design education change a student's conception of design inhis/her mind?
3. What does students of architecture learn about design and design process?

The study explores how the design characterizations in design studies literature correspond to the students' conception of design. Thus, the researcher investigates if there is a tendency from a specific design characterization towards another one from first year to fourth year in architectural design education in the selected schools of architecture. It is assumed that identification of specific design characterizations that are clustered in specific year of design education may give in-depth knowledge about what is taught about design in the respective design studios.

This study takes the setting of the design studio as an educational device in its totality together with the studio instructors, other students, and the physical environment of the studio. The researcher adheres to the general principles of learning-by-doing as it

is implemented in design studios; yet, what students actually learn about design and design process throughout their education is inquired. Often, studio evaluations are based on the end or on the intermediary product assuming that learning could be measured through the quality of the product. In this study, it is suggested that investigating and evaluating what students learn about design by asking their feedback could provide important insights about design learning.

1.3. Methodology

The study employs surveys and in-depth interviews with selected groups of students from all four levels among the students of architecture in the departments of architecture in Izmir Institute of Technology (IZTECH) and Dokuz Eylül University (DEU).

Both IYTE and DEU are located in Izmir. Their campuses are settled outside of center of the city. IZTECH has four departments under the faculty of architecture: department of architecture, department of city and regional planning, department of architectural restoration and department of industrial design. DEU has two departments under the faculty of architecture: department of architecture and department of city and regional planning.

The departments of architecture at IZTECH and DEU are selected due to their correspondence to each other in terms of their institutional structures and curricula. Both departments of architecture are under a faculty of architecture. Their undergraduate education is of four years consisting of eight semesters. Both schools have one design studio course for each semester. They all start with a basic design studio in the first semester of the first year in their curricula. The design studio course in their second semester of the first year introduces the notion of space to their students. The scale of the project in architectural design studio courses from first year to fourth year increases as a curricular strategy in both schools.

The research presented here was held in two steps among two schools of architecture, IZTECH and DEU. 364 students of architecture attended the study. The researcher conducted a questionnaire composed of 14 questions to gather data about the characterizations of design among the students from all four levels. Following the questionnaires, semi-structured interviews were carried out with focus groups composed

of three to five students from each year separately to obtain in-depth information regarding their characterizations of design activity where survey study remains incapable of providing explanation.

The study is specifically seeking an answer to the question of how students of architecture characterize design and analyzes how students of architecture define design, how their design process is shaped and how the architectural education affects their conception of design.

1.4. Structure of the Study

After a brief introduction in Chapter 1, Chapter 2 presents a literature review held in two main topics: design studio and design studies. Design studio's evolution as an educational device in terms of its structure and its associated pedagogy is discussed in detail. Then, the importance of design studio as a pedagogical device in design education is discussed under the light of related literature. Following this section, design methods movement and its phases and foci of these phases are presented. Some examples which show how design studies conducted to demystify design process affected the design education in the schools of architecture are presented.

In Chapter 3, the research methodology and how it is conducted is explained. This chapter is divided into two main sections: The Questionnaire and the semi-structured interviews. In each section, the procedure of the related research method, the material used, the profile of the participants and analysis of the gathered data are explained in detail.

In Chapter 4, the results of statistical tests and other related analysis of the collected data are presented with tables and figures under three sections based on the structure of the survey study. These three sections are respectively "students' conception of design," "students' conception of design process," and "students' conception of design education."

In Chapter 5, the conducted analysis is associated with the evaluation of in-depth interviews. The results are interpreted under the light of the literature review presented in the second chapter.

In Chapter 6, the implications for architectural design education are presented. A proposal for future work is proposed, followed by contributions to the field and limitations in the study

CHAPTER 2

EDUCATING THE DESIGNER

Design education in the form we know it today is rooted in the late nineteenth century. The history of design education shows a progressive move from the workplace into the college and university studio(Lawson, 2004).

This chapter presents an overview of the literature on two main subjects which are “design studio” and “cognition in design education”. It starts with a historical review of design studio as an educational device consisting of studio instructors, other students, and the physical environment of the studio. The discussionis followed by an investigation of how design studio works as an educational device with reference to design studies.

2.1. Design Studio – Roots of Design Pedagogy

The model from which architecture's studio-based pedagogy was established in the eighteenth-century Paris, the École des Beaux Arts (Cunningham, 2005). This prestigious institution traced its origins to the classes given by the Academies of Painting and Sculpture and of Architecture established under Louis XIV in 1648 and 1671 respectively.

Modern project-based education in the architectural education owes its structure, content, and method in large measure to the École des Beaux Arts. Cunningham (2005)states that the Arts and Crafts Movement which had its roots in the mid-nineteenth century romanticism in England as a second formative influence on architectural education. The formation of the Bauhaus in Weimar in 1919 can be seen as the educational culmination of this movement. According to Cunningham(2005), the educational method and its implicit dependency upon the antithesis ‘standardization’ versus ‘individuality’ also influenced the teaching of art and architecture throughout the world.

2.1.1. The École des Beaux Arts

According to Cairns (2005), Alberti and Vasari were principal influences upon the evolution of Italian Renaissance architecture releasing it from reliance upon tradition. As a result of this, *disegno* (design) became an activity separating intellectual preoccupations and manual labour. Cunningham (2005) states that consequently the education of architects has been centered upon learning-by-doing, a project-based, intellectual procedure from the very beginning.

A historical outcome of this separation was the emergence of formalized architectural education such as the French Academies. The Academies were founded by Jean Baptiste Colbert, a minister of Louis XIV (Collins, 1979). François Blondel, appointed as the first professor and director of the Académie Royale de l'Architecture in 1671, believed in teaching doctrines and universal truths. Cunningham (2005) states that Blondel assumed that any problem in architectural design was open to reasoned and logical solution and the education system he devised, which was a controlled and centralized organisation, reflected such conviction.

Twice a week in April and May, Blondel visited significant buildings with his students, which were subsequently criticised and exercises set in which students would 'correct' faults. The educational methods he devised became the basis upon which the nineteenth-century Ecole des Beaux Arts was modelled.

A parallel development having repercussions on architectural education was the formation in 1794 of the École Polytechnique devoted to scientific education. Cunningham (2005) points out that this early separation of science-based techniques from formal composition studies can be the reason for the difficulties encountered by the first modernists in combining technical advances with the conception of form.

Cunningham (2005) lists six methodological characteristics of the Ecole des Beaux Arts which indicate the roots of the pedagogy of the precedent of a modern architectural design studio and the educational devices.

- division of students into ateliers run by a Patron;
- teaching of younger pupils by older students;
- the design exercise as the core of the educational programme;
- the beginning of design studies immediately upon entering an atelier;

- systematic resolution of design problems starting with the ‘esquisse’ (sketch design);
- development of a competitive spirit as a pedagogic tool.

The Ateliers are organized by groups of 50 to 100 students between the ages from fifteen to thirty (Cunningham, 2005). The Patron was usually a distinguished architect and was invited by the students to act as their guide and critic(Cunningham, 2005). The students established a hierarchy among them which are the Nouveaux (new boys) and Anciens (old hands)(Cunningham, 2005). At certain times, the Patron visits the ateliers. He defines its goals in general and provides leadership. Only the work of the Anciens was viewed and criticized. The Nouveaux were guided by the senior students.

The changing needs emerged with the new technologies and innovations and French rationalism were the reasons of the reform in training of an architect. The expansion of professional functions and the introduction of new building types such as railway stations, offices, factories including technical innovations in heating, lighting and drainage made clear that the training became increasingly inadequate for the profession of architecture.

Architecture's studio-based pedagogy originates partially from eighteenth- and nineteenth-century French rationalism, which held that through the analysis of precedent and the application of reason. This rationalism underlay the teaching methods of the Ecole des Beaux-Arts.

Cunningham(2005) states that there was no unity of pedagogic means and ends comparing to the Ecole des Beaux Arts in the twentieth century.

Fisher (2000) points out that many of the basic features of today's design studio which are the unquestioned authority of the critic, the long hours of working, the focus on schematic solutions, the rare discussion of users or clients were originated from this 150-year-old system.

2.1.2. Arts and Crafts Movement

Cunningham (2005) states that the Arts and Crafts Movement tried to prevent the threat of progressive mechanization to craftsmanship and individual expression. It reunited the creative arts and realized again the *Gesamtkunstwerk*, the total work of art.

Norman Shaw and William Morris were the principal figures of a new social order that envisioned a 'total design of the living environment for the masses' (Cunningham, 2005, p. 418).

An educational philosophy based on such perceptions was implemented in South Kensington School later to become the Royal College of Art. W.R. Lethaby (1913-14), Professor of Design in South Kensington School states as:

> . . . all education should be apprenticeship and all apprenticeship should be education. Education has become . . . far too much a mere abstract grammar, and far too bookish. The Unit for regulating education is properly . . . the organizational art or craft, that is to say, its Guild. All education is the opening up of a necessary and beneficent life occupation. The exercise of such a calling furnishes the best and largest education in life itself.(Cunningham, 2005, p. 418)

The Arts and Crafts Movement heavily influenced theories and practice in Europe. In Munich in 1907 the Deutsche Werkbund declared its common goal, which was about the reform of environmental design through the productive work of craftsmen, industrialists and architects. Henry Van de Velde in Weimar and Franz Cizek in Vienna regarded craft training as a fundamental factor in their educational programmes and sought to relate theory to practice.

This era also witnessed the emergence of professional exams in 1860s defined and introduced by Royal Institute of British Architects (RIBA) which is established in 1834. This exam also evoked the formal, and continuing, debate about what makes the contemporary architect.

The Arts and Crafts Movement brought the concept of learning by doing in a master-apprentice environment to the agenda. The pedagogy of analysis of precedents by The Ecole des Beaux Arts left its place to a more experienced based learning and 'anti-academic' learning environment. This movement set the basis for the contemporary first year design studio pedagogy by leading towards the emergence of Vorkurs in Bauhaus which still keeps its traces in the design studio pedagogy.

2.1.3. Bauhaus in Weimar

The Bauhaus has been one of the most seminal art schools of the 20th century. It has completely changed the art education and its reflection can be seen in most of today's schools that teach design.

By the early 20th century, the search for universal design pedagogy was being addressed throughout Europe (Lerner, 2005). It raised issues of reform and resistance that are still being debated today.

Influenced by the British Arts and Crafts movement, the Vienna Secession founded in 1898, was concerned with bringing architecture back to life by freeing painting and sculpture from the chains of historicism(Whitford, 1984). Secession members played a great role in establishing the Wiener Werkstätte in 1903. Crafts workshops produced furniture, household goods, textiles for sale in its own shop, in this way training and financial support was provided for the artists and craftsmen.

In 1907 Muthesius succeeded in bringing together twelve artists and twelve industrialists in order to found an organization called the "Werkbund". Its aim was the harmony of art, craft, industry and trade, and a subsequent improvement in the quality of German products(Whitford, 1984).

Gropius joined the Werkbund in 1912. Another Werkbund member is Henry Van de Velde whose works and ideas were the foundation of the Bauhaus dream. In the private 'Arts and Crafts' seminar in 1902, he realized this dream of cooperation between artist, craftsmen and industrialist (Whitford, 1984).

The educational climate was anti-academic, anti-history, and mistrustful of theory, based on practical experiments and conscious of social need(Cunningham, 2005). In terms of educational policy and pedagogical concepts, the Bauhaus built on the models of the "technischeHochschulen" (technical colleges) and Kunstgewerbeschulen (schools of arts and crafts) in Germany (Whitford, 1984). These types of schools were differentiated in the sense that the structures of traditional universities and art academies were denied during the last third of the 19th century structures of traditional universities and art academies (Siebenbrodt & Reissinger, 2000). Siebenbrodt and Reissinger (2000) state that the technical colleges offered a practice-based scientific and technical curriculum, particularly at the affiliated research laboratories.

Whitford (1984) states that the pedagogical approach employed at the Bauhaus focused on the development of all of a student's skills and talents. Instruction in design was never devoted to the imitation of models or the reproduction of patterns, as it was the case in the Ecole des Beaux Arts, but it was focused from the outset on fostering students' individual creative talents(Whitford, 1984).

The "workshop" was the structural basis of the Bauhaus method of teaching. Gropius had the teachers called "masters" and the students called "apprentices" and "journeymen", to put them into the context of real world trades (Lerner, 2005). Each workshop was shared by two teachers: a "workshop master," typically a craftsman skilled in manual skills, materials, and production; and a "master of form ",generally a fine artist who would try to stimulate creative thinking because there were no qualified instructors for such a new style of teaching (Lerner, 2005, p. 215).

The education was based on the workshops but what differs Bauhaus from the other various reformed schools of arts and crafts in Germany was bringing a complementary system of workshop-teaching (Whitford, 1984). There were no teachers and students but guilds, masters, journeymen and apprentices. Apprentices were instructed by both masters of each particular craft and fine artists. The masters would teach method and technique while the fine artists would help them achieve a formal language of their own (Siebenbrodt & Reissinger, 2000). These artists were called as "Masters of Form" and the craftsmen were called as "Workshop Masters". Masters of Form were responsible for teaching core principles of color and composition as well as form itself. The Workshop Master taught carpentry, metalwork, and weaving.

Traditional academic forms of instruction, such as lectures or seminars, were not employed at the Bauhaus. Workshop training began on practically the first day of classes with material studies in the preliminary course or, beginning in 1923, in the special preliminary instruction workshop under Josef Albers(Siebenbrodt & Reissinger, 2000). Project work in one of the ten (in average) Bauhaus workshops was the constant focus of training.

In order to get a better idea about the talent and nature of the applicant, Itten proposed to Gropius that students be admitted for one provisional semester. This semester was called the Vorkurs or basic foundation course. Lerner (2005) states that instead of offering instruction that depended on "old forms and styles," he promoted teaching the student a "special language of shape in order to be able to give visible

expression to his ideas" (Gropius, 1937, p. 28). He or she would be exposed to "all the essential components of design and technique right from the beginning, in order to give the pupil an immediate insight into the whole field of his future activities" (Gropius, 1937, p. 28). By having all students, whether artists, designers, or craftsmen, share basic training in the "language of shape", Gropius hoped to provide "a general basis on which a multitude of individuals can work together harmoniously" (Gropius, 1937, p. 28).

The Bauhaus course lasted for three years (Wingler, 1969). The foundation course, “Vorkurs”, devised and conducted initially by Itten, which took up the first six months, was the most innovative and controversial. It has had a profound effect on art and architecture education. Itten was deeply influenced by his former teacher Cizek whose art instruction was based upon the principle that ‘individual potential can be best manifested through the playful and creative use of different materials relying on instinct, a key pedagogic demonstration of learning-by-doing’ (Cunningham, 2005, p. 419).The Basic Course had three objectives: “To free the creative powers . . . of the students, to make the student’s choice of career easier, to convey to the students the fundamental principles of design for their future careers”. (Itten, 1963, p. 9)

Lerner (2005) emphasizes that students were to remove all their preconceptions and open their creativity to new ideas. After a series of breathing and relaxation exercises, the problems of the day were often introduced through common drawing exercises. Lerner (2005) points out that Itten devised explorations in light-dark contrasts, tone scales, color, material and texture, form, rhythm, nature studies, old master analyses, and so on, while at the same time considering the sensual, intellectual and spiritual meanings that might emerge. Itten’s general theory of contrasts set the basis of his teaching (Lerner, 2005). Creating tension by comparing polar opposites, like light/dark or soft/hard, design problems were introduced in materials, textures, forms, colors, rhythms, and so on. Itten's book Design and Form: The Basic Course at the Bauhaus (1963) opened with his declaration, "Teaching cannot be repeated in its most valuable moments-when we succeed in touching students' innermost core and striking a spiritual light" (Itten, 1963, p. 7). Although he presented a set of controlled exercises, he was careful to qualify that "the basic goal of my efforts to teach art had always been the development of the creative personality" (Itten, 1963, p. 104). Lerner (2005) states that in this common goal, each successive Vorkurs master teacher was noted for his teaching and pedagogical contributions.

Lerner (2005) points out that Itten had been a kindergarten teacher earlier in his career, trained in teaching methods and materials developed by Friedrich Froebel, who is best known as the inventor of the kindergarten concept. Lerner (2005) states that Itten's Bauhaus Vorkurs had many similarities to Froebel's pedagogy (Brosterman & Togashi, 1997). For both Froebel and Itten, students learned by doing, experimentation for its own sake was encouraged and "play" was considered key in imparting important theoretical discoveries (Lerner, 2005). Wilson (1969) states that many of the published Bauhaus projects "appearto have been devised as more adult extensions and developments of Froebelian occupations" (p.104).

The evolution of the ideological focus in the Bauhaus from the Expressionism which Gropius had embraced briefly after World War I to the Neue Sachlichkeit (New Objectivity), coincided with Itten's 'replacement' by Moholy-Nagy to teach the Vorkurs. Albers described the change which is a move from subjectivity to machine rationalism. Albers states that, "the course aimed at the development of a new, contemporary visual expression… to a more rational, economic, and structural use of material itself... in pictorial terms, from collage to montage".(Naylor, 1985, p. 101)

The achievements of people who supported De Stijl in painting, sculpture and architecture deeply impressed Gropius, the staff and students. Gropius stated the change indirection in the 1923 Bauhaus exhibition 'Art and Technology: a New Unity'. Gropius presented the potential of an 'international architecture from a completely predetermined point of view, namely the development of modern architecture in the dynamic functional direction, without ornament or mouldings'. Cunningham (2005) states that Gropius announced the design school's intention as to influence the direction of architecture, internationally, by means of its educational programme which was an open and revolutionary programme. This intention was far removed from education and it was in the service of practice(Cunningham, 2005).

Manual and mental instruction in design were given simultaneously with practical instruction in the handling of various materials. The content and pedagogic methods of the workshops were based on the specialities and character of the masters (Cunningham, 2005).

Siebenbrodt and Reissinger (2000) state that Moholy-Nagy's arrival changed the aim and methods of the course towards a more rational, economic, and the structural use of material itself by removing all the metaphysics, meditation, breathing exercises,

intuition, emotional apprehension of colours and forms, and turning the course into a production-focused laboratory. Moholy tried to introduce the new techniques and the new media to the students. Also unlike Itten's teaching, Moholy-Nagy turned students attention to the real problems of designing without using expensive materials.

The main achievement of Bauhaus was that art was not put in opposition to the industrial world but as an essential part of it through the realization of workshop-based education and the introduction of the Vorkurs. Experience-based content and methods of teaching of the Vorkurs realized the idea of producing by supplying the conditions by the workshops. The replacement of Itten by Moholy-Nagy took the course much closer to the aim of production from an education promoting creativity towards a much focused education that would train individuals much integrated with the machine economy, that could feed the machine economy.

Cunningham (2005) states that the internal tensions developed among the teachers in Bauhaus divided them into two ideological groups. These were Constructivists and Rationalists.

This division had left its mark on the design studio pedagogy. The ideological opposition is embedded in the design studio pedagogy between the ways of teaching activities of studio instructors and the teaching process of the studio which become as the main features of the contemporary design studio education.

2.1.4. Main features of Design Studio Education

Design studio education is based on learning-by-doing. Design studio takes the tradition of this form of learning from Ecole des Beaux-Art. The studios were conducted under the guidance of experienced architects called as "Patrons". This also has set the foundation of master-apprentice model for architectural design education. Moreover, Bauhaus transformed the patrons into masters and differentiated the educational roles by dividing them into two as "Master of Form" and "Workshop Masters". As Cunningham (2005) stated the separation of science-based techniques from formal composition studies in the eighteenth century continues to be the remaining issue in the contemporary design education. In the context of the two schools of architecture took part in this study, design studio courses exits as a place for formal

studies and building and technology courses stand as the course that teach science-based techniques.

Master-apprentice model shaped by these earlier examples of design and architectural teaching brings forth some unquestioned assumptions about design learning. The ambiguity in the transfer of knowledge by such methods is the main research topic of this study. The nature of this relationship between the studio instructors and the students also brings forth the discussion about the unquestioned authority of the critics.

Bauhaus in Weimar added another unknown to the equation and transformed the design education into an art-based education with its Vorkurs by Itten. De Stijl's effect on Gropius had also an impact on the formation of the Bauhaus education. Art has always been an integral part of architecture however, with Itten's exercises in order to invoke creativity in students, the teaching methods that he brought into design education brought forth repercussive issues continuing today for students who learn to design. The relation between art and creativity is an integral part of design education. It could be said that the use of this implicit connection between art and creativity by the studio instructors especially in contemporary basic design studio courses has been one of the major reasons for the existence of informal teaching methods in design studio education.

As the École des Beaux Arts introduced the atelier system, Bauhaus turned it into a place for both learning and experimentation on the track of training creative individuals in the service of industry. The actors in both systems have had the same roles as teachers being masters and students being apprentices within an informal method of teaching.

The main difference that had affected the pedagogy involved in the studio, occurred in the ways of teaching design to the students. In the École des Beaux Arts, the students were trained to make analysis of the buildings and finding 'faults' and correcting these in their architectural designs. On the other hand, Bauhaus aimed to train individuals as creative crafters able to produce objects that are able to fulfill their needed functions who were aware of how they could be mass-produced in the service of the community. Bauhaus's vision and teaching methods had led the way to the contemporary diversity in informal teaching methods of design employed by the tutors of the studios with its success of evoking creativity in the students.

Many writers have critiqued the studio (Maass, 1991; Dutton, 1991; Kliment, 1991; Willenbrock, 1991). Boyer and Mitgang, in their 1996 Carnegie Foundation Report, Building Community, clearly advocate a reform of the design studio and the architecture curriculum.

2.2. The Critical Importance of Design Studio as Pedagogic Tool in Architectural Education

As outlined in the previous section, many of the attributes evolved and then incorporated into the education of architects over centuries have become embedded in the current design pedagogies.

In general, the architectural curriculum is composed of fundamental courses that develop design knowledge: technology based courses that develop scientific formation of architecture; artistic based courses for strengthening architectural expression; and the design courses, being a combination of the former three and constitute the most crucial part of design education (Demirbaş & Demirkan, 2003). Sagun et al.(2001)emphasize that the design studio where the design courses are conducted is an environment that is different than a traditional classroom pedagogically, sociologically, ideologically and epistemologically.

Virtually all architecture programs organize their curricula in terms of a "design studio as center point" model, with a constellation of support courses required and/or available to augment the integrative activities assumed to take place in studio. Because of the predominating impact of studio, student experience of studio pedagogy is central to understanding their interpretations of architectural education. Given the studio tradition's historical link to the master-apprentice model, this pedagogical format has been characterized as the "mystery-mastery" approach (Argyris, 1981). Groat and Ahrentzen (1996) state that the instructor has mastered the craft of architecture, yet the process by which the instructor arrives at this mastery remains a mystery.

Design studio process is important in design education since it is at the core of the curriculum and all the courses taught in design education are related to the design studio. In design education, design studios are places in which the simulation of real situation occurs (Schon, 1987).

The central pedagogy vehicle for architectural education is project-based learning. In this type of learning the students are expected to make proposals for the development of a piece of architecture, in response to a given brief. The core of pedagogy is neither subject nor discipline but instead an activity which is design. This synthetic process employs any information, knowledge, theory or technique from other disciplines which the designer may select as being relevant to the task in hand.

While there is no clearly defined body of knowledge which serves architecture, no single organizing principle, no central, intellectual paradigm— borrowing, as required, theories and techniques from other disciplines—it demonstrates that the acquisition of knowledge is not an educational end in itself. The intellect can be stretched in terms of recognizing the need for particular nuggets, seeking the means to search out and satisfy that need and then employing the results creatively.

Comparing to the education in some other disciplines, design project work does not seek a single correct answer but rather the student is invited to make propositions which are often speculative and exploratory in nature (Roberts, 2006). Considering the features of professional technical education, the students' responses tend to be unique and individualistic, and owe more to interpretation and intuition than to a logical or formulaic process or the application of a rational body of knowledge (Schon, 1985).

The role of the design studio can be considered with three steps: (a) learn and practice some new skills like visualization and representation; (b) learn and practice a new language as Schön described design as a graphic and verbal language (Schon, 1987); (c) learn to 'think architecturally' as Ledewitz (1985) explained as the "way of thinking" referring " to a particular domain of problems and solutions that characterize and which are fundamental to professional performance".

Ledewitz (1985) points out that the lack of clarity over the purpose and effectiveness of the design studio reflects its complexity as a teaching/learning setting. She states that the educational experience in design studio involves not only learning all three of the aspects mentioned above, but learning them all at the same time. In teaching studio, it has been experienced that it is both difficult and ineffective to isolate these aspects of design education. All the aspects of design education – the skills, the language and the approach to problems – are more effectively taught indirectly through experience than taught directly by explanation. Schon explains this as the learner cannot really understand what it is he/she needs to learn and nor can he understand what his/her

teacher tells him/her, until he has immersed himself/herself in various experiences that will make him/her understand (Schon, 1987).

Schon (1987), in his work Educating the Reflective Practitioner, describes design studio teaching in architecture as a ‘practicum’—a setting designed for the task of learning a practice. In a context that approximates a practice world, students learn by doing, by undertaking projects that simulate and simplify practice. “It could therefore be seen to stand in an intermediate space between the practice world, the lay world of ordinary life, and the esoteric world of the academy”(Schon, 1987).

However, and crucially, Schon (1987) goes on to observe that the virtual world of the studio becomes a collective world in its own right, with its own mix of materials, tools, languages and appreciations. Nicol and Pilling (2000) clearly state the most important aspect of the design studio as it offers the potential to provide a multifaceted and enriching learning experience. For the student it embodies particular ways of seeing, thinking and doing that tend, over time, to assert themselves with increasing authority. It is this feature of the studio which is seen to hold both the strength and, potentially, the greatest weakness of architectural education as a preparation for practice (Cuff, 1991).

Cuff explains the critical importance of the studio in the architectural design education as more than a place to study, the situation in which the student is initiated into what she has called the culture of the architectural profession (Cuff, 1991). It is here that the students learn what is currently accepted as ‘architecture’, ‘design’ and ‘the role of the architect’ (Sachs, 1999).

2.3. Design Methods

There was a strong belief to the capability of design methods to demystify the design process. Thus, design methods seemed to be able to provide an ideal framework for the teaching of 'how to design'.

Two important periods in the modern history of design were distinguished by the desire to produce works of art and design based on objectivity and rationality. The 1920s saw the emergence of a search for scientific design products. In the early 1920s, Theo van Doesburg, expressed his perception of a new spirit in art and design:

> Our epoch is hostile to every subjective speculation in art, science, technology, etc. The new spirit, which already governs almost all modern life, is opposed to animal spontaneity, to nature's domination, to artistic flummery. In order to construct a new object we need a method, that is to say, an objective system. (Naylor, 1968, p. 71)

Later, Le Corbusier (1929) defined the house as an objectively designed "machine for living": "The use of the house consists of a regular sequence of definite functions. The regular sequence of these functions is a traffic phenomenon. To render that traffic exact, economical, and rapid is the key effort of modern architectural science."

This desire to "scientise" design continued through 1960s but this time with a concern for scientific design process. Cross (2001) states that the first 'Conference on Design Methods', which was held in London in 1962 is generally regarded as the event which marked the launch of design methodology as a subject or field of enquiry, and the 'design methods movement'. The 1960s was proclaimed as the "design science decade" by the radical technologist Buckminster Fuller, who called for a "design science revolution" based on science, technology, and rationalism to overcome the human and environmental problems that he believed could not be solved by politics and economics (Fuller, 1999). Herbert Simon (1969) established the foundations for 'a science of design', which would be "a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process"(Simon, 1969, p. 113). The 1960s also saw the beginnings of computer programs for problem solving. The first design methods or methodology books appeared –Asimow (1962) Alexander(1964), Archer (1965), Jones(1970) - and some of the seminal works on creativity - Gordon (Gordon, 1961), Osborn (Osborn, 1963).

Many architects in the early 1960s, particularly those in the academic world, were enthusiastic about the capability of design methods to demystify the design process and so provide an ideal framework for the teaching of 'how to design'.

In the 1970s, the lack of success in the application of "scientific" methods to everyday design practice caused the opposition against design methodology and a rejection of its underlying values.

Buttle (1979) saw the main reasons for the failure to be that the boom in architectural practice in the 1960s and this boom left no time and no need to consider method. Fowles (1979) points out that according to Buttle (1979), the objectives and potential of the architectural process were neither recognized nor understood and there

was a lack of an effective communal language in architecture. According to Buttle (1979) design methods was not able to provide the language as those involved in it considered it would.

Fowles (1979) states in the review that there was a refreshing simplicity in the way Broadbent(1979a) now sees design and design education. Broadbent states as, “Design is seen as a matter of generating ideas then testing them, modifying and improving where necessary. So, design education becomes a matter of learning how to generate ideas and learning how to test them, thus solving a lot of problems as to the shape of the design process itself”(Broadbent, 1979a, p. 15).

Fowles (1979) states that the early theorists took the Cartesian approach of breaking down design problems into elements (Asimow), factors (Jones) sub-problems (Archer), and misfit variables (Alexander). Broadbent (1979b) notes that a “fundamental tenet of the design science which thus began to emerge was that the designer should abandon, absolutely, any question of pre-conceived design solutions” (p. 41). Fowles (1979) points out that First Generation Design Methods produced little to be used as an architectural design hardware. However, Disneyland at Orlando, Florida is claimed as “the most carefully calculated piece of architectural and urban design that has ever been built” (Broadbent, 1979b, p. 41), in terms of the techniques used in planning the complex.

The Design Methods Movement has always been in the search for a commonly shared theoretical body of knowledge which can be applied to generate a solution for a design problem.

The design theorist Christopher Alexander (1964), in his work Notes on the Synthesis of Form, proposed to break design problems down in manageable chunks with a mathematical system that could be addressed by the human mind in order to overcome the complexity of design problems. He illustrated this with an approach to the design of a village.

John Page (1963), a building scientist, proposed a method of designing based on sub-optimization and relying on a ‘cumulative’ approach. He applied the technique to a design of a window but this showed how complex simple design features can be.

The problem with the design methods was that there was not any known attempt to be used in practice. There is a reported attempt to use the Alexander technique (Hanson, 1969) which remained as a failure.

Lawson (1997) states that the two methods proposed separately by Christopher Alexander and John Page failed because they were such attempts that imposed a structure on the nonexistent problem-solution relationship in design. Design, unlike mere problem solving, requires the use of an implicit body of knowledge and unlike problems of science there is no one commonly shared theoretical body of knowledge which can be applied to generate a solution (Lawson, 2004). Goel and Pirolli (1992) claims that the kinds of knowledge used in a design process are practically limitless.

Design methodology was reclaimed by Rittel's (1972) proposal of 'generations' of methods. He suggested that the developments of the 1960s had been only 'first generation' methods. Cross (2007) explains that the first generation of design methods was based on the application of systematic, rational, 'scientific' methods. The second generation moved away from attempts to optimize and from the omnipotence of the designer, towards recognition of satisfactory or appropriate solutions and an 'argumentative', participatory process in which designers are partners with the problem 'owners' (clients, customers, users, the community)(Cross, 2007).

Bayazi t(2004) states that Broadbent identifies the Second Generation Design Methods as denying the skills and knowledge of the expert designer, and points to a third generation of design methods based on a Popperian view in which the expert makes the design conjectures which others can refute.

In the summary of the papers brought together by Robert Fowles in Design Methods and Theories, Volume 13, Number 1, (Jan-March 1979), and constituting Part Two of his investigation What Happened to Design Methods in Architectural Education?, he briefly states the situation of Design Methods in architectural education in the United Kingdom in 1970s.

Fowles (1979)mentions of MacMillan's(1979) paper the Mackintosh School's more traditional philosophy and curriculum, with no specific taught and examined subject named Design Method or Methods. However, 'the teaching of method is implicit in all course areas.' In the paper, it is stated that A Methods and Procedures course is outlined which is extensive and wide ranging, covering basic skills, specific methodologies, programming and organization, management and practice.

Bryan Lawson of the Sheffield University School in his paper "The Act of Designing" supports MacMillan's view. Fowles (1979) states that MacMillan's view of "the singular nature and particular ideological standpoint of First Generation Design

Methods were incongruent with the wider and complex context of architectural design" (p. 16). With the passing of the 'modern movement' Lawson reveals an uncertainty as to First Generation Methods' replacement. As a consequence, in the First Year at Sheffield, Design Methods takes its place amongst a range of 'architectural ideologies' presented to the students in the Theory of Architecture Course (Fowles, 1979). In the general area of methodology, the discussion focuses on the perception of architectural problems by the architect, with emphasis being placed on analysis of the design process actually followed by practising architects. In the techniques level, at Sheffield, gaming and simulation techniques and computer-aided design packages were stated as 'useful teaching instruments' and 'seem to be liked by First Year students'.

Cross (2007) states that the 1980s saw the establishment of design as a coherent discipline of study in its own right, based on the view that design has its own things to know and its own ways of knowing them. Archer (1979) encapsulated the view stating that "there exists a designerly way of thinking and communicating that is both different from scientific and scholarly ways of thinking and communicating, and as powerful as scientific and scholarly methods of enquiry when applied to its own kinds of problems" (p.17). Schon (1983) promoted the new view within his book The Reflective Practitioner, in which he sought to establish "an epistemology of practice implicit in the artistic, intuitive processes which [design and other] practitioners bring to situations of uncertainty, instability, uniqueness and value conflict" (p. 49).

2.4. Cognition in Design Education

Design schools characteristically use both the physical and conceptual studio as their central educational device. Conceptually the studio is a process of learning by doing, in which students are set a series of design problems to solve. Thus, they learn how to design largely by doing it, rather than by studying it or analysing it (Lawson, 2004). Physically the studio is a place where students gather and work under the supervision of their tutors. One of the weaknesses of the traditional studio is that students, in paying so much attention to the end product of their labours, fail to reflect sufficiently on their process (Lawson, 2004).

The professionalization of design and thus institutionalization of design education has led this focus on the product rather than the process. Alexander

(1964)argues that the unselfconscious craft-based approach to design must inevitably give way to the self conscious professionalized process when a society is subjected to a sudden and rapid change which is culturally irreversible.

Lawson (1997) states that the change in the designer's role, the separation of the designer from making caused drawing to have a central role in designing. In the context of this research "drawing" is not to communicate others but rather as part of the thinking process itself which is called design. Alexander(1964) clearly states the most important aspect of drawing as an activity for thinking which can be called as sketching, as a symbolic method to be replaced by real world trial-and- error design which does not rely on the experiment of actually trying the form out in the real world context.

In this regard, Schon (1987),taking the dialogue between students and a tutor as an example of design education, proposed some crucial arguments with respect to design process. Schon (1987) introduces the paradoxes in learning to design and recalls Meno paradox to explain the nature of design problems and process of learning to design.

Simon (1969) who thinks of designing as converting a situation from its actual state to a preferred one, proposes to solve the paradox of the Meno by distinguishing between "state" and "process". He states that the change of state that occurs can be described when a problem is solved even though the process that would produce it cannot be described. However, Alexander(1964) defines design as searching for harmony between two tangibles which are form that it has not been designed and context that it cannot be properly described.

Using Meno paradox, Schon (1987) states that design activity is to look for something without knowing what it is. So, according to Schon (1987), design cannot be defined; and to teach a student what design is becomes impossible but Schon (1987) proposes it is possible that the student can be coached. He states:

> He has to see on his own behalf and in his own way the relations between means and methods employed and results achieved. Nobody else can see for him, and he can't see just by being told, although the right kind of telling may guide his seeing and thus help him see what he needs to see." (Schon, 1974, p. 151).

Rogers (1969) supports the same learning process as stating that such self-discovered learning where the knowledge to be learnt which has been personally appropriated and assimilated in experience, cannot be directly communicated to

another. In this regard, Schon (1987) states that each student must construct for himself/herself the meaning of the other's messages and must design messages whose meanings the other can decipher.

Schon (1987) focuses on two main devices to teach design. These are "coaching" and "learning by doing" which stand for guidance and self-constructed process. According to Schon (1987), these two devices work complementarily because what instructors can say about designing and essential features of it, is graspable by a student only as he/she begins to design. Schon (1987) states three essential features of the dialogue between coach and student. The dialogue takes place in the context of student's attempts to design which creates a familiar ground for student. It also makes use of actions as well as words and it depends on a reciprocal reflection-in-action. So, "learning by doing" is to provide a student to have the sorts of experience to which the coach's language refers.

Schon (1987) states that the architectural studio rests on an implicit response to the paradox and predicament of learning to design. The student must begin to design before he/she knows what he/she is doing, so that the studio master's demonstrations and descriptions can take on meanings useful to his/her further designing. The weakness of this method of teaching is that it relies on the effective communication skills of the studio master. In this context, the messages that the instructor designs plays a crucial role. Schon (1987) states that these messages often refer both to the process of designing and to the process of learning to design.

Alexander (1964) describes the most important aspect of the process of learning by doing as enabling the designer scanning mentally all the ways in which other things have gone wrong in the past. Using this description, Alexander reveals that learning-by-doing is actually the activity to build history of previous design experience.

Constructivists states that meaning is seen as rooted in experience (Brown et al. 1989). Each experience with an idea – and the environment of which that idea is a part- becomes part of the meaning of that idea. The experience in which an idea is embedded is critical to the individual's understanding of and ability to use that idea. Therefore, as constructivists states the experience must be examined to understand the learning that occurs but Webster (2008) states that this experience is not just gained in the studio but outside of the studio too.

Although Schon's effect on the design education cannot be ignored, in recent years Schon's views of educating reflective practitioner is being criticized. Webster(2008)defines new dimensions to enrich the contemporary understanding of architectural education.

Webster demonstrates a number of significant epistemological, ontological and methodological weaknesses in Schon's work. The role of the tutor that Schon (1987) defines is to correct mistakes, correct students' designs but as Alexander(1964) states, it is impossible to correct every mistake and make them as a list of mistakes by the tutor. Webster emphasizes that especially in the protocol that Schon (1987) conducted the tutor imposes his solution to the student, showing the correct way to formulate a design problem and the right way to place a building on a sloping site however Schon seems oblivious to the notion that there might be more than one solution to any design problem.

Webster (2008) also emphasizes that the learning happens outside the design studio. She states that highly performing students are reading expensively, visiting cities, buildings, exhibitions, attending lectures, spending long hours in studio and living in houses with other architecture students(Webster, 2008).

Webster (2008) bring forward that Eraut (1994) has suggested reflection is no more than a metaphor for thinking. She also questions at what point action becomes reflection-in-action and at what point reflection-in-action stop and reflection-on-action starts(Webster, 2008). Nevertheless, reflection has an important role in designing but it is only one part of the design process (Webster, 2008).

Lawson's (1997) attempt to demystify the design process sums up various definitions of design from various individuals having different backgrounds and institutions. He depicts various route maps of the design process. He states that architects are taught through series of design studies and receive criticism about the solution they come up with rather than the method (Lawson, 1997). In the real professional world the solution is the thing that matters and the process is not examined. Enriching the understanding of the relationship between architectural knowledge, practice and education by using alternative theories of knowledge and learning may help the educators to understand the design process better (Webster, 2008).

Lawson (1997), in his book "How Designers Think", states that design is a form of thinking, and thinking is a skill then skills can be acquired and developed. On the

other hand, Webster (2008) emphasizes that regarding to her criticism of Schön, Schön's cognitive view of architectural practice fails to account for the reality that architectural identity is constituted of cognitive, affective and corporeal dimensions. Considering Webster's (2008) emphasis on what the architectural identity is composed of, it can be said that design process may be a cognitive activity but a designerly way of knowing (Cross, 1982) involves knowledge gained from outside of the studio and practice also.

2.5. Design As

Design as a form of thinking has been described by many theoreticians. The emergence of cognitive psychology in the 1960s offered both a conceptual paradigm for describing design, as well as a method for studying what is mostly an invisible, mental activity (Eastman, 2001).

It is possible to identify four main characterizations of design process based on the literature produced by design studies. These are entitled as "design as problem solving", design as conjecture-trial", "design as construction" and "design as insight problem".

In this section, the concepts unique to these characterizations of design process are explained. Then, this information will be used to interpret the results of questionnaires in relation with interviews conducted in Chapter 5.

2.4.1. Design as Problem Solving

Cross, Naughton, and Walker (1981) state that there is a major concern in design research to relate design method and scientific method since 1960s. Gregory (1966) noted that a major aim had been the hope "to establish a common basis of agreement about the nature of "the design methods", using this phrase in the same way as "the scientific method".' According to Cross et al. (1981), this aim contains a hidden desire which is to "emulate scientists who were presumably supposed to have a definite method that they practised and which was instrumental in their successes" (p. 195).

Eastman (2001) states that design was initially studied as a type of problem solving (Newell, 1969), "as a search of a space of possible solutions for the best or a

'satisficing' solution, in an approach similar to studies of chess, crypto-arithmetic, and puzzle solving". Design has been characterized as ill-defined (Eastman, 1969; Simon, 1973) or ill-structured (Reitman, 1964). Simon (1973) defines design as a problem-solving activity where the actual 'state' is structured through 'analysis' and solved with a proposition of a preferred one by 'synthesis'.

Bamford (2002) states that the common traditional view of scientific method has been characterised by this statement by a 20th century economist, A. B. Wolfe:

> If we try to imagine how a mind of superhuman power and reach, but normal so far as the logical processes of its thought are concerned … would use the scientific method, the process would be as follows: First, all facts would be observed and recorded, without selection or a priori guess as to their relative importance. Secondly, the observed and recorded facts would be analysed, compared and classified, without hypothesis or postulates, other than those necessarily involved in the logic of thought. Third, from the analysis of the facts, generalizations would be inductively drawn as to the relations … between them (Chalmers, 1999, p. 53).

Bamford (2002)defines the fourth stage in this process is the descent back to the world of facts, drawing predictions and supplying explanations of phenomena by deduction from these generalizations (Chalmers, 1999, p. 54).Bamford (2002) compares the above account with the four key stages in analysis-synthesis (Table **1**) with explanatory notes from Broadbent(1966, p. 683), and Chris Jones (1970, p. 63).

Table 1. Four-key stages in analysis-synthesis

(1) Briefing	programming, data collection
(2) Analysis	breaking the problem into pieces, formulation of performance specifications, identification of constraints).
(3) Synthesis	ideas generation, putting the pieces together in a new way, design development
(4) Evaluation	check against performance specifications and constraints,testing to discover the consequences of putting the new arrangement into practice

Bamford(2002) also recalls Broadbent's list (see Table 2) "as a 'first approximation' to the various 'ways… of thinking' architects require"(Broadbent, 1973, p. 18):

Table 2. Broadbent's list of 'ways of thinking architects require**.**

(A) Rational thinking	about the nature of the site, the available resources and so on
(B) Intuitive or creative thinking	about what these results of rational thinking imply for the building form
(C) Value judgements	as to the relative performance of these various and sometimes conflicting factors

According to Bamford (2002), rational thought dominates the stage 1 and stage 2 in design, while creative thinking is limited in stage 3. Thus, a design product would emerge from rational process rather than 'spring mysteriously" from architect's individual subjective appreciations.

Jonas (1993) states that his understanding of design as a process is transforming a verbally-formulated 'problem' situation into a detailed plan for a tangible', usable artifact, whether 'designed' or not. Jonas (1993) criticizes Van de Boom's (1989) 'visionary definition of design' that it sees design as a 'form-giving processing of information so that it can be consumed by people.' Jonas (1993) states that the question as to the cognitive nature of the design process is eliminated in the meantime: 'That design can be supported by the computer implies, in the end, that designing is simply a kind of data-processing.'

Simon (1969) characterized design as a search process, allowing the design process to be understood as one of the ''sciences of the artificial". Maher and Tang (2003) state that since Simon characterized design as a search process, the design research community has appropriated this model by formulating the goals, state spaces, and operators for various design domains and design problems. Although the search paradigm forms the basis of much of problem solving, other models of design have been proposed that address the formalisation of design knowledge and design goals (Maher & Tang, 2003).

Cross et al. (1981) state that it was not possible for designers to copy the scientists' method because designers and scientists have fundamentally different interests and goals. In this regard, Gregory (1966) stated as follows: "… the scientific method is a pattern of problem-solving behaviour employed in finding out the nature of what exists, whereas the design method is a pattern of behaviour employed in inventing things of value which do not yet exist. Science is analytic; design is constructive." (p. 6)

2.4.2. Design as Conjecture-Trial

After Simon's design characterization other models have been proposed. These were mainly about the formalization of design knowledge. Application of Popper's ideas on knowledge to design methods was the next step in the history of design methods movements.

In 1972, Hillier, Musgrove, and O'Sullivan were the first to apply Popper's ideas to design methods in their paper 'Knowledge and design' (Hillier et al., 1972). Hillier, Musgrove and O'Sullivan (1972) argued that design is 'essentially a matter of prestructuring problems either by the knowledge of solution types or by the knowledge of the latencies of the instrumental set [technological means] in relation to solution type' (Hillier et al., 1972, p. 7). They emphasized the role of what they called 'pre-structuring' in defining problems. They also stressed the corresponding need for a critical analysis of such pre-structuring, which they called as 'reflexive design' (Hillier et al., 1972, p. 7). Hillier et al. (1972) argued that conjecturing approximate solutions much earlier in the process compared to the analysis/synthesis model of design allows to structure an 'understanding of the problem, and to test out its resistances' (Hillier et al., 1972, p. 9). Bamford (2002) states that Hillier et al. (1972) rejected the notion of synthesis as a process by which pieces of a puzzle gradually come together and as a consequence they indicated that by such process a solution can only be visible only towards the end.

The characterization of design as conjecture-trial offered another approach for understanding the nature of design. A new understanding is proposed on the relation between the problem space and solution space in which problem space is where the prestructuring occurs and solution space is where the testing occurs.

2.4.3. Design as Construction

Cross (2001) states that Donald Schön (1983) offered a constructivist paradigm instead of the positivist doctrine which underlies much of the 'design science' movement.

Ward states that designers construct concepts in an instant to help them define and decompose problems rather than reasoning only from information derived from

knowledge in designer's mind. Zimring and Craig(2001) emphasize that the constructive nature of design brings another problem in the argument that "design can be characterized in terms of a series of logical processes"(p.139).Schön (1988) draws a parallel between design and information processing and search. Zimring and Craig(2001) emphasize that interrelations among well-structured sub-problems can be ignored in ideal situations to the extent that a "good procedure will divide the task into components that are as nearly 'self contained' as possible" (Simon, 1973).

Counter to Simon, Schön saw design as construction of steps of changes in the given situation by 'reflection-in-action' followed by 'reflection-on-action'. Designers construct and impose a coherence of their own that guides subsequent moves (Schon, 1988). Each move becomes an experiment for reframing the initial problem definition so the initial situation is transformed into another situation through constructions that are structured by 'selecting particular things and relations for attention'(Schon, 1988, p. 182).

Zimring and Craig (2001) explain the idea of construction that when a designer becomes "stuck in a problematic situation" that cannot be readily managed, he or she "may construct a new way of setting the problem- a new 'frame'" (Schon, 1983, p. 63) which is then imposed on the situation .

Schön (1992) states that a designer's subjective appreciations shape the problems he/she tries to solve. He adds that this should be contrasted with the common image of designing as 'search within a problem space'. He emphasizes that a problem space is not given by any presentation to the designer but rather he/she constructs a design world which he/she sets dimensions of problem space constructed. He concludes that the designer invents moves which are attempts to find solutions.

2.4.4. Design as an Insight Problem

During the late 1950s and 1960s, behaviourist psychology turned its attention to creativity. Progress has also been made in exploring the notion of creativity through the notion of expertise within a particular domain, such as, chess, music, painting, poetry and even architecture.

Weisberg(1995) states that solving a problem does not always proceed directly from problem presentation to solution generation. It can be commonly seen that an

initial approach taken by designer may be ineffective. According Weisberg (1995), he or she may have to switch to a new one before progress can be made. This can be called discontinuity in thinking (Weisberg, 1995).

Smith (1995) explains the nature of problem solving and creative thinking as:

> Problem solving and creative thinking also involve a constructive search, flexibly piecing together fragments of retrieved knowledge according to a guiding structure. This point of view acknowledges the importance of retrieval and the use of prior knowledge in creative thinking, but it also views the structuring of the retrieved elements as important.(p.136)

Smith (1995) suggests that the structuring of retrieved elements is done according to a mental model. If a known mental model is recalled as a unit stored in memory and used to guide thinking, then the process is reproductive rather than creative since known solutions are not novel (Smith, 1995).

Smith (1995) adds that creative thinking requires the construction of ideas or solutions. According to Smith (1995), problem solutions, and creative ideas are constructed by two different methods: searching within a plan and structuring (or restructuring) plans.

Smith (1995) defines the distinction between these two methods as:

> Searching within a plan refers to thinking that is guided by sets of rules. This type of thinking typically constructs targets and solutions incrementally or in a stepwise fashion. Structuring, on the other hand, refers to selecting a known plan or constructing a plan from pieces of knowledge. The structured plan then guides subsequent thinking and searching until or unless another plan is constructed.(Smith, 1995, p. 136)

The act of problem definition can be described as a creative act. The students describe the sudden changes in their perception of the problem as an "illumination". Smith defines this sudden new understanding of problem definition as "restructuring":

> Once a plan is abandoned, a new plan may be activated. This process is called restructuring. The term restructuring has been used to refer to a rapid perceptual-like reformulation or reconceptualization of a problem, causing a solution to burst suddenly into consciousness. (Smith, 1995, p. 142)

Rapid emergence of information into consciousness increases confidence in the reliability or appropriateness of the retrieved information (Kelley and Lindsay, 1993). Smith (1995) states that the rapid activation of a new plan, or restructuring, causes the extreme confidence in insight experiences.

Smith (1995) points out that a different representation enables the designer to produce a solution or the target of a memory search. He adds that this could lead to creative ideas that had been previously blocked by fixated thinking.

During incubation, the resolutions of problems may occur very suddenly and unexpectedly (Smith, 1995). This can occur during some unrelated or unstructured activity or when returning to a problem after a hiatus. Smith (1995) calls this sudden resolution of a problem when an idea bursts into consciousness as illumination or an insight experience. He also adds that if a problem presented in one context becomes fixated, trying the problem in a new context may lead to success if the new context induces a problem representation that avoids fixation (Smith, 1995).

A model for explaining design process focusing on such issues can be called "design as an insight problem". This model offers another approach to formalisation of design knowledge and it focuses on a very commonly experienced phenomenon in designers' design process. The commonly recognized "a-ha!" response is universally considered as a reference to the moment when a creative flash arrives (Akin & Akin, 1996). This phenomenon is also referred to as sudden mental insight (Akin & Akin, 1996). In the study carried out by Akin and Akin (1996), it is stated that the emergence of sudden mental insight is directly related with the ability of restructuring problem which depends on possessing the required domain knowledge to construct a new definition of problem that have the potential to lead to a new solution.

Akin and Akin (1996) summarize the common points concerning creativity on the basis of empirical observations as:

> • Creativity arises under special conditions
> • Creativity is manifested either through a product or a process
> • Creativity spans a considerable range of activities and products, from the sciences to the arts to everyday occurrences
> • The product of a creative act is novel and unusual in some sense (p. 343)

Akin and Akin (Akin & Akin, 1996) state that it would be reasonable to infer what arises so suddenly does not arise from nothing. It is the cognitive preparation that anticipates and evokes the idea (Akin & Akin, 1996). This cognitive preparation process can be called as incubation and it is used as a term in the questionnaire form.

2.6. General Overview - Investigating Students' Conceptions of Design throughout Architectural Design Education

Chapter 2 presented the literature review structured under five main subjects under the light of this study's research questions.

First section depicted the roots and main features of design studio pedagogy. It focused on two main schools of design and their design studio pedagogies in the history of architecture.

Second section presented the literature review on the importance of design studio in architectural education in terms of its teaching methods, its place in schools' architectural curricula and its role in educating architectural designers.

Third section entitled as "Design Methods", gave information about the design methods movement that shaped the current design research and how it is related to educating designers in order to understand the basis of intentions for investigating design.

Fourth section presented the literature on design cognition produced by design methods movements with respect to design education especially focusing on architectural design education.

In the fifth section, the views from design studies indicate various characterizations of the nature of design as a process. It focused on four main design characterizations to be used in investigating what architecture students' conceptions of design are and how they change throughout their education.

Design studio courses exits as a place for formal studies and building and technology courses stand as the course that teach science-based techniques in the context of the two schools of architecture which were selected in this study.In order to understand students' conceptions of design, their conceptions of design process and their conceptions of design education, this study employs a mixed research method presented in Chapter 3 in detail.

CHAPTER 3

METHODOLOGY

A mixed research method was employed in the study. A questionnaire was conducted among students of architecture to determine students' characterizations of design and their relationship to their architectural education. The questionnaire was followed by semi-structured interviews to obtain in-depth information regarding their characterizations of their design activities and to explore the rationale behind these characterizations together with their views of architectural education.

The research is conducted among students of architecture from two schools of architecture, Izmir Institute of Technology (IZTECH) and Dokuz Eylül University (DEU) in Izmir. The departments of architecture under the Faculty of Architecture at IZTECH and DEU are chosen for the study. The similarities between these two departments in terms of their institutional and curricular structures were the reasons of this selection. Both departments are constituted under a faculty of architecture in a public university.

A pilot study is conducted with the Department of Architecture in the Faculty of Fine Arts and Design, Izmir University of Economics (IUE). A questionnaire composed of 14 questions was conducted to gather data about the characterization of design among the students of architecture. Following the questionnaires, semi-structured in-depth interviews were carried out with groups of five students from each year separately to obtain in-depth information regarding their characterizations of design activity.

The participants (n = 196: 61 male, and 135 female; 39 first year, 56 second year, 47 third year, and 54 fourth year) were from four design studios. The undergraduate program at IUE is a four year bachelor program and participants were chosen from all four years. First year students of architecture take design studio with the other four departments which are Fashion Design, Industrial Design, Interior Architecture and Environmental Planning and Visual Communication Design departments.

The questionnaire inquired about the students' conceptions of design. The questions were grouped under three topics: design characterizations, design process, and design education.

The first group of questions under the topic design characterizations was prepared to collect information about the participants' conceptions of design. The second group of questions was focused on the participants' individual experiences of their design process. The third group of questions aimed at collecting information about the subjects' ideas on design education, the tutor's role in the design studio, the exchange of knowledge between the student and the tutor, and the students' dependency on their tutors.

To identify how students characterize design, it is attempted to classify design in four different definitions which are "design as problem-solving", "design as insight problem", "design as conjecture-trial," and "design as construction". This classification of design definitions made it possible to determine whether there is a general tendency towards a specific definition for every year and observe if there are changes towards another specific definition of design from the first year to the fourth year in design education.

The in-depth interviews investigated the same three topics in an open-ended format. The same questions as in the questionnaire were used to outline the interviews in order to get more in-depth information of the selected topics.

The results of the pilot study depicted that using studio hours are the most efficient way to gather the students to conduct the study and organizing interview sessions. It is also found out that contacting one instructors from each year is enough to organize the study. A short announcement and explanation was made to the students to introduce the questionnaire form and to explain the aim of the study after the short introduction about the researcher. This announcement also included the interviews. Students attended the study did not ask any questions. The questionnaire study took between fifteen minutes to twenty minutes including the announcement and collection of forms.

The pilot study helped in finalizing the research questions and the format of the surveys and in-depth interviews.

3.1. Questionnaire

This section will present how the survey was conducted, the material used, the analysis of the data gathered from the questionnaires.

The questionnaire form (see APPENDIX A) was composed of 14 questions to gather data about the characterization of design among students from all four years. A list of questions was prepared to be used in the questionnaire form. While the questions were being prepared, the literature from design studies and personal teaching experience of the researcher were crucial. Then, the questions were selected according to their correspondence to the aim of the study. After the selection, the questions were grouped under three different topics: design characterizations, design process, and design education. The section entitled as "About Design" includes five multiple-choice questions, "About Design Process" section includes three multiple-choice questions, one open-ended question and one ranking question and "About Design Education" section includes four multiple-choice questions.

The first group of questions under the topic entitled "About Design" was prepared to collect information about participants' conceptions of design. The second group of questions entitled "About Design Process" was focused on participants' individual experiences of their design process. The third group of questions which has a title as "About Design Education" is aimed at collecting information about participants' ideas on design education, the tutor's role in the design studio, the exchange of knowledge between the student and the tutor, and the students' dependency on their tutors.

To determine how students characterize design, questionnaire included four different definitions which are "design as problem-solving", "design as insight problem", "design as conjecture-trial," and "design as construction". This classification of design definitions made it possible to determine whether there is a general tendency towards a specific definition for every year and whether there are changes towards another specific definition of design from the first year to the fourth year in design education.

3.1.1. Procedure

Following the preparation of the form, one studio instructor from each design studio course was contacted to make an appointment with the class. In order to be able to gather the students easily with complete attendance and to make them focus on the questionnaire, the questionnaires were conducted in the studio hours with the help of the studio instructors. This also enabled the researcher to choose volunteers for the interviews and organize them easily.

An announcement was made to introduce the questionnaire form and the aim of the study following the introduction of the researcher. The aim of the study was explained as asking the students about their ideas and conceptions about design and design education. Students attended the study did not ask any questions about the questions in the form. The questionnaire study took between fifteen minutes to twenty minutes including the announcement and collection of forms.

3.1.2. Material

The questionnaire is composed of fourteen questions. It includes twelve multiple choice questions, one rating question and one open-ended question. The form includes a short explanation of the aim of the study. It also includes age, gender, year of education and the information about whether students had repeated a studio course in the beginning of the questionnaire form.

The questionnaire is printed on one side of A4-size white papers. One set had four pages and each set is stapled from its upper left corner.

3.1.3. Participant

The participants (n = 364: 116 male, and 248 female; 113 first year, 87 second year, 103 third year, and 61 fourth year) were from four design studios at the departments of architecture in the Faculty of Architecture, Izmir Institute of Technology (IZTECH) (n = 158) and in the Faculty of Architecture, Dokuz Eylül University (DEU) (n = 206). The undergraduate programs at both IZTECH and DEU are four-year

bachelor programs and participants were chosen from all four years. Attendance to the questionnaire study was told as obligatory by the studio instructors.

Table 3. Participants by numbers.

School of Arch.		IYTE				Total	DEU				Total	TOTAL
Class		1	2	3	4		1	2	3	4		
#of students	male	13	13	14	6	46	29	13	19	9	70	116
	female	37	33	23	19	112	34	28	47	27	136	248
	total	50	46	37	25	158	63	41	66	36	206	364

3.1.4. Analysis

Cross tabulation wasapplied to summarize categorical data to create contingency tables about the relationship between variables. A statistical hypothesis test wasapplied on the answers of the survey questions to determine the statistically significant results using Chi-Square tests. Chi-Square test wasapplied to see if there is a significant relationship between two variables, namely design characterizations and classes. Statistically significant results were focused on for further analysis and interpretation.

Open ended question is analyzed with a coding scheme. This scheme is based on the four design characterizations which are “design as problem-solving”, “design as insight problem”, “design as conjecture-trial,” and “design as construction”. The correspondence to these characterizations is investigated.

The results of Question 5 and Question 10 are subjected to ranking analysis. The percentage of the choices are calculated and ranked among each other according to the students' year in their education.

3.2. Semi-structured Interviews

This section will present how semi-structured interviews were conducted, the procedure, the material used, and the analysis of the data gathered from the interviews.

The reason for using focus groups rather than individual interviews is that groups can produce stimulating discussions that reveal perceptions and concerns that might go undetected in a survey. Sommer and Sommer (1997) state that a focus group is a type of group interview designed to explore what a specific set of people (such as teenagers, senior citizens, or police) think and feel about a topic. They emphasize that focus groups are useful for clarifying the meaning of images, words, or products, and locating points of concern, disagreement, or ambiguity which suits perfectly to the aims of this research. They are more efficient than individual interviews because more people are contacted at a single time. As Sommer and Sommer (1997) stated focus groups are helpful to explain why people answered the survey questions as they did. The focus group is an excellent method for collecting and exploring opinions in depth.

3.2.1. Procedure

The schedules for the interviews were decided following the survey study completed in the design studios in the course hours. The students were contacted via email or phone to get a confirmation or to reschedule the meetings for the interviews.

The in-depth interviews were conducted with eight different focus groups having minimum three maximum five people in each group from first year to fourth year from both universities. Although five interviewees for each group were invited to the meetings, due to the personal reasons and time conflicts some focus group interviews were conducted with less than five participants. The motivation and enthusiasm of the interviewed students were encouraging since they told that the discussions were very informative and lead them think about the notion of design ,design process, and design

education. The students, however, sometimes went beyond the scope of the discussion and took this as an opportunity to voice their complaints specific to their schools.

The same questions as in the questionnaire were used to outline the interviews in order to get more in-depth information of the selected topics. The interviewees were given the same questionnaire form used before to be able to follow the topics the interviewer inquires about.

The in-depth interviews were conducted under the same three topics stated above in an open-ended format. The interviewees were asked to give detailed explanations regarding to their choices in the questionnaire form with respect to their previous experiences from previous years in their undergraduate education.

First, the students were asked about how they define design under the light of four different design characterizations taken from literature stated in the first question in the questionnaire form. Then, under the same topic, the researcher asked the interviewees to briefly explain their individual reasons for their preferences by recalling their experiences in the design studios.

Second, the students were asked to think about their individual design processes. Detailed information is inquired about how they start to design, which activity in their design process has the highest importance for them. They were also asked to define phases in their design process in their own words.

Finally, the effects of the educational devices that were used to teach design were inquired. They were asked to give information and examples regarding the experiences in their undergraduate education in terms of how design is taught, the acts of studio instructors, the utilization of educational devices such as critiques, juries and etc.

3.2.2. Material

The researcher used the questionnaire form composed of 14 questions printed on four pages of A4-size paper as an outline to be able to lead the discussions throughout the interviews. The copies of the form were handed out to the interviewees too.

A sound recorder device was used to capture every moment of the interview and to spend more effort on the process of the interview.

All of the interviews were conducted within the limits of the campus areas of the selected universities. The interviews were conducted in different spaces. Seven of the interviews were conducted in design studios at lunch time or outside studio hours. Only one of them had to be conducted in the university's coffee house in open air due to the personal schedules of the interviewees. Using design studios as a space for the interviews had some positive effects. It was observed that the interviewees seemed relaxed and focused. The groups were more focused comparing to the group in open air. The high level of noise and crowd affected the concentration of the group.

3.2.3. Participant

The profiles of the interviewees vary from successful students to average students or students that failed the studio before. The variety of the profiles of the participants gave the researcher to inquire about different aspects of the design education in the selected schools. Especially, the students that failed before were more focused on the relations between the students and the studio instructors. In addition, since these students have more experience on the design studio course that they take, the amount of examples that they used were more in number and more varied.

3.2.4. Analysis

The researcher converted the audio material recorded in the sessions into written transcripts. The transcripts were coded according to the seven main topics which are explained below. The structure of the questionnaire form is used again as topics for the content analysis. These are "design characterizations", "design process", and "design education".

The design process section includes the four design characterizations – design as problem solving, design as insight problem, design as construction, design as conjecture and trial - that are pulled out from the design studies.

The design education section included five sub-topics. These are "learning by doing", "formal learning", "implicit learning", "studio education vs. master-apprentice", and "strategic approach to studio learning".

The fourth category is “mode of transmission of design knowledge”. This category includes four sub categories which are “one-to-one desk critiques”, “desk critiques in groups”, “jury” and “correction done by the tutors”. The answers belong to this categories were based on the personal experiences of the students throughout their design education in relation to the design studio pedagogy.

The fifth category is titled as “fields related to design”. These are “engineering”, “art”, “science” and “craft”. This category is used to see how the students interviewed relate the conception of design and design process to these mentioned fields.

The sixth category includes the sub-categorizations of qualifications that are seen as the main one that leads the students to success in design. The sub-categories are entitled as “knowledge”, “skill”, “creativity” and “experience”.

The seventh category is the collection of emergent topics throughout the interviews. These are “fitness” with reference to Alexander (1964), “incubation”, “the contradiction between the nature of design process and design studio pedagogy”, “design as puzzle”, “reflection on action” with reference to Schön (1987), “problem definition as a creative act” and “Alexander's (1964) "unselfconscious process", the need for direct response to get feedback of the process”, “effective communication skills of the studio master”, “evaluation/assessment issues in design education”, “being withdrawn from the real world” and “learning a language” with reference to Schön (1987).

Content analysis was conducted to determine the repeating and common themes in the interviews. The coding was done by the researcher.

CHAPTER 4

RESULTS

A statistical hypothesis (see Table 4) test is applied on the answers of the survey questions to determine the statistically significant questions.

Chi-Square test results indicate that five questions among fourteen were significant: how students define design (Q1, χ^2= 22.144, p< 0.008), which concept is more related to success in design (Q3, χ^2= 18.951, p<0.026), how students start to design (Q7, χ^2= 20.672, p< 0.014), in what ways the information exchange between students and studio instructors occurs (Q13, χ^2= 59.289, p< 0.000), and what is students' preference for frequency of consulting with their instructors (Q14, χ^2= 56.362, p<0.000).

The results of Question 5 and Question 10 are also evaluated separately since Question 5 is based on multiple choice items and Question 10 is a ranking question. Question 5 is analyzed by calculating the percentages of the given keywords and distribution according to the years in education. Question 10 is analyzed with a ranking analysis method in order to understand which choice is preferred more in relation to other choices.

Table 4. Statistical Results.

	QUESTIONS	CHI-SQUARE TEST
Q1	How do you describe design?	χ^2= 22.144, p< 0.008
Q2	Which field of the following is more close to design?	χ^2= 6.648, p< 0.674
Q3	Which of the following is more related to design?	χ^2= 18.951, p<0.026
Q4	How do you reach a design idea?	χ^2= 15.408, p< 0.080
Q5	Which of the following words would you use to describe design to someone else?	-
Q6	How does your own design process is shaped?	χ^2= 15.692, p< 0.074
Q7	How do you start to design?	χ^2= 20.672, p< 0.014
Q8	How would you divide your design process into phases?	-
Q9	Which of the following activities is more related when you think of your design process?	χ^2= 15.459, p< 0.079
Q10	Which of the following sources do you use the most?	-
Q11	How do you learn to design	χ^2= 14.422, p< 0.108
Q12	In the context of architectural design studio, on which subject does the transfer of knowledge occur from studio instructors during critics?	χ^2= 13.822, p< 0.129
Q13	In what ways does the transfer of knowledge occur with studio instructors the most?	χ^2= 59.289, p< 0.000
Q14	In the context architectural design studio, how often do you want to meet with your studio instructors?	χ^2= 56.362, p<0.000

4.1. Students' Conception of Design

Chi-Square test result (Q1, χ^2= 22.144, p< 0.008) indicates that there is a significant relation between students' class levels and students' conceptions of design.

Figure **1**shows the distribution of the percentage of students from each year according to how they define design (Q1): (a) design as problem-solving, (b) design as insight problem, (c) design as conjecture-trial, and (d) design as construction.

Almost half of the participants in the survey of the first year students chose the definition (a), design as problem solving. More than half of the fourth year students describe design as problem solving. A post-hoc test comparing the standard residual values for each cell in the chi-square cross-tabulation to the critical value (-1.96 and +1.96) indicates that the conception of (d), design as construction, among the fourth year students (*std. residual* = -2,3) decreases significantly.

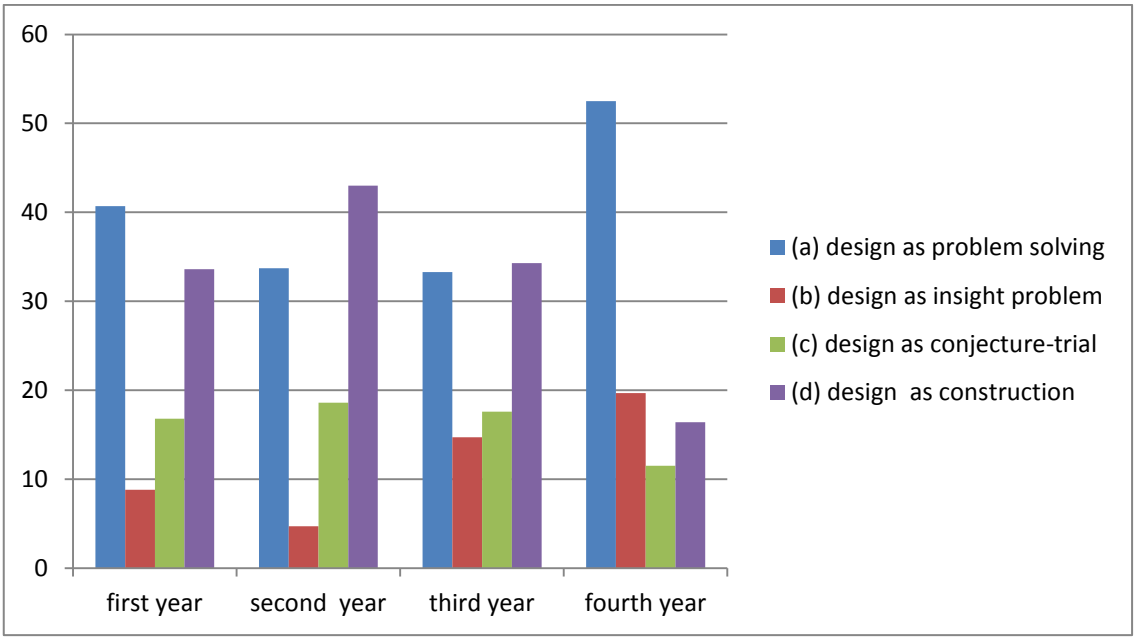

Figure 1.The distribution of the percentages of students from each year according to how they characterize design (Q1).

Figure 2 shows the distribution of percentages regarding the selected choices by students of architecture to describe which is more related to success in design (Q3): (a) Knowledge, (b) Skill, (c) Creativity, and (d) Experience.

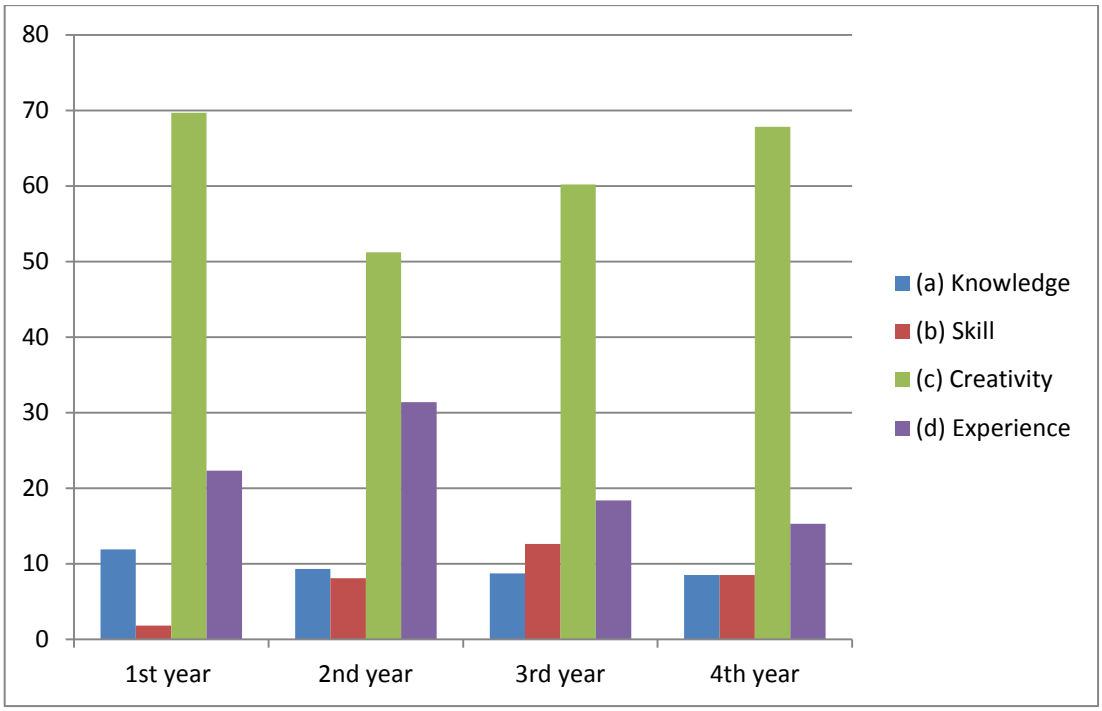

Figure 2. The distribution of percentages regarding the selected choices by students of architecture to describe which more is related to success in design (Q3).

Creativity has the highest percentage for students from each level, therefore, being creative in a design problem is seen as the most important qualification that leads the designer to success. A post-hoc test comparing the standard residual values for each cell in the chi-square cross-tabulation to the critical value (-1.96 and +1.96) indicates that for the first year students, (b): Skill, has lower percentage than expected (*std. residual* = -2,2) while for the second year students, (d): Experience has higher percentage than expected (*std. residual* = -2,2) although it's their second year in the design education.

Question 5 inquired about which keywords students prefer to use to define design. Eight common keywords were presented in the questionnaire form.

Figure **3** shows the distribution of the percentages according to the year of education.

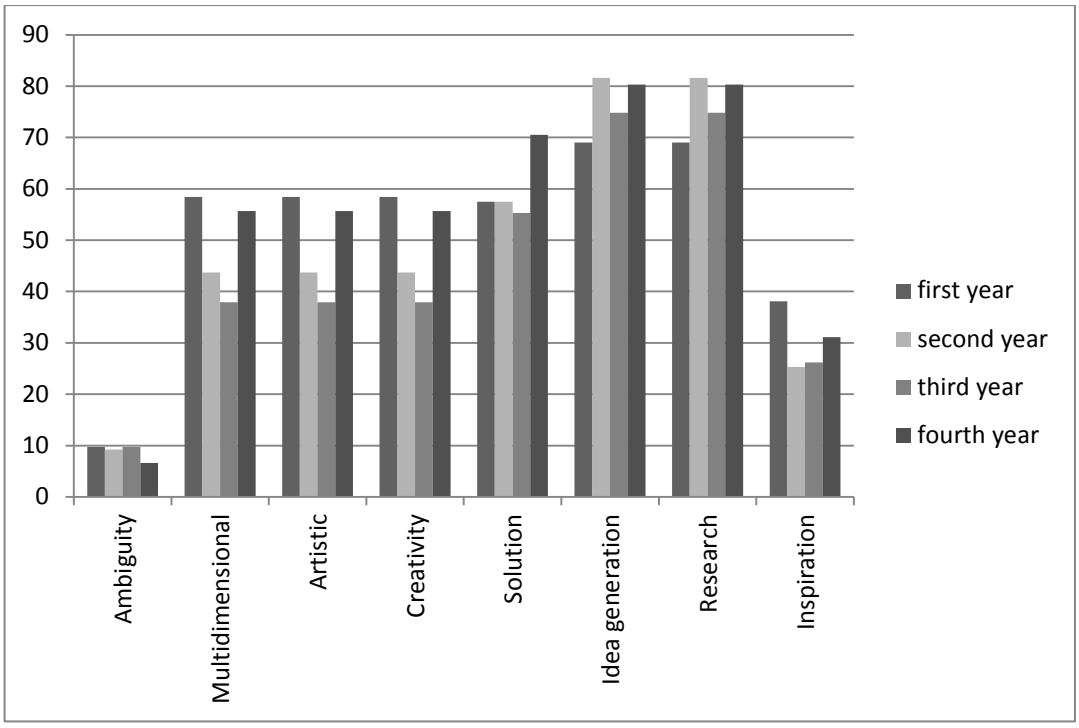

Figure 3. Terms used to define design (Q5).

More than half of the students in first year use the word “multi-dimensional” to describe design. However, there is a decrease in second year students and third year students compared to first year students. More than half of the fourth year students describe design as multi-dimensional again.

The same distribution can be seen for the words “artistic” and “creativity”. This also depicts that the same group of students tend to use these three words together to describe design.

The word “solution” is used by more than half of the students at each level. However, there is a significant increase in the number of fourth year students compared to the previous years in using the word “solution” for describing design.

The act of generating ideas is commonly used to describe design by more than half of the students at each level. It shows an increase at second year and fourth year.

The word “research” is preferred by more than half of the students at each year. However, it shows the same ratio of increase and decrease at the same years of education. The students that use “idea generation” to describe design also use “research” as a keyword to describe design as a process.

Inspiration is preferred by almost 40% of the first year students to describe design. Second year students tend to prefer the "word" inspiration less, however, the percentage increases again at third year and fourth year.

4.2. Students' Conception of Design Process

Figure 4depicts the percentage of students with regard to the way they start to design; (Q7): (a) waiting for inspiration, (b) understanding the problem/making a problem definition, (c) starting drawing right away, (d) making a research through architecture/design magazines to find a similar project.

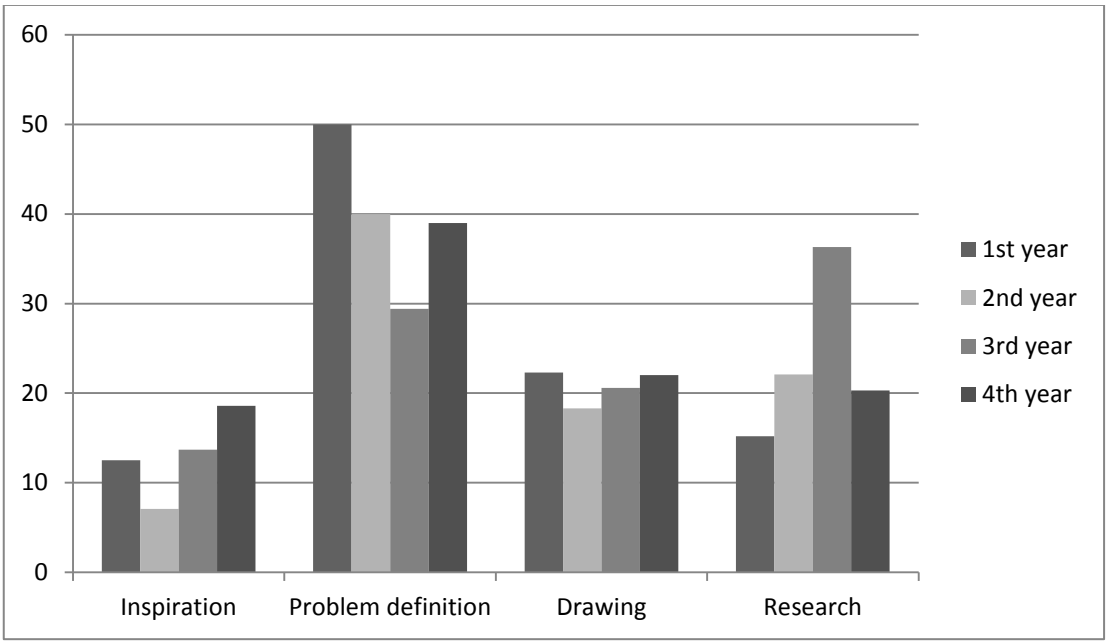

Figure 4. The distribution of percentages of students with regard to the way they start to design (Q7).

Understanding the problem or defining a problem is significantly more preferred than the other ways to start to design for students of architecture. The results indicate that the majority of students start to design by understanding the problem throughreading the assignment sheet several times. However, apost-hoc test comparing the standard residual values for each cell in the chi-square cross-tabulation to the critical value (-1.96 and +1.96) indicates that for the first year students, making research to start designing (*std. residual* = -2,2) is less than expected. On the other hand, third year

students look for similar cases more than expected (*std. residual* = 2,0) since their expertise in their design education might make them do less research when compared to the first year students.

Question 10 inquired about which sources students use while designing. The participants were asked to order the choices from "the least" to "the most". The results shown in Table 5depicts that studio instructor is the most used source in design studio education compared to the other sources. Students in the fourth year prefer to use architectural/design magazines as a source while designing more than studio instructors. Making use of an experienced architect's knowledge or experience while designing is the least preferred source for knowledge among the others.

Table 5. The preference for sources that students use while designing. (Q10)
(5=the most, 4=More, 3=medium, 2=less, 1=the least)

	First Year	Second Year	Third Year	Fourth Year
Studio Instructor	4	4	4	3
Arch-design magazine	3	3	3	4
Classmate	3	3	3	2
Students from upper class	2	2	2	2
Experienced architect	1	1	1	1

4.3. Students' Conception of Design Education

Figure **5**shows students' preference for four teaching methods that are used for knowledge transfer between the tutor(s) and student(s) as part of design studio education (Q13). The teaching methods were: (a) one-to-one desk critiques, (b) tutor-to-multiple students desk critiques, (c) critiques in juries, and (d) tutors' corrections.

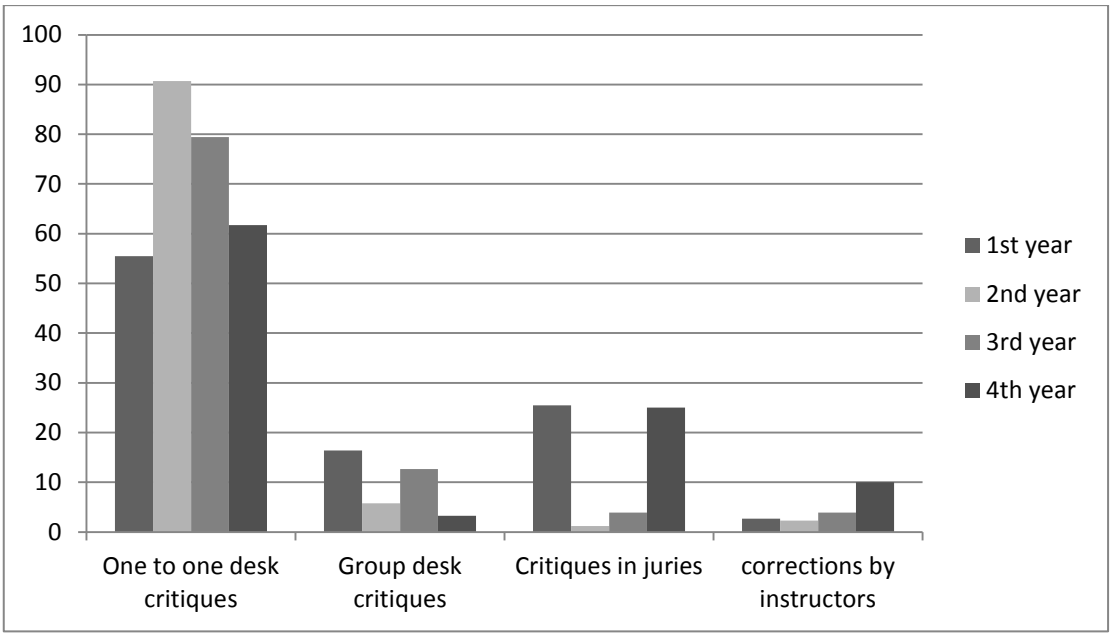

Figure 5.The distribution of percentages of four teaching methods that are used for knowledge transfer between the tutor(s) and student(s) as part of design studio education (Q13).

Choice of (d) corrections by instructors increases from first year to fourth year. A post-hoc test comparing the standard residual values for each cell in the chi-square cross-tabulation to the critical value (-1.96 and +1.96) indicates that first year students benefit from (a) one-to-one desk critiques (*std. residual* = -2,0) less than expected but they benefit more than expected from (c) critiques in juries (*std. residual* = 3,5). However, the second year students see (a) one-to-one desk critiques (*std. residual* = 2,1) more beneficial than expected, and (c) critiques in juries (*std. residual* = -3,1) less beneficial than expected. Third year students have almost the same attitude with the second year students with respect to (c) critiques in juries (*std. residual* = -2,6). The fourth year students see (c) critiques in juries (*std. residual* = 2,5) as a beneficial tool for knowledge transfer more than expected. However, (d) corrections by instructors as a beneficial way of knowledge transfer increases significantly and is more than expected (*std. residual* = 2,2).

Figure **6** displays the percentages of students' opinions of how often they would like to meet their tutors (Q14): (a) Once a week, (b) Twice a week, (c) Everyday, and (d) Time to time, as the need arises.

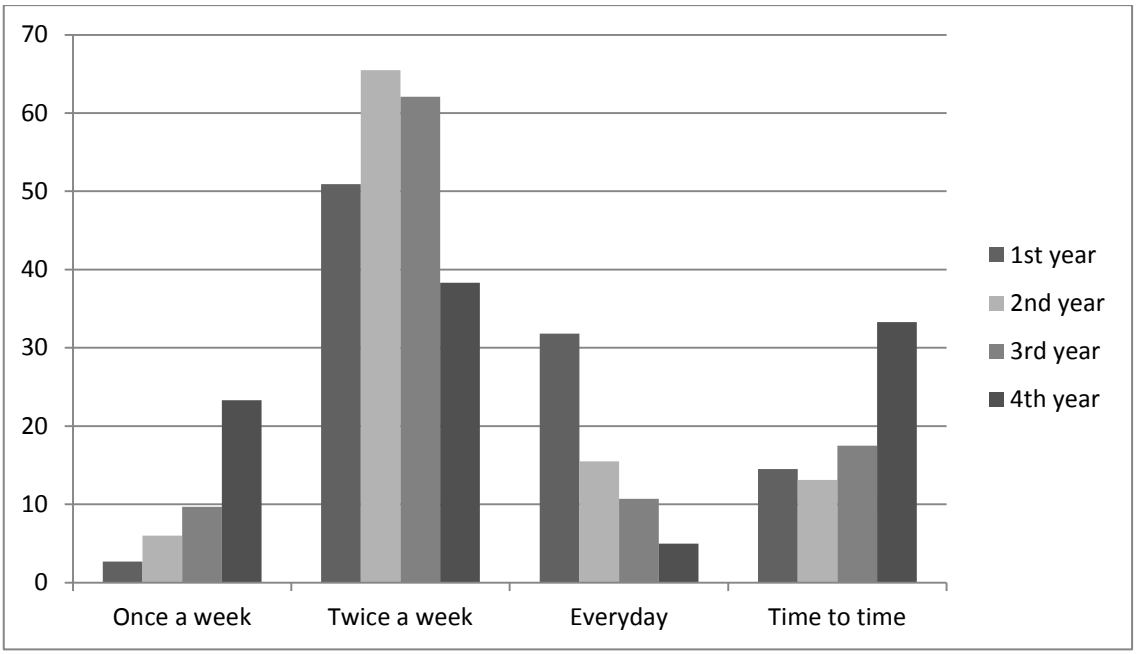

Figure 6. The distribution of percentages of students' opinions of how often they would like to meet their tutors (Q14).

The choice (b) twice a week which also corresponds to studio hours at both schools of architecture, has the highest percentage among other choices from first year to fourth year. The choice (c) Everyday decreases as expected from first year to fourth year students. A post-hoc test comparing the standard residual values for each cell in the chi-square cross-tabulation to the critical value (-1.96 and +1.96) indicates that first year students see meetings with their studio tutors (a) once a week (*std. residual* = -2,2) with tutors less beneficial than expected, but meeting with their studio tutors (c) everyday (*std. residual* = 3,6) more beneficial than expected. The fourth year students prefer to meet their studio tutors either (a) once a week (*std. residual* = 3,7) or (d) time to time (*std. residual* = 2,7) significantly more. They think that meeting their tutors (c) everyday is significantly less beneficial (*std. residual* = -2,3).

4.4. Content Analysis of the Interviews

The coding scheme included four mentioned characterizations of design. Among these "design as problem solving" and "design as insight problem" has the highest rate for correspondence with the transcribed material.

One of the most mentioned issue among all of the interviews with the focus groups was “learning by doing” and it is followed by “implicit learning” since it is consequently related with it.

The concepts “one-to-one critiques”, “desk critiques”, “jury” and “correction” which are gathered under the main topic entitled as “mode of transmission of knowledge” has the highest rate among all other concepts in the content analysis.

During the coding of the transcribed material, there are two emergent topics added to the coding scheme in the content analysis. One of them is “incubation” which is an integral part of the characterization of design as insight problem. The other topic corresponds the contradiction between the design studio pedagogy and design process named as “Design Process vs. Design Studio Pedagogy which is mentioned by various students in different times during the interviews either directly or indirectly.

The results of the content analysis are used briefly and in detail with quotations from the students in the following chapter in order to obtain in-depth information regarding to the results of the questionnaire study.

CHAPTER 5

DISCUSSION

This section presents the interpretation of the statistical analysis of the questionnaire with respect to the content analysis of the interviews conducted with the focus groups from each year in each school of architecture.

The discussion follows the structure of the questionnaire. The first section focuses on students' conception of design, its general attributes, and how design studio affects students' characterizations of design. The second section discusses students' design processes based on their studio experiences in terms of the tasks involved and their specific nature with regard to the four design characterizations extracted from the design studies literature. The last section discusses the effects of the pedagogic tools employed in the design studio education on students' design process and design learning.

5.1. Students' Conception of Design

The conception of design as problem solving is the most common characterization of design among students of architecture in DEU and IZTECH according to the results of the statistical analysis of the questionnaire. At the fourth year of architectural education, this conception is internalized by almost half of the students.

When students are asked to tell more about their conception of design as problem solving, they commonly used the words "analysis" and "synthesis". Considering the open ended question (Q8) in the questionnaire form, the answers show direct resemblance to the concepts "briefing", "analysis" and "synthesis". However, while Bamford (2002) states that rational thought dominates the stage 1 and stage 2 in design, while creative thinking is limited in stage 3, in the interviews students emphasized that defining the design problem is a creative act and this phase is crucially important to be successful in the design studio.

During the interviews, when the first year students were asked how they characterize design, they directly started to tell about their personal experience in the

design studios. More importantly, they all describe design as a process. Since the first year design studio pedagogy is based on giving fully specified problem definitions, all of the answers from the students regarding to how they characterize design start with understanding the problem definition as the first step in the design process. Then, they state that they move on with the analysis of the problem given in a given context.

Although they all start design by doing analysis, the following individual activities in their design process shows differentiation and give reference to other design characterizations stated in the questionnaire. In the interviews, the level of students' knowledge about design prior to their first year design education was inquired. Students mostly agreed that design could be seen as an insight problem and that as design is thought to be an artistic activity. In the (b) design as insight problem choice the word 'artistic activity' is used in the statement which refers to 'design as an insight problem'. In the interviews with students from upper levels, students are asked what is the place of art in design regarding to their experience in the first year design studio. Students stated that they were unable to relate their submitted projects to any particular field, e.g., architecture, industrial design, etc. However, they were able to classify their work as an object of art. The material used in the assignments like certain paintings most probably encourage students to think in this direction.

The interviews also showed that as students started to understand the process of learning-by-doing, they stated that their conception of design process moves from design as insight problem towards a conception of design as problem solving. When they fail a certain assignment or when they fail the design studio in the first year, they stated that they realized inspiration does not come out of a sudden. The nature of design problems presented to students in the design studio, the ambiguity of a method needed to solve an ill-defined problem, and the deadline for the solution forced students to abandon the act of waiting for an inspiration.

Once students abandon the conception of design as insight problem, the statistical analysis shows that they think of design as construction or as conjecture-trial. First year students stated that they all employ trial-and-error in their design process but once they start to manage the process of learning to design as it is taught in the studio, they emphasize that following the steps presented by the tutors in the assignments lead them to success in the studio.

This requires more information about what the tutors teach as steps of the design process. When all students interviewed were asked to define the steps of their design process, they all reported the same steps. They all indicated that they all start with a broad deep analysis of the design problem and the context given followed by a research. Then, after gathering a certain amount of data, they all go through a process of trial-and-error in order to find what "fits the context" (Alexander, 1964) that is analyzed by synthesizing "what they have in hand". It is crucially important to state that these explanations of the design processes regarding to the characterization of design as problem solving shows one-to-one correspondence with Bamford's (2002) four key stages in analysis-synthesis (Table 1). This situation how the characterization of design as problem solving offers a definite method that can be practiced and the ability of this characterization of design being 'analytic, partly formalizable, partly empirical, teachable doctrine about the design process' (Simon, 1969, p. 113).

Following this question, students were asked if these were their own steps defined by themselves. They answered that they follow what their tutors tell them. Then, it might be said that the steps of the design processes of the students are actually the phases of the design studio defined by the tutors in a semester. It is probable that the design studio does not offer or embrace a variety of different and personal design processes according to the interviews conducted. Thus, the high rate of selection of the characterization of the design process as problem solving can be explained as a result of a strategic approach by the students to "stay alive" in the design education.

This approach could be described as emulating the studio instructors' preferences of design. This act of developing a strategic approach could be a response to an imposition of a particular design studio pedagogy employed by the tutors because especially the second year and third year students emphasize that first year design education and the following years are completely different learning processes. While first year design studio is a place for experimentation and exploration, the studios in the following years are seen as the places where a negotiation on a specific idea occurs between the student and the instructor.

In addition, according to the statistical analysis, at the second year, the idea that design is an insight problem loses its all effect on the student. They emphasize that the studio tutors stated very clearly and persistently that there is no such thing as inspiration in architectural design. However, after the first year, once they learn to manage the

design process in the studio, the third year and the fourth year students emphasize that there must be an inspiration, or a point where they define as a "Eureka!" moment is still waited and needed. In this regard, it can be said that the definition of creativity changes in students' mind.

The choice for characterization of design as conjecture and trial is always referred to as part of the design process. Students stated that they all do this as an activity at some part of the design process throughout the semester. However, the characterization of design as conjecture-trial is commonly mistaken with learning-by-doing throughout the interviews because it is often referred to learning to design. In other words, the activity of learning to design and designing cannot be dissociated from each other.

There is another significant result in the statistical analysis to be discussed. It is possible that significant decrease for the (d) design as construction can be the result of the increase in expertise of students as they go from first year to fourth year. This is also directly related to the amount of familiarization of students to design and design education. It might be that they learn to manage the design process. However, this also states that design education leads students to spend less time on exploration. As Lawson(2004) states that one of the weaknesses of the traditional studio is that students, in paying so much attention to the end product of their labors, fail to reflect sufficiently on their process.

The characterization of design as construction requires exploration on design process in order to be grasped by student by himself/herself. It cannot be predefined by an instructor. It cannot be divided into steps to be followed.

Especially considering the struggles of the students going through during their first year and the amount of time they spend to explore design, this learning process fits into Schon's (1987) conception of design activity that it is to look for something without knowing what it is. In this regard, Schon (1987) states that design cannot be defined; and to teach a student what design is becomes impossible but he proposes it is possible that the student can be coached. He states:

> He has to see on his own behalf and in his own way the relations between means and methods employed and results achieved. Nobody else can see for him, and he can't see just by being told, although the right kind of telling may guide his seeing and thus help him see what he needs to see." (Schon, 1974, p. 151).

Under the light of Schön's statement, recalling Meno paradox, it can be said that what students experience in this learning process is not about just the nature of this type of learning but the struggle to understand and respond the informal teaching methods used by the studio instructors which corresponds to Schön's concept of "coaching", also defined as behavioural activities by Duffy et al. (1992).

This also brings another issue that the nature of the design process actually does not correspond to the design process taught in the design studio; but the design studios rather offer a more linear process of design to realize an end product.

Although the results of question 2 (Q2) is not statistically significant, it is worth to mention and discuss its results. The results show that students correlate design with art very closely although they characterize design as problem solving mostly.

There are several reasons that are revealed during the interviews. First, most of the students correlate design with art because of the content of the basic design studios. because of the course materials in the lectures or the nature of the assignments or the end products produced by the students in the studio. One student states it this very clearly:

> AA: … in architecture a lot of art is in the loop. I mean, basic design was so alien to me. I mean this kind... I didn't know that we are so interacted with art.*

Second, another student states that the relation between design and art relate to the fact that an artist and an architect are similar in the way they look at their surroundings. An artist has always a critical approach to an issue. Student T.T. states that architects have the same tendency and approach:

> TT: It's not about aesthetics, but emphasis of art. For example, I guess we've talked about this in a course or something, every artist has an issue with something and he/she tries to tell it, like a painter in his/her painting, we are like him/her, too. I think this is why it is closer to art.

In addition, according to students, there is another resemblance in terms of the way artists and architects have both aesthetic concerns. Renzo Piano(1997) states this resemblance as follows:

> Those who build houses provide shelter: for themselves, for their families, for their people. In the tribe, the architect performs a role of service to the community. But the house is not just protection: this basic function has always gone hand in hand with an aesthetic, expressive,

* All translations are done by the author.

> symbolic yearning. The house, from the very beginning, has been the setting for a quest for beauty, dignity and status. The house is used to give expression to a desire to belong, or to desire to be different.(Piano, 1997, p. 10)

The idea of choosing pairs is emerged during the interviews. It is stated that engineering is related to architectural design when designed project arrives at the construction phase. The general preference of pairs was art and engineering since architectural design was the focus of the discussion in the interviews. However, according to students, in the field of architecture, the design process is composed of two different phases which are design and construction. It is reasonable for students that the process of design of a building is more associated with art and the process of realization of the building is more associated with engineering.

A first year student was the only one who related design to science. The main idea of his argument was that science is the main and only field that allows an architect how he/she designs and builds:

> İÖ: I think that the most important determinant in design is science. We can design very different and imaginary stuff but we can realize them only within the limits of what science allows. For example, let me say it like this, let's say that we're going to build something here. We benefit from geographical conditions, that's a scientific data. Let's analyze the direction of the sun path, the direction of the wind, the north and south of the site and etc... We always use scientific data. So, the biggest determinant of design turns out to be scientific data.

This student associates the field of science directly with technology in any terms related to architecture in comparison to other students who embrace that there is a relation between art and design although they characterize design as problem solving..

When students were asked which is more related to success in design, the statistical analysis showed that producing creative solutions is seen as the key qualification that leads the designer to success. The answers of the students interviewed showed the same correspondence with this result. However, when they are further questioned, being an experienced designer is held as more important for two reasons. One of them is defined as "being experienced in a familiar design problem" which is more related to professional life of a designer after school or as the students referred to it as "practice". The other understanding of experience is stated as "being experienced in design education" and the students interviewed directly relate it to learning-by-doing. In addition, it is stated that the other qualifications which are creativity, skill, and

knowledge are defined as qualifications that can be improved through experience as they learn by doing.

Students stated that having or learning certain skills is needed to learn to design and execute a design project. Moreover, throughout the discussions, being talented is brought to discussion too. A second year student explains this matter of having skills and being talented as follows:

> B.Ü.: Talented people can be ten steps ahead but anybody can be an architect or understand design by improving himself/herself. The degree of it would change if you're talented, you'll be ahead from the others for ten or twenty steps.

The concept of skill is directly associated with the execution of a design project. The skills needed to learn to design and design are acquired by learning-by-doing. In the beginning of the architectural education, it is observed that having the skills like making a model, drawing, thinking three-dimensionally are the first year students' primary concern.

The students interviewed stated that there is no need to be creative to design a product. However, it is stated that if one tries to come up with an original and successful design, he/she has to be creative. There are three key points in the discussions about creativity. First, creativity is seen as a mysterious talent that comes from birth for an individual. One of the students explains this as follows:

> A.T.: I think some people have this 'eye' for it. I mean, there is a difference obviously. Those people have this for every subject. They feel that themselves. It must be. I mean, it sometimes happens that those people has already recognized and analyzed the stuff that we haven't even seen.

Boden (2004) states that the dictionary definition of creation is'to bring into being or form out of nothing' and this common definition affects students' conception of creativity. Moreover, it is believed that some students have this mysterious talent. On the other hand, this is considered not to be an important qualification in the design studio education. Students commonly state that a creative student is only a few steps ahead of the other students.

Second, being creative is directly associated with the problem definition phase of design by some students.

> T.T.:The creativity here is about being able to grasp the points that may be important for your project. That's why, creativity becomes a part of design. I think like that.

Here, it is crucial to mention about the tutors' approach to students at the beginning of each studio project. They generally ask students for a conceptual development before starting their projects. They want them to build a conceptual foundation that will shape the orientation, spatial organization, and form of the building. At this phase, students are either explicitly or implicitly pushed to come with a critical approach. However, students state that designing means to tell something "new". So, this critical approach is thought to lead the student to an original idea, "something new". In this regard, problem definition is learnt by students as a creative act that is a must for a successful design.

Third, creativity is considered as a skill to be taught and learnt. Although it is anambiguous statement, a student describes this learning process and how knowledge, skills, and experience are integrated in this process of learning to be creative as follows:

> İ.Y.: … first some knowledge, then your skills are getting better. Later, after you have some experience, as some things are presented, creativity can be achieved there…

This studentstated that as one enters the school, first there is an increase in the knowledge about architecture and design and anything that can be related. Then, he/she acquire the needed skills by learning-by-doingand he/she gains experience through the projects in the studio. As he/she produce and presents design ideas as this process continues, he states that one can become more creative.

The statistical analysis of the same question also shows that the second year students give more importance to being experienced, although it is their second year in their undergraduate education. However, in the interviews, it is seen that even the first year students value more to being experienced in designing and design education.

5.2. Students' Conception of Design Process

This section will discuss the students' conception of the design process. The discussion will focus on how students start to design and the general descriptions of students for their design process based on their experiences in the studio.

When the students were asked about the way they start to design, understanding the problem definition had the highest rate of selection in the statistical analysis. The interviews support this result as being the most common statement. Nevertheless, although the conception of design as problem solving appears as the most common characterization of design, the focus of pedagogy employed with a focus on the exploration of the design process leave its place to a more solution-oriented activity and conception of design process in time.

As students move from first year to the fourth year through their undergraduate education, while a first year student is in the search for an inspiration, a fourth year student is in search for a problem definition. Consequently, a fourth year student need more information and often conducts analysis to reach a design idea.

The need for research to start to design increases as students give up waiting for the muse of inspiration to come to them. However, after understanding the design problem and some initial research for problem definition, first year students stated that they need time to process the information. It is crucially important to highlight that this information processing starts and continues as their research into the design situation progresses. Students stated that they wait and do either daily routines or meet friends or etc... These descriptions fit directly to the concepts of fixation, incubation, and discontinuity. Two students described this feeling as follows:

> E.G.: If I'm stuck, I immediately go out. I wonder around for some time, I let it all hang out. Then, when I come back, it's like I thought about it during that time and right away some stuff appears before me on the table.

> S.M.: I can't start to design by just grabbing cardboard and box cutter. For example, we always have fourdays from one critic to another. For the first three days, I look at blogs on the internet. I try to look at magazines and see stuff. This is not for just inspiration but I guess I just like it this way. On the last day, I sit atthe table. I start like 21:00 – 22:00. It turns out to be that everything in my mind has fallen into its place.

There are a lot of descriptions of processes referring to the notions of "A-ha!" response and incubation in the interviews. Moreover, whatever the students' characterization of design process is, incubation, and discontinuity occurs in their design process. One student reports as follows:

> K.D.: …but there is no need for design input for the main idea to be built. I mean, sometimes it happens suddenly. It can be also something already in your mind.

This student's explanation refers to the characteristics of the conception of design as an insight problem. Itis possible that the student goes through a process of structuring and framing a problem definition which may not be known to the student himself. In the interview, he stated that sometimes even a word used to define design problem like the function of the building mightinspire a problem definition. At this step, though, the student claims that there is no need for a research regarding the design problem. Some knowledge in the long term memory is probably used to structure the design problem. The phrase "something already in your mind" and "reminds something else" actually supports such an assumption. Another student continues as follows:

> S.B.: There are some moments that an idea comes to my mind suddenly. We mentioned it a few minutes ago, if an idea is going to come, if we wait for an inspiration, some research must be done. However, we say that this inspiration comes rarely. When we do a group work, something that a friend says reminds something else.

Students commonly stated in the interviews that first year design education is far different from the following years. Schön (1988)states that designers are in transaction with the design situation by responding to the demands and possibilities of a design situation. He defines this as "reflective conversation with the design situation". The reason for first year design education differs from the following years is that the first year sets the stage as the first encounter with a design situation and it directs the students to diagnose the demands. This also could be called as the problem definition phase. Learning-by-doing pedagogy takes up its position to teach the act of responding to these demands with the possibilities of that design situation.

In the interviews with the other classes, students emphasized that defining a problem in one's own way in a given context is stated as a creative act. Moreover, it is seen as the most important phase in the design process to be successful in terms of both producing a design solution and passing the studio course. It is also stated that this phase, as students describe this as the conceptual phase of the design process in the studio, is the most time consuming process throughout the semester. During this process of problem definition, awareness of the complex environment and its every element involved in it, and a critical approach by critical thinking are defined as the most important skills needed in order to be able to come with a creative idea

They also associate this process with the term incubation because the expected original idea is not built directly through analysis-synthesis. As Weisberg (1995) states

solving a problem does not always proceed directly from problem presentation to solution generation. In the interviews, students stated that they have waited to find a source of inspiration especially in their first year. They emphasized that tutors told them that they cannot wait for it but they have to look for it. The reason for the increase in the conception of design as an insight problem can be that although they learn to do research for a source of inspiration which also trigger them to find the solution, they all mentioned that there are still 'A-ha!' moments in the design process.

Schon (1992) tries to specify kinds of information processing tasks in designing. 'Seeing/Drawing/Seeing' is the most obvious kind of information processing activity in the design process since the design studio pedagogy is based on the teaching of this activity.

'Seeing/Drawing/Seeing' also includes a process of trial-and-error which studio pedagogy defines it as learning-by-doing. This kind of trial-and-error by drawing is directly linked to the concept 'self-conscious process' of Alexander. Alexander describes this as achieving the adaptation and development that took centuries, on the drawing board spending time measured by hours by inventing a form that clearly fits its context.

In addition, drawing as a representational tool is used as a pedagogic tool for transferring knowledge from tutor to students. Information processing is the conversion of tacit information to manifest information. Design studio pedagogy is focused on the tools of this conversion and uses them by means of transferring experience of tutors to students. So, once students learn this tool and how it is used in design education, it loses its priority for the students. The conception of design as construction, design as conjecture-trial, and design as insight problem lose their priority of in the meaning of exploration and students focus on the conception of design as problem solving which they think would lead them to success in the design studio.

Another result which became apparent in the post-hoc test, doing research is less than expected among the first year students. In the interviews, first year students commonly stated that they were not aware of a need for research beforehand until their tutors asked for it. This statement reveals three key issues. First, it becomes apparent that doing research is defined and taught as an initial phase to start designing. This becomes a proof of being dependent on the tutors at a high level since this dependency is "doing what is told".

Second, although students commonly state that they do not have much knowledge about particular design problems which they can transfer it into their design process, doing research seems to be not an activity that would help solve the design problems. Although they tend to characterize design as problem solving, this contradiction depicts the transitional phase from characterization of design as an insight problem towards a conception of design as problem solving.

Third, doing research is separated into two paths for students. First involves doing research about a certain concept or an idea of their own. Second one involves searching for examples having solutions for certain problems that are stated in the studio assignment. Jonas (1993) states that existing 'solutions' are the most important starting points, 'problems' are defined in a way that enables the result to deliver optimum solution for the following 'problem' definitions. In the interviews, the students state that their tutors ask for research about projects that also solve the problem defined in the assignment. Students learn that there is no single solution to the design problems that they come across. They also realize that the problem they diagnose is actually derived by a present solution in the existing situation (Jonas, 1993).

The tutors also guide students to do research for finding similar cases that have solutions to similar problems among other problems in their design process. It can be said that unintentionally students learn doing a research for a specific problem in their whole design process as part of one problem-solving process in design.

Bamford (2002) concludes, from Schön's example of computer program for structural design (GROWLTIGER), that guessing and (technical) knowing, ideas and algorithms, are part of one problem-solving process in design. On the other hand, Bamford (2002) reminds Broadbent's 'design spectrum'—algorithm, ratio, deduction, analogy, induction, metaphor, and chance—was an attempt to chart the breadth of thinking in synthesis (Broadbent, 1966, 1973). Bamford (2002) states that although there are problems with it, this 'spectrum' reminds of the diversity of tasks in design process. One of the third year students exemplified the variety of tasks such as constructing a concept, solving programmatic issues while maintaining spatial qualities or bringing a new approach to a certain spatial issue in architectural design process and how every task requires special skills and methods to deal with them.

> K.D.: The school puts a process before us. Actually, I think it's not something that school says 'Do this". It's more like if it is done one can get results. But this is up to himself/herself.

> Because, there are students that they think too much on the concept, and once they decide on something they solve the whole project smoothly, they can solve the spatial problems very well. On the other hand, some comes with a cool concept immediately but fails to solve the programmatic issues for months. I mean this is a very individual and personal thing. Because of this, they (studio instructors)never say something when you bring more than they asked for the studio. But if you bring less, then it becomes a problem for them. Because, this is like the worst possibility they determine. If you stay above that line for the worst possibility, you get results. Staying below that is of course a problem.

This quote also gives some insights about students' design process and its relation to the design studio pedagogy. First, it is stated that students think that there is a way of doing things at the school of architecture to be successful. This is not an explicitly stated method but they are aware of its existence. Second, this way of doing things does not fit every student at the school because every student has his/her predisposition to certain activities in this prescribed design process. Finally, students think that this prescribed ways of doing things are related to pedagogical concerns to avoid students from failure.

Moreover, students stated that it has been told the design process is not a linear process but on the other hand in the design studio courses they are expected to follow a very 'linear', 'step by step' process. This contradiction between the nature of design process and design studio pedagogy causes an obstacle for students. One student describes this as follows:

> S.A.: Supposedly it is being mentioned that the design process is not a linear one, but, in practice it is not always like that.

Students state that they cannot explore their own design processes. In order to follow the syllabus of the studio course, they state that they cannot question the phases of the design process to be followed that are determined by the tutors. One of them puts it as follows:

> B.Ü.: It is like some things are too formulated. I mean, "How do one design?" "We analyze, then do this, then we draw that, we make a diagram of it. We pass to mass after diagram. Then, we draw plans from mass." That for instance, diagram is determined at the moment, but no one says: "What happens if we do the opposite?" Nobody does.

It can be said that students gain experience about design activities that are common like mass studies, using diagrams and etc… However, they emphasized that they don't have any control on the sequencing of those design activities. This quotation by a second year student brings to light that design studio pedagogy introduces certain

design activities that are determined by the syllabus in a specific order to make the assessment of a student possible during the semester. Nevertheless, the holistic conception of the management of design process for a student is not taught formally.

In this regard, the lack of a comprehension of design process holisticly leads student to characterize design as problem solving because the design studio pedagogy breaks down the problem of learning to design into small chunks to be dealt one-by-one. Each small chunk refers to a step in the agenda of the studio defined by the studio instructors. Each step is aimed to have students study on a certain design task that helps students progress towards an end product. Since students are not able to see the whole process beforehand and they are told to follow the process of the studio, the moves taken by students to achieve the design tasks becomes incidental for each task. In this regard, a second year student states as follows:

> B.Ü.: I mean, it gets worse when you try to formulate a thing that does not have a formula at all. Actually, this is exactly the problem.

Louridas's (1999) description of design as bricolage shows resemblance with the nature of students' explanation of experiences in their design processes. It can be said that every incident either happened in a critic or a sudden mental insight moment that is triggered interferes in the students' design process. Louridas emphasizes that the incidental, "in the guise of the use of indirect' means, is the notion that has been retained. The bricoleur makes do with what's there, with what he encounters" (Louridas, 1999, p. 518).

Louridas defines three issues. First, he states that the designer must be creative. He explains that the designer sells his/her trade. He/she does not design for himself/herself. He/she designs a product for others, a product which he must sell. For the product to be sold, it must be unique, it must differ in some way from other solutions to the same problem. In the interviews, as soon as students learn to defend ideas and how to conduct relationship with their instructors, they state strategically that they must be creative in order to be successful in the studio. The designer must determine the 'occasion contingencies' (Louridas, 1999).

Second, Louridas (1999) claims that the designer must also create his/her own inventory of materials that he/she will bring to bear on the problem. The selection of materials is sometimes as important as the form of the product. Having inventory of

materials is required in the architectural design studios. The designer must determine the ‘execution contingencies’(Louridas, 1999).

Third, Louridas (1999) states that the designer often defines the purpose of the artifact. In the interviews, students stated that problem definition is described as the most important phase in their design process in design education and being creative at this phase of the design process is the key factor to be successful in design. The designer must determine the ‘purpose contingencies’(Louridas, 1999).

In this regard, based on these significant demands defined by Louridas that are imposed on the designer, and as the students become aware of these issues, because of the design studio pedagogy, every instance of a transfer of knowledge from any source invokes an incident movement especially among the first year students. As the experience in design and design education increases, the strategic approaches are improved. Consequently, students learn to manage their design process and design education more efficiently in terms of time management and idea generation.

Many of the criticism obtained from the interviews about design education is focused on how it contradicts with the nature of design process. The next section will focus on the students’ conception of design education and the teaching tools that are used in design studios.

5.3. Students’ Conception of Design Education

When students were asked about four teaching methods that are commonly used for knowledge transfer between the tutor(s) and student(s) as part of design studio education, the statistical analysis showed that first year students benefit less than expected from one-to-one critiques, however, they prefer juries more than expected for transfer of knowledge. First year students stated that they see the jury as an opportunity to get various opinions.

In the interviews, students’ views take two opposite sides. One group of students defines the jury as a stage of power and authority of the tutors upon students where there is no opportunity for learning. On the other side, the other group state that they enjoy this event since they are successful at adopting the tactics to “stay alive” at the juries.

Webster (2005) states that there is now a growing literature that suggests that the asymmetrical construction of power created by the jury ritual encourages students to adopt surface tactics that are likely to result in ‘‘a good judgment’’ (hiding their weaknesses and playing to their strengths, pandering to the critics’ taste, etc.) and positively deter them from presenting their authentic architectural ideas and understanding for reflection with expert others.

Under the light of statistical analysis supported by the interviews, the second and third year students state that they see no benefit in the juries in terms of any transfer of knowledge, but they rather prefer one-to-one desk critiques. One-to-one critiques are preferred more since student is able to communicate and present their architectural ideas in a more cooperative environment.

The statistical analysis indicates that in the fourth year, students start to think juries have benefits in terms of transfer of knowledge. The interviews support that result and students state this as simulation of the relation between the designer and the client.

According to the statistical analysis, the corrections done by the tutors are seen as an useful mode of transfer of knowledge between student and tutor for the fourth year students. However, the interviews conducted indicate two different opinions depending on the impact of the correction made on their project. When the tutor’s correction is parallel to the needs of the student offering a reinforcement in the design idea, or is an intervention for a certain point pending for solution for a long time, it is consequently welcomed by the students and considered to be beneficial. If it is completely the opposite where the correction of the tutor is considered to be an imposition of the tutor’s personal ideas, tastes or opinion, students state this as another authoritarian intervention upon themselves.

Chiu states that although senior students should have more expertise than junior students, the seniors in this study appeared to have much more demand for design knowledge than the juniors (Chiu, 2010). The increase in the use of (a) one-to-one desk critiques from juniors to sophomores indicates the change in the notion of a tutor in the design studio from a teacher correcting a student‘s work, to a guide and a source of knowledge for students. Concurrently, in the interviews it is stated that one-to-one desk critiques remain much more efficient since other factors such as jury members and classmates, distract the attention of a student and he/she becomes unable to focus in the dialogue taking place about his/her project.

CHAPTER 6

CONCLUSION

> İ.Ö.: ... this is either a method of our education or a form of it. This must be working somehow because we make progress.

The focus of the study was to determine if there are changes in the wayarchitecture students characterize design. Design definitions taken from design studies that reflect different aspects of design were presented to the students and the students' conceptions of design are associated with their experience of design education in the previous chapter.

This study aimed to answer the following research questions.

1. How do students of architecture characterize design throughout their education?
2. How does architectural design education change a student's conception of design inhis/her mind?
3. What does students of architecture learn about design and design process?

6.1. Inferences

As mentioned previously, there are informal methods that are used by the studio instructors pragmatically that enable implicit learning(Kowaltowski et al., 2010). Moreover, there is a 'hidden curriculum' in the design studio education. Nevertheless, it is observed that these informal methods change students' conception of design.

So, how do students of architecture characterize design throughout their education? From the first year in design studio education, it can be said that the conception of design as problem solving is the dominant characterization of design process that is taught. In addition, since design studio pedagogy imposes a linear design process, it is not just a preference of studio instructors but it is the most appropriate conception of design that can be taught by the current pedagogy in instutionalized education. Design Methods was integrated into architectural design education as a pedagogy in the 1970s. However, in the 1980s it was rejected due to the failure of

design methods in practice and inhibition of creativity. The conception of design process is not thought to be a linear process anymore. Nevertheless, it is possible that the reason for the teaching methods being linear can be because it is teachable. Although, it is not clear that if analysis-synthesis is taught in the architectural design studios implicitly, can the contradiction between the nature of design process and the design studio pedagogy be the reason for architecture students being obligated to develop strategies?

Once students abandon the conception of design as insight problem, the statistical analysis shows that they think of design as construction or as conjecture-trial. First year students stated that they all employ trial-and-error in their design process but once they start to manage the process of learning to design as it is taught in the studio, they emphasize that following the steps presented by the tutors in the assignments lead them to success in the studio.

Students state that there must be an inspiration, or a point where they define as a "Eureka!" moment is still waited and needed and it is a part of their design process.

The change in how students characterize design is caused by the change in the students' conception of design from being based on the attributes of the end product towards an awareness of the nature of the design process.

Then, how does architectural design education change a student's conception of design in his/her mind? Design studio pedagogy imposes a conception of a more linear design process by stating certain deadlines for certain phases to the students. On the other hand, inside these phases, the tutors try to make use of Schön's 'reflection-in-action' and 'reflection-on-action' as pedagogical tools through desk critics and learning-by-doing.

Design studio pedagogy breaks down the problem of learning to design into small chunks to be dealt one-by-one. Since students are not able to see the whole process beforehand and they are told to follow the process of the studio, the moves taken by students to achieve the design tasks becomes incidental for each task.

However, as the literature form design studies show, design process contains various activities and concepts such as incubation and discontinuity. Especially, the concepts that are described by the studies on creativity are not even mentioned in any informal way by the studio instructors. The students are on their own to eliminate their preconditioned conceptions about the mystery of creativity.

This study also aimed to find some answers about what students of architecture learn about design and design process? As Sachs (1999)states students are asked to perform at least two tasks simultaneously: to design and to learn to design. Students, in addition, must present and defend ideas, conduct personal relationships with instructors and fellow students, and learn new techniques and skills. Moreover, as Schön (1987) states the virtual world of the studio becomes a collective world in its own right, with its own mix of materials, tools, languages and appreciations. It is observed that the familiarization of design education and the experience gained by students accelerate the acquisition of needed skills for designing and the ability to learn to design.

Students learn that there is no single solution to the design problems that they come across. They also realize that the problem they diagnose is actually derived by a present solution in the existing situation (Jonas, 1993).

In this regard, although students are able to establish correspondence between the characterizations of design and their experience in their design education, they fail to state how they learn to design what they learn and know about design. The third year and fourth year states that they realize what tools are used in design education however how it triggers learning is still not fully clear to them.

Learning by doing and consequently implicit learning has advantages and disadvantages. Learning by doing provides the opportunity to explore on design activity. The implicit learning occurs during these exploratory activities in learning by doing. The individual experience through this exploration enhances creativity in a student. However, this implicit learning causes deficiencies in the evaluation of students progress. Design studio pedagogy does not allow this type of learning in the studio completely, instead it controls this activity covered inside studio assignments with imposing certain rules and deadlines. This pedagogy makes learning by doing into a noncritical type of learning.

In addition, the tradition of a 150 year old system brings various prescriptive pedagogical tools. Jury has always been one of the most criticized devices in the design studio pedagogy. As a result of this study, once again it is revealed that both conceptually and physically the concept of jury has been giving damage to learning in the studio.

The comments from the students about the descriptions in questionnaire forms and the interviews indicate that thinking about design, design process and design

education and verbalizing on those subjects created an awareness of their knowledge about design and what they understand, learn and know about these topics. The students stated that they wish they can talk and share about these issues more and often.

6.2. Future Work

This study is conducted in two schools of architecture with 364 students. First, asking the same questions with different words may enable the researcher obtain more in-depth information. Including more schools with similar curriculum and structures may give more insight to the questions asked. Moreover, grouping schools of architecture according to their curriculum and studio structures, and comparing them may shed more light on the issues discussed in this thesis.

The study is conducted only with architecture students. It can be conducted with students from other design fields. Expert designers and studio instructors can be added as separate groups to make comparisons with student groups.

Only two schools of architecture took part in the study. The study can cover more schools in Turkey by grouping them according to their pedagogical approaches. It can be conducted also internationally to depict the cultural effects on this issues.

With regard to difficulties of evaluating what students learn about design, it is possible that building a students' vocabulary of design may help to gain more insight about how they characterize design, what they learn and know about design, and how it is transformed throughout the architectural design education.

6.3. Limitations

The results (Figure 1) could have been different if the questionnaire could have been conducted on the first day of the first year students since they would not be familiar with the design education and the concepts that are taught at all. Having even a semester of design studio learning does make a change in students' conception of design.

The study is conducted only with architecture students and it covered only two schools from Turkey. The grouping of the students is done according to the higher education system in Turkey which offers four year undergraduate program.

6.4. Contributions

This study stated the pedagogy involved in a school of architecture can be referred to a certain design characterization. Moreover, the dominancy of a certain design characterization has effects on various aspects of the teaching in the design studio consequently.

With regard to the interviews conducted, the change in how students characterize design is caused by the change in the students' conception of design from being based on the attributes of the end product towards an awareness of the nature of the design process. Such insight is considered important not only for the participants in the design studio but also as a contribution to understanding the design studio and evaluating the knowledge to be gained by the student and the informal methods of teaching involved in the design studio.

The pedagogical approach in designing and preparing studio assignments to enhance the exploration by the students on their design processes requires more attention because it is believed that considering the existence of the contradiction between design studio pedagogy and the nature of design process while designing the studio assignments may affect the learning in the studio positively.

BIBLIOGRAPHY

Akin, Ömer, & Akin, Cem. (1996). Frames of reference in architectural design: analysing the hyperacclamation (A-h-a-!). *Design Studies, 17*(4), 341-361. doi: 10.1016/s0142-694x(96)00024-5

Alexander, Christopher. (1964). *Notes on the Synthesis of Form*. Cambridge, MA: Harvard University Press.

Archer, B. (1965). *Systematic Method for Designers*: Council of Industrial Design.

Archer, Bruce. (1979). Design as a discipline. *Design Studies, 1*(1), 17-20. doi: http://dx.doi.org/10.1016/0142-694X(79)90023-1

Argyris, Chris. (1981). *Teaching and Learning in Design Settings.* Paper presented at the in Consortium of East Coast Schools of Architecture.

Asimow, M. (1962). *Introduction to design*: Prentice-Hall.

Bamford, Greg. (2002). From analysis/synthesis to conjecture/analysis: a review of Karl Popper's influence on design methodology in architecture. *Design Studies, 23*(3), 245-261.

Bayazit, Nigan. (2004). Investigating Design: A Review of Forty Years of Design Research. *Design Issues, 20*(1), 16-29.

Boden, M.A. (2004). The Mystery of Creativity *The Creative Mind: Myths and Mechanisms* (pp. 11): ROUTLEDGE CHAPMAN & HALL.

Broadbent, G. (1979a). Design Methods at the Portsmouth School of Architecture. *Design Methods and Theories, 13*(1).

Broadbent, G. (1979b). The Development of Design Methods. *Design Methods and Theories, 13*(1).

Broadbent, Geoffrey. (1966). Design method in architecture. *The Architect's Journal, 144*(11), 679–685.

Broadbent, Geoffrey. (1973). *Design in architecture: architecture and the human sciences*. London: John Wiley and Sons.

Brosterman, N., & Togashi, K. (1997). *Inventing kindergarten*: H.N. Abrams.

Buttle, D. (1979). Attitudes to Design Methods 1958-78. *Design Methods and Theories, 13*(1).

Cairns, Stephen. (2005). Design media: Architecture and the grounds for invention. *The Journal of Architecture, 10*(3), 307-315. doi: 10.1080/13602360500162345

Chalmers, A. F. (1999). *What is this thing called science? An assessment of the nature and status of science and its methods* (3rd ed.). St Lucia, Brisbane: University of Queensland Press.

Cross, Nigel. (1982). Designerly ways of knowing. *Design Studies, 3*(4), 221-227. doi: 10.1016/0142-694x(82)90040-0

Cross, Nigel. (2001). Designerly Ways of Knowing: Design Discipline Versus Design Science. *Design Issues, 17*(3), 49-55. doi: 10.1162/074793601750357196

Cross, Nigel. (2007). Forty years of design research. *Design Studies, 28*(1), 1-4. doi: 10.1016/j.destud.2006.11.004

Cross, Nigel, Naughton, John, & Walker, David. (1981). Design method and scientific method. *Design Studies, 2*(4), 195-201. doi: http://dx.doi.org/10.1016/0142-694X(81)90050-8

Cuff, Dana. (1991). *Architecture: The Story of Practice*. Cambridge: MIT Press.

Cunningham, Allen. (2005). Notes on education and research around architecture. *Journal of Architecture, 10*(4), 415-441. doi: 10.1080/13602360500285542

Demirbaş, O. O., & Demirkan, H. (2003). Focus on architectural design process through learning styles. *Design Studies, 24*(5), 437-456. doi: http://dx.doi.org/10.1016/S0142-694X(03)00013-9

Duffy, Thomas; Jonassen, David. (1992). Constructivism: New Implications for Instructional Technology. In T. M. J. Duffy, David H. (Ed.), *Constructivism and the Technologu of Instrcution, A Conversation* (pp. 1-16). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publishers.

Dutton, Thomas. (1987). design and studio pedagogy. *Journal of Architectural Education (1984-), 41*(1), 16 - 25.

Eastman, C. (1969). Cognitive processes and ill-defined problems: a case study from design. In D. E. Walker (Ed.), *Proceedings of the International Joint Conference on Artificial Intelligence, May 7-9, 1969, Washington, D.C*.

Eastman, C. (2001). Chapter 8 - New Directions in Design Cognition: Studies of Representation and Recall. In C. M. Eastman, W. M. McCracken & W. C. Newstetter (Eds.), *Design Knowing and Learning: Cognition in Design Education* (pp. 147-198). Oxford: Elsevier Science.

Eraut, Michael. (1994). *Developing professional knowledge and competence*. London: RoutledgeFalmer.

Fisher, T. (2000). *In the Scheme of Things: Alternative Thinking on the Practice of Architecture*: University of Minnesota Press.

Fowles, Robert A. (1979). Design methods in UK schools of architecture. *Design Studies, 1*(1), 15-16. doi: http://dx.doi.org/10.1016/0142-694X(79)90022-X

Fuller, R.B. (1999). *Utopia Or Oblivion*. New York: Bantam Books.

Gordon, W. J. J. (1961). *Synectics*. New York: Harper & Row.

Gregory, S.A., Design, University of Aston in Birmingham., & Group, Innovation. (1966). *The design method*: Butterworths.

Groat, Linda N., & Ahrentzen, Sherry. (1996). Reconceptualizing Architectural Education for a More Diverse Future: Perceptions and Visions of Architectural Students. *Journal of Architectural Education (1984-), 49*(3), 166-183. doi: 10.2307/1425326

Gropius, W. (1937). Education toward creative design. *American Architect and Architecture, CL(2657),* 27-30.

Hillier, Bill, Musgrove, John, & O'Sullivan, Pat. (1972). *Knowledge and Design.* Paper presented at the Environmental Design: Research and Practice.

Itten, J. (1963). *Design and form: The basic course at the Bauhaus*. New York: Reinhold Publishing Corp.

Jonas, Woalfgang. (1993). Design as problem-solving? or: Here is the solution —what was the problem? *Design Studies, 14*(2), 157-170. doi: http://dx.doi.org/10.1016/0142-694X(93)80045-E

Jones, J.C. (1970). *Design Methods: Seeds of Human Futures*. New York: John Wiley & Sons.

Kowaltowski, Doris, Bianchi, Giovana, & de Paiva, Valéria. (2010). Methods that may stimulate creativity and their use in architectural design education. *International Journal of Technology and Design Education, 20*(4), 453-476. doi: 10.1007/s10798-009-9102-z

Lakoff, G. (1987). *Women, fire, and dangerous things*. Chicago, IL: University of Chicago Press.

Lawson, Bryan. (1997). *How designers think: the design process demystified* (Completely rev. 4th ed.). Oxford ; Boston: Architectural Press.

Lawson, Bryan. (2004). *What Designers Know*. Oxford: Architectural Press.

Ledewitz, Stefani. (1985). Models of Design in Studio Teaching. *Journal of Architectural Education (1984-), 38*(2), 2-8.

Lerner, Fern. (2005). Foundations for Design Education: Continuing the Bauhaus Vorkurs Vision. *Studies in Art Education, 46*(3), 211-226. doi: 10.2307/3497081

Lethaby, W. R. (1913-14). *Apprenticeship and Education*. Leicester: Art School Press.

Louridas, Panagiotis. (1999). Design as bricolage: anthropology meets design thinking. *Design Studies, 20*(6), 517-535. doi: http://dx.doi.org/10.1016/S0142-694X(98)00044-1

MacMillan, A. (1979). Architecture is not a degree game, or never mind the ball, let's get on with the game. *Design Methods and Theories, 13*(1).

Maher, Mary, & Tang, Hsien-Hui. (2003). Co-evolution as a computational and cognitive model of design. *Research in Engineering Design, 14*(1), 47-64. doi: 10.1007/s00163-002-0016-y

Naylor, G. (1968). *The Bauhaus*: Studio Vista.

Naylor, G. (1985). *The Bauhaus reassessed: sources and design theory*: Herbert Press.

Newell, A. (1969). Heuristic Programming: Ill-structured Problems. In J. Aronofsky (Ed.), *Progress in Operations Research* (Vol. 3, pp. 360-414): John Wiley & Sons.

Nicol, David; Pilling, Simon. (2000). Architectural education and the profession: Preparing for the future. In D. P. Nicol, Simon (Ed.), *Changing Architectural Education: Towards a new professionalism* (pp. 1-21). London: Spon Press.

Osborn, A.F. (1963). *Applied imagination; principles and procedures of creative problem-solving*: Scribner.

Piaget, J. (1971). *Genetic Epistemology* (E. Duckworth, Trans.). Norton Library: Columbia University Press.

Piaget, J. (1997). *The Origin of Intelligence in the Child* (reprint ed.): Routledge.

Piano, R. (1997). *Renzo Piano: Logbook*: Monacelli Press.

Reitman, W. (1964). Heuristic decision procedures, open constraints, and the structure of ill-defined problem In G. L. B. M. W. Shelly (Ed.), *Human judgments and optimality* (pp. 282 - 315). New York: Wiley.

Rittel, H. (1972). The DMG 5th Anniversary Report.

Roberts, Andrew. (2006). Cognitive styles and student progression in architectural design education. *Design Studies, 27*(2), 167-181. doi: 10.1016/j.destud.2005.07.001

Rogers, Carl. (1969). Personal Thoughts on Teaching and Learning. In C. Rogers (Ed.), *Freedom to Learn: A View of What Education Might Be*. Columbus, Ohio: Merrill.

Rowland, G. (1991). *Problem solving in instructional design.* (Unpublished doctoral dissertation), Indiana University, Bloomington, IN.

Sachs, Avigail. (1999). `Stuckness' in the design studio. *Design Studies, 20*(2), 195-209. doi: 10.1016/s0142-694x(98)00034-9

Sagun, A.; Demirkan, H.; Göktepe, M. (2001). A framework for the design studio in web-based education. *Journal of Art and Design Education, 20*(3), 332-342.

Schon, Donald. (1983). *The reflective practitioner: how professionals think in action*. London: Temple Smith.

Schon, Donald. (1985). *The design studio: An exploration of its traditions and potential*. London: Royal Institute of British Architects.

Schon, Donald. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass.

Schon, Donald. (1988). Designing: Rules, types and words. *Design Studies, 9*(3), 181-190. doi: 10.1016/0142-694x(88)90047-6

Schon, Donald. (1992). Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems, 5*(1), 3-14. doi: http://dx.doi.org/10.1016/0950-7051(92)90020-G

Siebenbrodt, M., & Reissinger, E. (2000). *Bauhaus Weimar: designs for the future*: Hatje Cantz.

Simon, H. (1969). *The Sciences of the Artificial*. Cambridge, MA: MIT Press.

Simon, H. (1973). The structure of ill structured problems. *Artificial Intelligence, 4*(3-4), 181-201. doi: 10.1016/0004-3702(73)90011-8

Smith, Steven. (1995). Fixation, Incubation, and Insight in Memory and Creative Thinking. In T. B. W. Steven M. Smith, Ronald A. Finke (Ed.), *The Creative Cognition Approach* (pp. 135-181). Cambridge, Massachusetts: MIT Press.

Sommer, B.B., & Sommer, R. (1997). *A practical guide to behavioral research: tools and techniques*: Oxford University Press.

Webster, Helena. (2005). The Architectural Review. *Arts and Humanities in Higher Education, 4*(3), 265-282. doi: 10.1177/1474022205056169

Webster, Helena. (2008). Architectural Education after Schön: Cracks, Blurs, Boundaries and Beyond. *Journal for Education in the Built Environment, 3*(2), 63 - 74.

Weisberg, Robert W. (1995). Case Studies of Creative Thinking: Reproduction versus Restructuring in the Real World. In T. B. W. Steven M. Smith, Ronald A. Finke (Ed.), *The Creative Cognition Approach* (pp. 53-72). Cambridge, Massachusetts: MIT Press.

Whitford, Frank. (1984). *Bauhaus / Frank Whitford*. London: Thames and Hudson.

Wilson, Stuart. (1969). EARLY EDUCATIONAL REFORMERS AND CONTEMPORARY ARCHITECTURAL EDUCATION. *Architectural Science Review, 12*(4), 99-104. doi: 10.1080/00038628.1969.9697123

Wingler, H.M. (1969). *The Bauhaus*. Cambridge, MA: MIT Press.

Winograd, Terry; Flores, Fernando. (1986). *Understanding computers and cognition: A new foundation for design*. Norwood, NJ: Ablex Publishing Co.

Zimring, Craig, & Craig, David Latch. (2001). Chapter 7 - Defining Design between Domains: An Argument for Design Research á la Carte. In M. E. Charles, W. M. McCracken, W. M. M. Wendy C. NewstetterA2 - Charles M. Eastman & C. N. Wendy (Eds.), *Design Knowing and Learning: Cognition in Design Education* (pp. 125-146). Oxford: Elsevier Science.

APPENDIX A

QUESTIONNAIRE FORM (TURKISH)

Bu çalışma mimarlık eğitimi boyunca mimarlık öğrencilerinin tasarım ve tasarım süreci hakkındaki fikirlerinin nasıl geliştiğini ve değiştiğini belirlemek üzere düzenlenmiştir.

Yaş:

Cinsiyet:

Mimarlık eğitiminizin kaçıncı yılındasınız? (Hazırlık hariç)

Şu anda aldığınız Mimari Tasarım Stüdyosu dersini daha önce aldınız mı?

A. TASARIM HAKKINDA

1.Tasarımı nasıl tariflersiniz?

a)Tasarım, diğer problem çözme alanlarında olduğu gibi bilinenlerden hareketle ihtiyaca cevap verecek çözüme ulaşılmasıdır.

b)Tasarım, herhangi bir zamanda ve yerde herhangi bir şeyden ilham alınarak yapılan sanatsal bir aktivitedir.

c)Tasarım, belirlenen bir ihtiyaca deneme-yanılma yöntemiyle yanıt verme sürecidir.

d)Tasarım, bir heykeltıraşın bir mermer bloğunu yontarak şekil vermesi gibi bir fikrin çeşitli araçlar kullanılarak inşa edilmesidir.

2.Tasarım aşağıdaki alanlardan hangisine daha yakındır?

a)Sanat

b)Bilim

c)Mühendislik

d)Zanaat

3.Tasarımda başarı aşağıdakilerden hangisi ile daha çok ilişkilidir?

a)Bilgi

b)Beceri

c)Yaratıcılık

d)Tecrübe

4.Bir tasarım fikrine nasıl ulaşırsınız?

a)Fikir, birdenbire oluşur, nerede ve ne zaman geleceği belli değildir.

b)Fikri, bir veya birden fazla benzer projeye bakarak oluştururum.

c)Fikri, tasarım girdilerini değerlendirerek inşa ederim.

d)Fikri, daha önce geliştirdiğim projelerdeki fikirleri dönüştürerek oluştururum.

5.Birisine tasarımın ne olduğunu anlatırken aşağıdaki tanımlamalardan hangisini/hangilerini kullanırsınız? (Birden fazla seçenek işaretleyebilirsiniz)

a) Belirsizlik
b) Çok yönlü
c) Sanatsal
d) Yaratıcılık
e) Çözüm
f) Fikir üretimi
g) Araştırma
h) İlham

B. TASARIM SÜRECİ HAKKINDA

6.Kendi tasarım süreciniz nasıl şekillendi? (Size en çok uyan seçeneği seçiniz)

a)Tasarım stüdyosunda veya başka derslerde işlenen tasarım sürecine dair konulardan hareketle.

b)Kendi kendime yaparak öğrendim.

c)Stüdyo veya üst sınıftan arkadaşlarımın yöntemlerinden faydalandım.

d)İzlediğim belli bir yol bulunmamakta, her seferinde başka bir şekilde tasarım yapıp bir ürün hazırlayabiliyorum.

7.Tasarıma başlarken nasıl bir yol izlersiniz?

a)İlham gelmesini beklerim, aklıma bir şeyler gelene kadar düşünmeye devam ederim.

b)Verilen ödevin kağıdını elime alarak tekrar tekrar okuyup üstünde düşünür, problem tarifini iyice anlamaya çalışırım.

c)Hemen bir kağıt ve kalem alarak bir şeyler çizmeye başlarım.

d)Hemen benzer bir şeyler bulmak için mimarlık/tasarım dergilerini vb. gözden geçirmeye başlarım.

8.Kendi tasarım sürecinizi aşamalara ayırmanız istense bu aşamalar neler olurdu?

9.Tasarım sürecini düşündüğünüzde aşağıdaki aktivitelerden hangisi en önemlisidir?

a)Çözümleme (analiz)

b)Sentezleme

c)Esinlenme

d)Kuluçka evresi (fikrin gelişip, olgunlaşmasını bekleme)

10.Tasarım yaparken aşağıdaki kaynaklardan hangisinden daha çok yararlanırsınız? (Herbir seçeneği 1'den 5'e kadar kendi içerisinde değerlendiriniz)

	En Az (1)	Az (2)	Orta (3)	Çok (4)	En çok (5)
Stüdyo öğretim elemanı	1	2	3	4	5
Mimarlık/Tasarım Dergileri	1	2	3	4	5
Stüdyo arkadaşlarınız	1	2	3	4	5
Üst sınıf öğrenciler	1	2	3	4	5
Mesleki pratikte deneyimli bir mimar	1	2	3	4	5

C. TASARIM EĞİTİMİ HAKKINDA

11.Tasarım sizce en iyi nasıl öğrenilir?

a)Deneyimli bir mimarın yanında çalışarak

b)Mimarlık okulunda

c)Başkalarının mimarlık ürünlerini inceleyerek ve deneyimleyerek

d)Mesleki pratik içerisinde proje üreterek

12.Mimari Tasarım Stüdyosu kapsamında, mimari tasarım dersinizi veren öğretim elemanı veya elemanlarıyla kritik aldığınız sırada hangi konuda bilgi alışverişiniz daha çok olmaktadır ?

a) Tasarım yaparken hangi basamakları izlemem gerektiği konusunda
b) Tasarım yaparken araştırma yapmam gereken konuların ne olduğu hakkında
c) Tasarım sürecinin doğasının nasıl bir şey olduğu hakkında
d) Kritik almaya getirdiğim taslak projenin eksikleri hakkında

13.Mimari tasarım dersinizi veren öğretim elemanı veya elemanları ile bilgi alışverişiniz en çok hangi şekilde gerçekleşmektedir?

a) Birebir masa kritiklerinde
b) Toplu masa kritiklerinde
c) Jürilerde verilen kritiklerde
d) Hocanın verdiği tashihler doğrultusunda (düzeltmelerle)

14.Mimari Tasarım Stüdyosu kapsamında, mimari tasarım dersinizi veren öğretim elemanı veya elemanlarıyla hangi sıklıkla görüşmek sizin için daha faydalı olur?

a)Haftada bir kere.
b)Haftada iki kere, stüdyo saatlerinde.
c)Haftanın her günü.
d)Ara sıra, ihtiyaç duydukça.
e)Hiç.

Bu çalışmaya katıldığınız için teşekkürler. Sorularınız için bana aşağıdaki e-posta adresinden ulaşabilirsiniz.

Batuhan Taneri
İYTE Mimarlık Bölümü Yüksek Lisans öğrencisi
batuhantaneri@gmail.com