THE DESIGN PROCESS IN ARCHITECTURE

A PEDAGOGIC APPROACH USING INTERACTIVE THINKING

BY

AMIR SAEID M. MAHMOODI

B.Sc., B. Arch., M. Arch.

SUBMITTED IN ACCORDANCE WITH THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD)

THE UNIVERSITY OF LEEDS

SCHOOL OF CIVIL ENGINEERING

United Kingdom

September 2001

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Acknowledgements

In the name of Allah, the Compassionate, the Merciful. I would like to express my indebtedness to my mother and late father who taught me to love and care.

This work would not have been possible without the invaluable assistance of my supervisors, Professor Nigel Smith (the principal supervisor), Professor Peter Dale, and Professor Iraj Etessam. Also, I would like to thank one of my colleagues, Dr. Hamid Nadimi from Iran, whose constructive criticisms assisted me to formulate the final research design and I found his Thesis very enlightening in the area of architectural education.

Numerous individuals contributed to the research, which led up to this thesis, and they deserve special acknowledgements. Among them the following individuals were from academic organisations: Professor Geoffrey Broadbent (who was the External Examiner), Professor Peter Smith from Halam University in Sheffield, Dr. Jens Pohl from California Polytechnic State University in California, Dr. Mitchel Waterman from the Department of Psychology at the University of Leeds, Dr. Bob Felix from the Department of Architecture at Leeds Metropolitan University, Dr. Clive Beggs and Mr. Kris Moodley, from the School of Civil Engineering at the University of Leeds who participated as my examiners during my Transfer Report from provisional Ph.D. into full-Ph.D, and Mr. Abbass Ali Izadi from the University of Tehran.

Presenting this thesis would not have been possible without the help of my nephew, Nima Golijani Moghaddam – a British born, Ph.D. Psychology student – who proof-read my work and edited the text diligently. Many thanks go to Mrs. Dorothy A. Carr, the Postgraduate secretary at Leeds, whose friendly support was offered throughout my research. I should also thank my postgraduate officemates in Leeds, Mr. Wael Seif from Syria, Dr. Ahhmed Ghallab from Egypt, and Dr. Kostas Tsagarakis from Greece whose friendship and support will be remembered for the years to come.

Finally, I would like to express my utmost gratitude to my daughter, Mona, my son, Amir Mohammad, and particularly to my wife, Nasrin, who was working on her Ph.D. in Architecture during this research and was a great mother, a superb wife, and a helping colleague throughout this research.

I dedicate this work to:

My Homeland

Which provided this opportunity
and made this research possible.

Abstract

To present a discussion about architectural design, it is necessary to identify the theoretical perspectives behind architecture. The application of "positive" theories – which require a thorough understanding about the users, their behaviour in space, and their environment – has been selected for this purpose. Such a theoretical perspective calls for systematic research and understanding about man and his environment. The fields of Psychology – in general – and Educational Psychology – in particular – have a great deal to offer architectural educators and students in their search for training and becoming a better problem-solver and designer. Understanding the human nature of thinking and reasoning mechanisms, as the central issue of the design process, plays a major role in this research. The Iowa State University's "Complex Thinking Processes" model – which defines an interaction between "content/basic", "critical", and "creative" thinking – is integrated with a proposed model for design methodology – which introduces an interaction between three stages of 'understanding', 'idealising', and 'presenting'.

The use of action research in this thesis facilitated the collection of data from British educators as well as educators from other countries, on the subjects of architectural design education and the design process. This thesis concludes with a case study in which the proposed "interactive" teaching strategy has been trilled with a group of Third-year students of architecture at the University of Tehran.

Author's Profile
and Dissemination of Findings

Amir Saeid M. Mahmoodi is an Architect, graduate of California Polytechnic State University (Cal Poly) – San Luis Obispo, in 1986. He is a faculty member of the Department of Architecture – School of Fine Arts, University of Tehran, Iran – where he received his scholarship to study for a Ph.D. in Architecture in 1997. The scholarship was based on an extramural scheme, spending half of the period of the research in the UK at the University of Leeds under the supervision of Professors Nigel Smith and Peter Dale, and the other half in Iran, at the University of Tehran under the supervision of Professor Iraj Etessam. The findings of his research were disseminated through various ways as described below.

Throughout the past ten years, the Author has conducted many design studios at the University of Tehran, and in many other universities in Iran such as Imam Khomeini International University in Qazvin, Islamic Art University of Tabriz, and Azad University in Qazvin. The outcome of each educational experience throughout the years has contributed greatly to the formulation of his hypothesis in this research. During the research period, the Author had the opportunity to present his findings in the form of articles and delivering speeches as follows:

- ***New Methods of Teaching Arts Seminar***. School of Arts, University of Al Zahra, Tehran, 25-26 May 1998.
- Mahmoodi, Amir Saeid, (1998), **Art Education, Effective Use of Students Talents,** *Jelveh Honar*, Journal of the School of Arts, University of Al Zahra, No. 4, 5, 6, pp. 8-15. (Original article in Farsi, extended abstract in English)
- Mahmoodi, Amir Saeid, (1999), **The Design Process in Architecture, An Educational Approach,** *Honarhaye Ziba*, Journal of the School of Fine Arts, University of Tehran, No. 4, 5, pp. 73-81. (Original article in Farsi, extended abstract in English)

Table of Contents

Chapter 4, Investigating for an Architectural Theory

Chapter 5, Reviewing Design Methodologies

Chapter 6, An Alternative Design Methodology

Chapter 7, Thinking and Problem-solving

Chapter 8, Design Thinking

Chapter 9, An Interactive Model of Design

Chapter 10, Collecting Data

Chapter 11, Educators' Questionnaire

Chapter 12, Students' Questionnaire

Chapter 13, Teaching Strategy in Design

Chapter 14, Case Study

Chapter 15, Feedback and Validity

Chapter 16, Conclusions

Appendices

List of Figures

Chapter 1

Chapter 5

Chapter 6

Chapter 8

Chapter 9

Chapter 11

Chapter 12

Chapter 14

Chapter 15

List of Tables

Chapter 4

Chapter 6

Chapter7

Chapter 10

Chapter 12

Chapter 14

Chapter 1
Introduction

1.1. Background

Today's architectural design problems have become complex and are changing dramatically. Among many factors influencing such changes, one should chiefly consider the contribution of population growth, increased demand, changes in social needs, economic consciousness, energy conservation, and environmental concerns. Because of these changes, and in order to be able to train young talented designers to deal with future challenges, the Author suggests that schools of Architecture world-wide ought to make a periodical evaluation of their teaching curriculum and their methodology of teaching. This study is focused on the subject of Architectural Design and seeks a more efficient methodology to be utilised by educators and students of architecture. In this search an attempt will be made to address a more comprehensive list of issues involved in design and engage the hidden talents of students by encouraging them to think about all the issues involved in a design problem in a simultaneous and interactive manner.

The initial need for this research was felt by the Author when he was a young design student in the United States and was struggling to find a methodology in design. Later on during his teaching career some of his students, many of whom had finished high school with excellent grades, would approach him and ask for advice on how to do better in their design courses. The Author's response to these students has always been that although intelligence is needed to succeed in design, it is not enough to make them "creative" designers. However, privately the Author would question himself about how best to make students more successful in design courses. Does it have to do with students' capabilities and/or their levels of creativity? Does it have to do with the methodology of teaching Design and the way design instructors/advisors would conduct a studio? Or is it a combination of both? Back in the 1980s, a book was written by an American artist, Dr. Betty Edwards (1981, 1992), called "Drawing on the Right Side of the Brain". This book introduces some exercises to the drawing students and encourages them to look at their drawing subjects in a different way. As the name of the book suggests, Edwards introduces the characteristics of the right side hemisphere in the brain[1], (as the creative hemisphere appropriate for drawing), and through her drawing strategies she stimulates the characteristics of the right brain in her students. The Author was fascinated by the results of these exercises when he gave them to his Second-year architecture students (see Appendix A, for samples of architecture students' sketches using Edwards' drawing strategies). In these exercises students would look at their subjects more effectively and most of them would develop better drawings. This improvement suggested to the Author that students have hidden talents and all of them could become more successful in drawing exercises if these hidden energies could be recognised and released. The idea of using students' hidden talents became more apparent throughout the Author's teaching career in architecture and led him to formulate his research questions: Could there be a pedagogic teaching methodology to bring out students' hidden talents in architectural design? And if so, could a plan of work, (i.e., a teaching/design strategy) be formulated for those students who feel lost during a complex design process, outlining an effective approach for thinking about the design problem, and specific steps to take during the design process?

This research will make an attempt to investigate these questions and propose a methodology of Design which could benefit students and educators of architectural design. In the following sections of this chapter, aims and objectives of this research along with an introduction to the scope and the methodology of the research will be identified.

1.2. Aims and Objectives of the Research

The two major aims of this research are directed in the general area of architectural education, specifically:

- Developing an alternative design methodology for Architectural Design education,
- Developing an "interactive" teaching strategy for Design studios.

Since the subject of architectural design could effect the educational system and have some consequent implications on the built environment and the natural environment, the objectives of this research could include various related issues. However, the specific objectives related to the described aims of this research could be outlined as the followings:

- To investigate and review the background of architectural design education and the shortcomings of design studio pedagogy. (This could be accomplished through literature reviews and enquiries),

---

[1] For more on the brain characteristics see Chapter 7.

- To investigate about thinking and the human thought process during the design. (This could be accomplished through literature review and enquiries, i.e., interviews),
- To investigate and review the views of architectural educators/students on the subjects of design methodology and the design process. (This could be accomplished through literature review and enquiries, i.e., questionnaires),
- To develop a teaching model for the design process. (This could be accomplished through analysing the findings and examining the results in the form of a case study).

1.3. Scope of the Research

This research will involve examining the methodology of the design process in architecture. It is directed toward architectural education, and so, it will review current educational issues facing schools, as well as the background of architectural education. Since the research is limited only to the subject of Architectural Design in a pedagogic perspective, it will concentrate on the subject of designing and architectural design theories which would best benefit educational programmes. Based on the "positive" theoretical perspectives of architectural design, which is discussed in Chapter 4, the Author is concerned mostly with the importance of man and his environment as a major component of any architectural design process. Investigating in the area of design, requires an understanding about the thinking processes involved in design activities. Therefore, by reviewing the contributions of the psychological theories to design, the Author will closely examine the implications of findings in cognitive psychology for his proposed model of the design process. This will require some understanding about the way people think and the structure of the human brain for processing complex thinking tasks. This investigation, however, will be limited in the form of observation, by proposing an alternative design methodology and teaching strategy and observing students' accomplishments under the new model.

Also, in this research, the Author is attempting to examine architectural design educators' views on the subjects of design education and the design process; therefore, he is contacting several educators world-wide by sending them enquiries. Since students' views are very important in formulating an educational model of the design process, the Author will also collect some students' views from two architecture schools in Iran, where he is employed at the University of Tehran.

To examine his alternative proposal for the design process, the Author will conduct a case study at the University of Tehran with a group of Third-year architecture students. The results of this case study will be evaluated by those students who were involved with the study and also a group of design educators, involved with Third-year Design, at that university. Therefore, the findings of this research, more than anybody, will benefit Design students in the Iranian schools of Architecture, and the contributions of this research will be limited/directed toward design methodology and teaching methodology in Architectural Design courses.

1.4. Methodology of the Research

Research in Architecture, as the nature of architecture itself, involves discussions from multi-disciplinary fields. Research topics and methodologies of research in architecture may borrow as much from the Social Sciences, Education, and Natural Sciences, as they might borrow from History and Arts (Duerk, 1993). Therefore, the methodology involved in an architectural research and other environmental studies can be a mixture of research experiences in various fields. However, Michael Crotty (1998) suggests that four elements could remain common in any research process. They include:

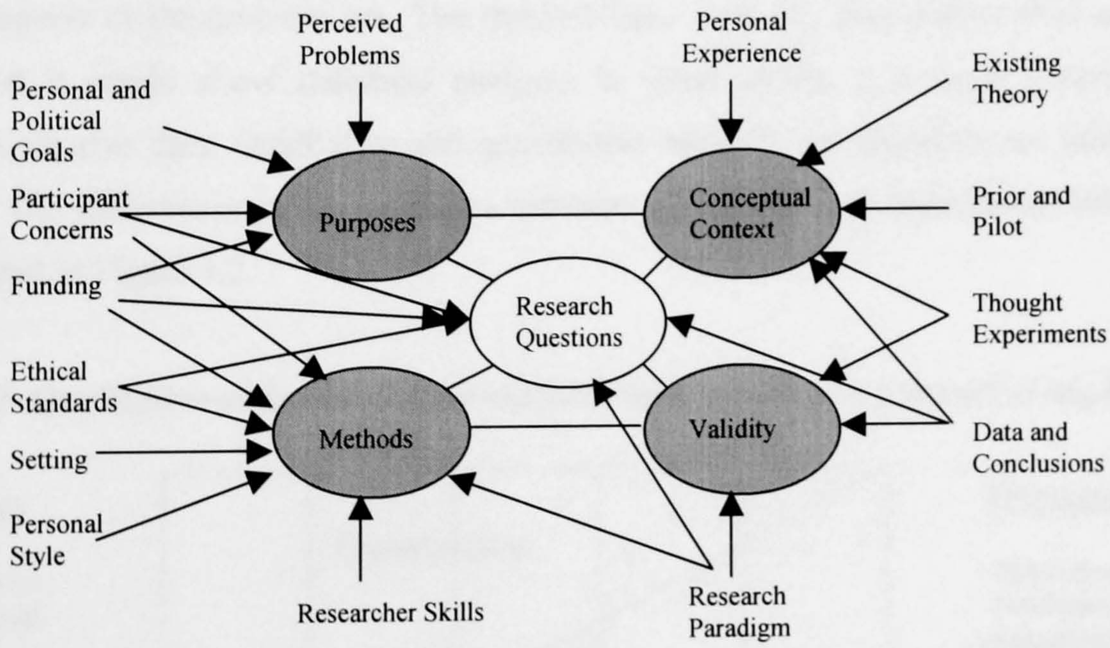
- "Methods: the technique or procedures used to gather and analyse data related to some research question or hypothesis,
- Methodology: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes,
- Theoretical Perspective: the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria; and,
- Epistemology: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology" (Crotty, 1998, p. 3).

Discussions on the subjects of selecting research method, methodology, theoretical perspective, and epistemology for this research will be specified under Research Approach and Action Research, in the following sections. However, in his search for formulating research questions and selecting an appropriate research methodology, the Author made an attempt to review all possible research methodologies and discuss them with his supervisors. In one of his periodical meetings with his supervisors in Leeds, Professor Nigel Smith explained that a good research should be "specific, measurable, achievable, reliable, and time constrained (SMART)"[2]. The SMART rule of thumb, however, has been expressed by other researchers in a slightly different format. For example, Joseph Maxwell (1996) in his book, Qualitative Research Design, explains an interaction between the five major elements of a research – purpose, conceptual context, methods, and validity. Figure

[2] SMART was explained by Professor N. Smith in his office at the U. of Leeds, in Aug. 1998.

1.1 presents Maxwell's suggested factors in the environment of a research which can influence the design and conduct of a study and displays some of the key linkages of these factors with components of the research design. He claims that the interaction between "purposes", "conceptual context", "methods", and "validity" of a research with the "research questions" are vital characteristics of a research. Maxwell suggests that there are always some contextual factors influencing any research design. He introduces an interactive model for research and emphasises on the contextual factors as the determining elements of the environment of the research. As indicated in this Figure, many factors could have a direct influence on the selection of the method of a research – i.e., participant concerns, funding, ethical standards, setting, personal styles, researcher's skills, and research paradigm. Among these factors, the Author was particularly influenced by "participant concerns" (his students' concerns to improve their design performance), "funding" (since he was granted scholarship for this research from the University of Tehran, he felt obliged to produce a research which would benefit that university), and "setting" (where he needed to be in close contact with design students and their educational environment).

Figure 1. 1 Contextual factors influencing a research design (adopted from Maxwell, 1996, p. 7)



The initial aim of the Author was toward improving the design performance of architecture students in general, and investigate practical ways for students to become more successful in their architectural education. However, throughout the development of the research, it became apparent that the initial aim could never be accomplished without considering the interaction between the contextual factors of the environment of his research – i.e., students, curriculum, educators, schools, and many other educational factors within a particular programme. Therefore, he decided to examine the architectural design programme at the University of Tehran by investigating for a methodology of teaching design which could improve the problems of a specific group of students – i.e., Design-III students[3].

The following sections introduce the selected research approach and the research method which enabled the Author to design his research and proceed with necessary actions to collect data, analyse them, and apply his findings into practice.

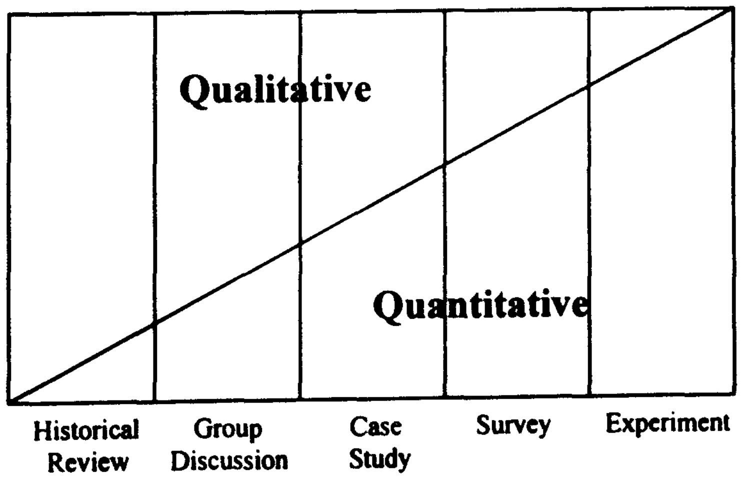
1.4.1. Research Approach

In general, two approaches can be distinguished in the research methods: qualitative and quantitative. The main difference between qualitative and quantitative research as Crotty (1998) suggests is not "quality" or any question of quantification, but the procedure. It has to do with the reflection of different perspectives on knowledge and research objectives. In qualitative research, findings are not arrived at by statistical methods or other procedures of quantification, and it is quite common for researchers to collect their data through observation and interviews. Qualitative methods are flexible and unstructured as compared to quantitative ones. They employ a limited number of observations and try to explain different aspects of the problem era. The research may code the data collected in such a manner that it would allow statistical analysis. In other words, it is quite possible to quantify qualitative data. Qualitative and quantitative methods are therefore not mutually exclusive. The differences in the emphasis between qualitative and quantitative methods are illustrated in Figure 1.2.

Figure 1. 2 Qualitative and quantitative methods and techniques (Ghauri *et al.*, 1995)

Techniques

-Conversation
-Unstructured and semi-structured interviews, etc.



Techniques

-Structured observation
-Structured interviews
-Structured surveys
-Attitude scaling
-Field equipment

---

[3] See Chapters 3, and 12 for more information about architecture students at the U. of Tehran.

As indicated in this Figure, although similar research methods (i.e., historical, group discussion, ...etc.) may be applied in the two different qualitative and quantitative approaches, the techniques of collecting data and executing research are completely different. In the qualitative approach the techniques tend to be informal and unstructured, while in the quantitative approach more structured techniques are implied.

The present research, however, due to the nature of its questions and aims of the research – which are related to informal observations of students' performances – can be categorised as a qualitative approach which involves human performance in an educational experience. It will involve informal/unstructured interviews, questionnaires, and observations. Therefore, it belongs more to the "subjectivism" epistemology in which the human thought process influences one's performance.

Subjectivism comes to the fore in structuralist, post-structuralist and postmodernist forms of thought. Wherein, it is argued that meaning does not come out of an interplay between subject and object, but is imposed on the object by the subject. In subjectivism, everything can have a meaning since the meaning which is ascribed to the object may come from dreams, or one's collective unconsciousness, or from religious beliefs, or from any other mental influences (Crotty, 1998). In this research, too, the qualitative approach of reviewing educational issues with respect to students'/educators' thinking processes which is very much engaged with their intuitive characteristics could be considered as a subjective approach in applying theoretical perspectives and theory of knowledge (epistemology) in research.

1.4.2. Action Research

The methodology of this research, due to its educational context involves *Action Research.* Dick (URL-0, 1999) describes an *Action research* as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. He suggests that two major characteristics of an action research are:

- using a cycle or spiral process which alternates between action and critical reflection, and
- in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles.

It is thus an emergent process which takes shape slowly; it is an interactive process which converges towards a better understanding of "what" happens. In most of its forms it is also participatory (among other reasons, change is usually easier to achieve when those affected by the change are involved) and qualitative (URL-0, Dick, 1999).

Action research is situational - it is concerned with diagnosing a problem in a specific context and attempting to solve it in that context. It is usually (though not inevitably) collaborative – teams of researchers and practitioners work together on a project; it is participatory – team members themselves take part directly or indirectly in implementing the research; and it is self-evaluative – modifications are continuously evaluated within the ongoing situation, the ultimate objective being to improve practice in some way or other (Cohen and Manion, 1994).

Action research has been mostly used in social studies and education. Kemmis and McTaggret (1998) define it as a form of collective self-reflective inquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices.

From the intervention and subsequent evaluation action researchers intend not only to contribute to existing knowledge but also to help resolve some of the practical concerns of people, or clients, who are trying to deal with a problematic situation. This approach to research design involves a planned intervention by a researcher, or more often a consultant, into some naturally occurring events (Gill and Johnson, 1997).

Some areas in school life where action research could be used are described as:

- "Teaching methods – replacing a traditional method by a discovery method.
- Learning strategies – adopting an integrated approach to learning in preference to a single-subject style of teaching and learning.
- Evaluative procedures – improving one's methods of continuous assessment.
- Attitudes and values – encouraging more positive attitudes to work, or modifying pupil's value systems with regard to some aspect of life.
- In-service development of teachers – improving teaching skills, developing new methods of learning, increasing powers of analysis, of heightening self-awareness.
- Management and control – the gradual introduction of the techniques of behaviour modification.
- Administration – increasing the efficiency of some aspect of the administrative side of school life" (Cohen and Manion, 1994, p. 194).

In this research, application of action research could help the Author to develop an appropriate teaching method for design education, improve learning strategies for students, evaluate educational procedures in the design process, improve students' attitudes to work, and improve teaching skills in design.

In order to start on his investigation about research questions – regarding design methodology and teaching methodology – the Author intends to collect data through the means of conducting *literature reviews*, *correspondences*, *interviews*, and *enquiries*. Using this acquired knowledge, the Author will then attempt to apply them in his design studio at the University of Tehran in the form of a *case study*. The intended case study will involve Design-III students at that university who will be given a design project and the Author will apply his pedagogic model of teaching design in this study. The final outcome of the design methodology proposed by the Author – with regards to the findings for teaching design and developing a plan of work for design students – then will be evaluated by the students and educators who were involved in that experience.

1.5. Organisation of the Thesis

In order to present the contextual thoughts as well as the new findings about this research in a comprehensible format, the flow of data has been organised into sixteen separate chapters.

This first chapter made the introductory points as far as why? what? where? and how? to do this research. Chapter 2 of this thesis reviews the history of formal architectural education (basically in the western world, where it was started) in order to set the context for better understanding of the current educational programmes and a brief introduction to the School of Fine Arts at the University of Tehran – where the final case study will be conducted in. In Chapter 3, there will be a discussion on the current issues facing architectural education, i.e., the design studio pedagogy. It will examine various views collected by the Author through literature reviews, correspondence, and interviews. Understanding the current architecture educational status provides a background for a discussion in Chapter 4 to review the nature of architecture and its theoretical perspectives. Major concerns which play a role in defining architecture will be reviewed in this chapter as well as examining architectural theoretical perspectives which lead architects in their design decisions. In an attempt to develop an understanding about design methodology, Chapter 5 will examine the subject of design methodology and the design methods used in the architectural design process. In chapter 6, the Author will propose an alternative design methodology – based on "positive" theories of design – which calls for an interaction between the participating realms of design.

In an attempt to understand more about the subject of thinking and the way designers think, Chapter 7 introduces the human thought process and will review different styles and modes of thinking. Chapter 8 will specifically examine the findings of Chapter 7 in relation to thinking types involved in different design strategies. The objective of this chapter is to introduce thinking processes involved in the design process which requires a closer look at the act of designing with regards to the implications of Psychology. Chapter 9 introduces an 'interactive' model of the design process by applying the Iowa State University's model of Integrated Thinking Process. The components of the proposed model of 'interactive' design methodology, based on an "interactive" thinking process, will then be introduced with some recommendations for students and educators of architectural design.

Chapter 10 will introduce the enquiry methods utilised by the Author – i.e., pilot studies, enquiries, and interviews – to collect, analyse, and evaluate information for developing a pedagogic model in design education. It reviews the fallacies of the research, the encouraging replies through enquiries, and the way which the Author finalised his research design. Chapters 11 and 12 will present the responses of educators and students of architecture through analysing their questionnaires. Some striking results of shortcomings in design education as well as some very constructive criticisms about the educational system will be presented in those chapters. The Author will summarise his key findings from each group, the educators and the students, in an attempt to consider them in his proposed model of teaching design.

Chapter 13 will review the shortcomings of the conventional teaching strategies before the Author introduces his teaching methodology and his 'interactive' teaching strategy. Chapter 14 provides a practical example of the Author's proposed interactive model of teaching Design, which is presented in the form of a case study. This study is conducted at the University of Tehran with a group of volunteered Third-year architecture students. Some samples of a student's design exercises are illustrated in order to demonstrate different design activities.

Chapter 15 will reflect the feedback of volunteer students who were involved in the case study along with some feedback from four educators who also instructed Design-III with different groups of students. In this chapter, the Author will review the quality of his findings. He will make an attempt to present the "external" validity of his findings by reflecting the views of some of his design colleagues and reviewing the results of another experience conducted by one of his colleagues – using the Author's teaching strategy with a group of students at the Islamic Art University of Tabriz.

In Chapter 16, the Author makes some concluding remarks by reviewing what was looked for, and what was found in this research. The significance of findings as well as recommendations for further future studies will be presented in that final chapter.

Chapter 2
Background of Architectural Education

2.1. Introduction

Despite the practical nature of the profession of architecture, ever since the example of Vitruvius, writing in the late first century BC, the education of the architect has belonged to the realm of architectural theory. According to Vitruvius (1914), the architect should be broadly educated in all the areas of learning that touch upon the natural environment, the social and cultural context, artistic traditions, and building technology. Vitruvius recommended that the architect be conversant with geometry, arithmetic, optics, history, philosophy, music, medicine, law, and astronomy.

Now in the beginning of the 21st century, the Author argues, it appears that architect's responsibilities have increased and more issues – related to the man and his environment – are involved in architectural design which require careful planning and preparation during architectural education. However, architectural education has always been under the influence of architectural practice, after all the products of the educational system must serve the practical world of the profession. Therefore, it is critical to train students in various subject matters which are in demand and apply a practical method of teaching which would serve them best.

The actual structure and forms of architecture were almost always the product of time and space – of circumstances more than will. Man's thoughts and actions – his religion, politics, art, technology and aspirations, as well as landscape, geology and climate are the things from which an architecture is born. Training of an architect, too, could be viewed under the influence of these circumstances.

In the past, architects were trained through oral teachings and training under the supervision of great masters[1]. However, the formal architectural education *academia*, in the sense of teaching courses with regards to architectural theory, did not get underway until the 15th century and under the influence of the Western European models, in particular the French. Nevertheless, the influences of architectural profession and training in Britain, Germany, and the United States have been extraordinary in the world and many architecture schools are still under the influences of architectural education programmes of these countries[2].

To investigate about the subject of architectural education, the Author had to first review the background of architectural education through the spectrum of history (introduced in this chapter), and then examine the current issues involved in architectural education (see the following chapter). In this chapter, a brief look at the architectural education in the West – which has so greatly influenced architectural teaching practice throughout the world – will be presented in order to set the context for the discussion in the current era. This chapter will introduce the establishment of architecture programmes in leading Western countries – with respect to the social, geographical, political and many other issues involved in the history of architecture. Also, there will be a section about the establishment of the School of Fine Arts in Iran – at the University of Tehran – where the final case study will be conducted in.

2.2. Pre Renaissance

Jordan (1969, p. 23) suggests that "the story of modern man begins when the Greek first enters upon the stage of history". Civilisation began centuries earlier, but it is not until the Periclean Age that one could find intellect and the rule of law. Vitruvius (1914) characterised architect's education in Greece and Rome under two aspects: *theoretical*, which for Vitruvius included such things as proportion, and *practical* training "on the job" in the actual technicalities of building. Broadbent (1995) indicates Greek education was based on the principle of *arete* (struggle), and it was common for the young to practise physical combat in a courtyard while philosophers disputed in the shady colonnades. In a very literal way, Greek education was a combination of physical and mental exertion.

---

[1] In Iran, for instance, and many other Eastern countries, the profession would transfer through the family; and masters would teach architectural lessons on the job to their sons and relatives.

[2] One example could be the British system which has its influences on over 12 countries and 45 universities in those countries (RIBA, 1997).

Plato's school of philosophy, however, was the original academy – as Broadbent (1995) discusses. Plato had pragmatic views on architecture, for instance he describes a pleasurable and beautiful house as that in which the owner can find pleasant retreat in all seasons and can protect his possessions. Therefore, one may conclude that although there was no formal education at that time, Plato's Academy existed and had "theory".

With regards to the procedures of designing, drawing, and constructing, there is much evidence suggesting that drawing tools and techniques were used in the past. For instance, Haselberger found grids, not to mention other quite remarkable drawings, in his thorough study published in 1985 of the temple of Apollo at Didyma in western Turkey. This suggests that Greeks, like the Egyptians, based their designs on grids. There is no reason to suppose that Roman practice was any different except that, having drawn their curves with compasses, they left them geometrically "correct" but unrefined (Broadbent, 1995).

For creation of the masterpieces of Gothic architecture, too, there are some 2000 Gothic drawings which survive today in various parts of Europe which testify that rulers, compasses, dividers, pen and ink were used in their proportion. Nevertheless, it is obvious that designers had to use some sort of design and drawing procedures in order to create their works, though the extent of applying theory in their designs varied due to social/political and other influencing factors of their era.

2.3. The Renaissance

Renaissance, the great revival of art and learning in Europe took place during the 14th, 15th, and 16th centuries. It began with a revival of Classical literature and philosophy initiated by Dante (1265-1321) and Petrarch (1304-1374). As a consequence of this revival, much interest was shown in the surviving buildings from the Roman and Classical eras. Designers such as Brunelleschi studied and reflected the geometry of those forms in their buildings without actually having any theories behind them.

Later in 1435, Leon Battista Alberti, who was initially a prolific writer, began to study perspective and proportion. He started designing many buildings, even though he had other people to carry out the building for him. Alberti believed that architecture – unlike painting, sculpture, literature and poetry – was most susceptible to theory. He saw himself as a philosopher, much in the manner of Plato. In fact, Broadbent traces the history of architectural education back to the 15th century *Lorenzo da Medici's Academia Platonica* in Florence. "The whole thing was originated through a dispute between the two great masters", Leon Battista Alberti and Lorenzo da Medici, "over the importance of applying theory in practice, in 1460"[3]. Lorenzo thought of himself as a practical man, his discussion with Alberti, led Lorenzo to understand the importance of theory; therefore, in the mid-1470s, he established his own private school, the *Academia Platonica*. This academia soon became a viable alternative to the existing training trends of working under the supervision of master artists, painters, architects and sculptors. In fact, Leonardo da Vinci, who had entered in 1475, and Michelangelo, in 1480, were among the graduates from the Academia.

Most likely the Italian Renaissance and Post-Renaissance models had inspired the French and led to the establishment of the Academie Francaise in 1635. Collins (1979) cites Academie Fancaise, which finally turned into *Academie Royale d'Architecture*, as the root of the present concept of architectural education. The Royal Academy of Architecture must be seen in the social/cultural setting of aristocratic Europe, and its identical intellectual tradition looking back to Renaissance Rome as its origin and source of inspiration. Risebero (1982, p.11) illustrates the architect's situation at that time as a "gentleman, ... educated, cultured, enjoying a high social status and willingly assisting in this process of class expression by designing palaces, great houses and public buildings .... His education was theoretical and antiquarian rather than practical...". The "academic architect" with his characteristics, and the "craftsman architect", who actually took most of the projects those days, separated their ways by the nature of their training and practice.

2.4. The French Ecole Des Beaux-Arts

The late 18th century Revolution in France declared the dawn of bourgeois domination, leading to the 19th century Industrial Revolution in Britain. Being an anti-monarchy movement, the early revolutionary ideas tended to adopt a pre-Roman past of sublime simplicity as its source of inspiration and to avoid any association with the aristocratic period. This movement partially resulted in the neo-classical and Romantic spirit of the early 19th century in Europe. The revolutionary government dissolved all French Academies in 1793 (Collins, 1979), and it was not till 1819 that the Academy was refounded as the "Ecole des Beaux-Arts" – School of Fine Arts (Hansford and Smith, 1980).

Cunningham (1993) lists seven strands as the methodological characteristics of architectural education of the Ecole des Beaux-Arts:

1. Division of students into ateliers run by a patron;
2. Teaching of young pupils (*Nouveax*) by older students (*Anciens*);

[3] Professor Broadbent told the Author in the 1999 meeting with the Author.

3. Teaching of design by practising architects;
4. The design exercise as the core of the educational program;
5. The beginning of design studies immediately upon entering an atelier;
6. Systematic resolution of design problems starting with the *esquisse*;
7. Development of a competitive spirit as a pedagogic tool.

Broadbent (1995) introduces Beaux Arts' syllabus which included lectures in theory of architecture, the history of architecture, construction, perspective and mathematics and, by 1900, physics and chemistry, descriptive geometry, building law, general history and history of French architecture had been added to the initial lectures. Atelier exercises were in the form of monthly competitions, most of them in architectural compositions. They were initially of two kinds: *esquisses* (sketch designs) and *projets rendus* (fully finished drawings rendered in ink). Broadbent (1995, p. 15) further elaborates: "an *esquisse* might consist of part of a façade, a small house, a public fountain or whatever, whereas *projets rendus*, at the second level, might consist of a small school, an assembly hall or a small railway station". Later on, in 1876, a third kind of *projet* was added, called *elements analytiques*. In these projects, students were required to exercise Classical Orders in their drawings.

The mode of education of the Beaux-Arts dominated architecture and the way architects were taught until the 1920s when the Bauhaus presented a different scheme. The Beaux-Art influenced modern architectural education, particularly in the United States, quite seriously and the traces of its influences are still seen in some architectural programmes around the world (Cunningham, 1993, Esherick, 1983, Wakely, 1983). Among remaining influences of the Beaux-Arts pedagogy which are still useful and applicable in many architecture schools, the Author believes, *esquiss* exercises could be considered as one of the most productive ones. However, one unfortunate legacy from the Beaux-Arts remains the separation of lectures from design studios which distances "theory" and "practice". As indicated earlier, the two aspects of "theory" and "practice" in architecture were inseparable elements of training an architect, however, the Author suggests that eversince the Beaux-Arts separation of lectures from design studios, architect's training has entered a superficial stage in which neither "theory" nor "practice" courses could be successfully practised.

2.5. The British Pupilage

Gradidge (1990) describes *Pupilage*, the educational system in which the young student, or *pupil,* actually paid to work with a master – and occasionally attended lectures on the related subjects – as "British and successful", from the 18th to early 20th century.
In this system, studies were frequently followed by a trip abroad which almost always included Rome. The differences between *apprenticeship* and *pupilage* are described by Crinson and Lubbock (1994) as the pupil had to pay for his instructions, while the apprentice was in the manner of the medieval craftsman, exchanged his labour for instruction.

Gradidge (1990) introduces pupilage as a successful system in Britain, wherein many talented architects were trained. Amongst them were included most of the 18th century architects, including Soane and the Adams, and all the towering masters of the 19th century, the great academics, like Cockerell and the Gothic Revivalists, like Street, right on up to Lutynes and the Arts and Crafts designers. He further describes how this great family tree developed: Street and himself from Scott's office, taught William Morris, Philip Webb and Norman Shaw, who in turn taught Lethaby and Newton, and the office of Ernest George turned out a whole galaxy of stars, including Lutyens and Herbert Baker.

The short period after 1900 is believed by Davey (1989) to have witnessed a wasted opportunity for Britain to invent a kind of training which incorporated the best of both the pupilage system and academic education. This was the time when the British architectural education system chose to use a combined model of Arts and Crafts based courses or an American academic interpretation of the Beaux-Arts. During this period, the 19th century, events moved towards "professionalism" and more formalised educational programmes were adapted. The Architectural Association (AA), which turned to become the only independent architectural school to survive, was launched in 1847. Alan Balfour (1995), Chairman of the AA School of Architecture, expressed that the AA was founded almost 150 years ago to radically reform the education of the architect. "It was created", he suggested "to be wholly independent and private, free from the influence of government, and would have as its central concern the imagination of individuals. Underlying this concern was the realisation within progressive society for the preparation of individuals whose imagination belonged as much – if not more – to themselves than the State" (Balfour, 1995, p.78).

In 1856 the Royal Institute of British Architects (RIBA), which had grown out of the "Architects Club" and had been granted its Royal Charter in 1837, agreed to recognise the

AA Diploma in practical subjects such as construction, surveying, etc. In 1863 the RIBA's first voluntary examinations were held to test for professional competence. As the voluntary examinations proved to be unpopular, the Institute decided, by 1877, to set up an obligatory examination for membership, aiming to establish a minimum standard of competence.

In 1891 the evening course at the AA was intensified and the Schools of Art in Sheffield and Nottingham soon started similar courses in architecture. In the following year, a three-year full-time course was launched at King's College, London. The Liverpool School of Architecture was established in 1895 and when, in 1902, the honours degree of the School was recognised as the RIBA's intermediate examination, architecture as a vocational discipline had finally gained its academic status (Nadimi, 1996).

Another phenomenon in the British architecture is related to the works of Scotish architect, Charles Rennie Mackintosh (1868-1928), who created a style of enormous originality, related to Art Nouveau. In 1897 he won the competition to design the new School of Art in Glasgow, the work which Pevsner singled out for its interior as an early example of the sort of spatial effects which were later to be central to the modern movement. It is therefore ironical that Mackintosh should have been written off by English critics as dangerously exotic, since it was precisely his geometrical control and tendency to abstraction which appealed in European artistic centres – partly as a support for their own revulsion against the excesses of Art Nouveau. Mackintosh was less appreciated in London than in Vienna, where publications of his plans and drawings made him known and influential (Curtis, 1982).

The British critics were very hostile to the technical training of the German architecture and thought it was more successful in branches of applied sciences than in architecture. So it is understandable that Britain's first recognised school of architecture in Liverpool was under the influence of the French Beaux-Arts (Stirling, 1978).

Although the formal architectural schooling in Britain dates back to the turn of the century, the old system survived as an important stream of training architects. This was to the extent that in 1957, one year before the Oxford Conference, the number of students attending recognised schools still represented barely half the total (Gardner, 1974).

2.6. The German Bauhaus

The Academy of Arts and the School of Arts and Crafts were combined in 1919 at Weimar, Germany, to establish the new school of Bauhaus. Walter Gropius, founder of the Bauhaus, stated his purpose of establishing the new school as the idea of the fundamental unity underlying all branches of design through the school's pedagogic system (Cross, 1983). The first proclamation of the Weimar Bauhaus reads: "... Architects, Sculptors, Painters, we must all turn to the crafts" (Bayer, *et al*, 1959, p. 16). This emphasis on crafts stems from the Arts and Crafts movement of the 1880s in Britain (the first country to experience the effects of the Industrial Revolution). It was a reaction against the artistic confusion of the time caused by the new industrial developments. The Arts and Crafts Movement sought to stem the threat of craftsmanship and individual expression of progressive mechanisation and to reunite the creative arts. This tendency towards craft training and attempt to relate theory to practice is obviously seen in the works of Lethaby in London, Van de Velde in Weimar and Cizek in Vienna (Cunningham, 1980).

Cunningham (1980) further describes the educational climate of the Bauhaus as being anti-academic, mistrustful of theory, based on practical experiments and, above all, conscious of social need. The curriculum of the Bauhaus consisted of two main parts:

1. Practical instruction in the handling of different materials and tools.
2. Formal instruction under the following heads:

   Aspect, the study of nature and of materials; *Representation*, the study of plane geometry, construction, draughtsmanship, and model-making; *Design*, the study of volumes, colours, and composition. Lecture courses in different branches of art and sciences were also provided.

The full course was performed in three stages: Six-month *preparatory instruction*; three-year *technical instruction* leading to pupil's *Journeyman's Certificate*; and *Structural instruction*, an alternation between manual work on actual building sites and theoretical training in the Research Department of the Bauhaus, leading to a *Master-Builder's Diploma* (Gropius, 1983).

Perhaps the most innovative and influential component of the Bauhaus tradition, which still appears to be taken into account in pedagogic systems, is the "foundation" or "basic" course in design, devised and conducted by *Johannes Itten*[4]. "The projects and exercises of the course aimed at freeing the students from preconceived notions of art and design, by exploring basic properties in materials" (Cross, 1983). The notion of co-ordinating the

[4] For biographical notes on the Bauhaus' people, see Bayer, et al, (1959).

revival of traditional "arts and crafts" with the new "machine style" by "... absorbing ... the spirit of engineering into art" (Bayer. *et al*, 1959, p. 11) might be considered as the most important contribution of the Bauhaus to modern design education.

The dominant tendency in the Bauhaus way of teaching was the emphasis on the experimentation of abstract forms. This brought a conflict between Itten's approach to abstraction and that of Gropius' – which called for an equal involvement in industry and the crafts. Eventually it resulted in Itten's resignation from his position at the Bauhaus, but it was his approach which proved to be the more influential on architectural schooling ever since (Nadimi, 1996).

Cunningham (1993) enumerates History and Architecture as the two prominent omissions from the teaching program of the Bauhaus. It was only after 1927, however, that the architectural issues: environmental relationships, district planning, and *inter alia* – preliminary studies to identify space 'needs' – were introduced to the curriculum. The school established a rational towards architectural planning and design, which reached its apogee in the 1960s and still survives in many present-day architecture schools. It appears to have been an approach opposing the classical formulation of the Beaux-Arts and the empirical tradition which was followed in England (Cunningham, 1980).

When the school was threatened by the Nazis, Mies van der Rohe, the head of Bauhaus at that time, decided to close it down and himself and several other leading members of faculty emigrated to America to go on working towards the same goals. After the Second World War, the Bauhaus approach was introduced in several countries, while at the same time critical voices began to be heard. One vocal critic of Bauhaus education is Norberg-Schultz. He argues (Noberg-Schultz, 1966, p. 221) that: "the program of the Bauhaus surely contained a basic contradiction, in wanting simultaneously to free the *self-expression* and to create a new common formal language". He understands the wish for self-expression as a reminiscence of the first expressionistic phase of the school and considers the latter ideas as stemming from the Dutch De Stijl movement.

Although the Bauhaus model of architectural education was a "poor model", as Cunningham (1993) argues, the Author believes that the positive influence of Bauhaus today lies in encouraging appreciation for the role of material, techniques, and construction in architectural schools.

2.7. The American Schools of Architecture

By reviewing the history of establishment of professional/educational organisations in America, one could realise that although the American architecture was influenced by the European models, i.e., the French Beaux-Arts, it developed its own character throughout the years. In 1837 a group of architects established a professional organisation called the American Institute of Architects, which lasted only briefly despite the fact that its members represented the leaders in the architectural profession throughout the United States. Another attempt to form a professional organisation was made by Richard Upjohn (1802-1878) in mid-February of 1857. The first regular meeting of the new organisation, following its incorporation as the "American Institute of Architects", was held on May 5, 1857. "Its purpose were, and remain the establishment and promotion of professionalism and accountability on the part of its members and the promotion of design excellence" (Harris, 1998, p. 8).

One noticeable point in the American architecture testifies that the trend of architectural profession was under the influence of European models – particularly the Beaux-Arts and the Arts and Crafts – up until the First War. Sergeant (1984, p.92) states that "In 1925, a French building exposition was held in Paris, whose rules were that entries should be of contemporary style. No American exhibit appeared because President Hoover and his advisers knew of no architect able to design buildings that were free of classical orders". Sergeant (1984) further explains that architectural education in the United States was academic and architectural schools were the repository of formidable piles of classical plaster casts. "In 1928, George Beal obtained permission to operate a nonclassical course at the University of Kansas. It was 1935 before Columbia University followed suit, under Dean Hodnut, who then went on to Harvard, where he invited Gropius, and the international style, to America" (Sergeant, 1984, p. 119).

One major contribution of the American educational system to architectural education has been considered the establishment of the Illinois Institute of Technology, (IIT). The School of Architecture in Chicago, Illinois, was established by Mies van der Rohe, who had left Nazi Germany, in 1938. Mies' syllabus included three major parts: studies of *means*, of *purpose*, of *planning and creating*. By "means" he meant materials: wood, stone, brick, steel, and concrete; in terms of construction and their implications in architecture. By "Purpose" he meant building types and purposes to build: houses, offices, hotels, and so on. This also included student's analysis of building's function as well as designing the building's furniture and fittings. And by "planning and creating" Mies acknowledged dependence on the epoch – the supporting and compelling forces of the items: material, functional and spiritual (Broadbent, 1995).

One argument with Mies' pedagogy was that he had limited the creativity of his students by insisting that they ought to work his way. Although some of his students continued to do so after graduation, the Author questions the appropriateness of similar design solutions in different climatic and/or regional conditions throughout the world which these ideas were put to work. In general, one could conclude that the problem with Mies' model – and in a wider context – with the "Modern" prescription to architectural design, was the lack of integrity between architecture and its context[5]. Regardless of the conditions of a site, its climatic conditions, and social/cultural values of the users, "Modern" architecture had its own formula for architecture and tended to give less credits to the local identity of an architecture – instead, looked more toward "function", free planing, and simplicity.

One extraordinary event in the development of modern history of architecture and the American architecture, has been the works and philosophies of Frank Lloyd Wright (1869-1959). Edgar Kaufman in his book about Wright wrote, "Mr. Wright's challenge to the accepted way of life is fundamental. So is his faith in the ideals and principles which formed and continue to guide his work" (Kaufman, 1955, p. 15). In addition to Wright's public buildings in the United States and a few other countries, Wright's work is mostly recognised by his Usonian[6] houses which he designed in post-Depression years. In the design of those houses, he used natural materials and cool, shaded interiors, and considered their close relationship with their sites. He introduced the concept of organic architecture, the idea of building with nature rather than against it. For Wright the experience of nature was the most enduring and meaningful element in all education. The "little experiment station", an architectural school at Taliesin – in a pastoral landscape above Wisconsin River – was not an escape from an industrial society, but a bold step toward the way all society should go. "If nature could not be brought to the schools, then the schools could go to nature. Decentralisation would be the result" (Sergeant, 1984, p. 119).

Wright saw life as a continual learning process. Attitude was an integral part of education, which was not a period of quarantine prior to life. His thinking goes back to the roots of his experience. It is also very modern in content. It is impossible to underrate the importance

[5] By "context", the Author means all concerning elements and/or forces on a site (and its adjacent neighbourhood) which tend to influence an architectural solution.

[6] "Usonia" was Wright's name for the reformed American society that he tried for the last 25 years of his life to bring about – i.e., the Broadacre City and his plans for decentralisation (for more information, see Sergeant, 1984).

of geometrical organisation in Wright's work. The origins of this design tool have been suggested by MacCormac (1968) to lie in biological terms of Sullivan and the kindergarten handbooks and "gifts" of Froebel[7].

Criticisms have been made that Taliesin failed because it did not produce another architectural superstar to succeed Wright. However, the Author disagrees, since this view seems to depend on a narrow definition of success. Taliesin's effect can be seen in the work of many unassuming architects, working all over the United States to realise their clients' needs. Its influence is discernible in the work of the National Parks Division of the Department of the Interior, where ex-Taliesin fellows worked in the thirties. It can be seen in the Los Angeles, San Francisco Bay, and California coastal areas and in much good, human housing across the United States, not to mention its influences on the architecture of the entire world.

The "unit" system of curricula introduced by American universities to higher education, could be considered as the most influential issue in developing a unified educational curriculum in different fields in the entire world. Today, the 4-Year[8] "undergraduate" programmes in most architecture schools world-wide use a very similar curriculum to the American version (see Appendix B for a typical 4-Year curriculum in Architecture). The American influence on architecture programmes world-wide, however, the Author believes does not end by the influences of "unit" systems. There are increasing number of issues – i.e., influences of contents, specialisation fields, and even the length of time for educational studies[9] – which influence architecture schools around the world and many schools look upon the American educational system as an ideal educational pattern to follow. Although these influences initially seem to provide a unified international educational system, the Author suspects, they take away the identity/concern of local architectural schools.

2.8. The Iranian School of Fine Arts

Since the final research will be conducted at the Department of Architecture at the School of Fine Arts, University of Tehran – where the Author has employment – this section will

[7] For more on Froebel's "gifts" and educational blocks see MacCormac (1968); also see Chapter 7 under 'Visual Thinking'.
[8] The American schools of Architecture conduct a 4-Year programme leading to a Bachelor Degree in Architectural Studies, a 5-Year programme leading to a professional degree of Bachelor of Architecture, a 1-Year and 2-Year programmes leading to Master of Architecture degree, and a 4-Year programme leading to Ph.D. in Architecture.
[9] One example could be Schon's report (1985) in support of establishing Bachelor of Architecture degree in the UK, similar to the one in the United States.

introduce the background of architectural education at that school. "The School of Fine Arts has been the leading, and for two decades the only, school of architecture in Iran, a study of its origin and evolution will give a general understanding of the sub-history of architectural education in Iran" (Nadimi, 1996, p. 78). The following passage reflects the history of education in Iran and the School of Fine Arts which the Author wrote when introducing the school's background in *Bulettin 1992-93*.[10]

The Iranian origin goes back to some six thousand years ago, when a group of Ariyans migrated to that region and established the Persian civilisation (Frye, 1962). Throughout the years, education and the eagerness to learn about the sciences and arts has long been with the people of Iran. The outstanding achievements of Iranian scientists and artists has been the glory of that country throughout the history of mankind. World-famous scientists like Mohammad Zakaria Razi and Abo Ali Sina, as well as, master poets such as Molavi and Hafez are among the few figures whose works have been recognised and cherished throughout the civilised world[11]. However, in the arts and architecture, the outstanding figures are either unrecognised or unknown. Styles and techniques in these fields, particularly in architecture, reflected some magnificent solutions to the needs of the people with regards to their local and cultural context. Great architectural lessons were passed on from masters to their students, and in many cases from fathers to their sons.

Before the emergence of Islam in Iran (6^{th} century AD), education was not offered in a public sense and therefore, there is no evidence of any specific places/methodologies for education. For centuries after the establishment of Islam in Iran, however, higher education was conducted in religious schools called *Madreseh* [the place of education]. In these schools, students were trained not only on religious topics, but also, on some scientific ones – i.e., Geometry, Philosophy, Medicine, and so on. The traditional teaching/learning methodology in *madreseh* was called *Tallabegi* [teaching/learning through the means of lectures and research in small groups under the supervision of a head master]. In *madreseh*, in addition to the formal lectures from head masters, students had to teach other students in lower levels and learn from other students in higher levels[12]. The characteristics of this interactive process of teaching and learning among students deserves more attention in the contemporary educational programmes and the Author recommends this methodology to

[10] Bulletin 1992-1993, School of Fine Arts, Departments of Architecture and Urban Planning, University of Tehran Publishing. [Edited and translated by the Author using the School's Education Office records, in 1992]
[11] For more information about individuals/terminology in this section refer to *Loghatname Dehkhoda* (1879-1955) published by the University of Tehran, 1998.
[12] For more on *Madreseh* and *Tallabegi* see Ghonaimah (1993), Kiani (1987), and The Great Encyclopaedia of Islam, (1995).

be considered in today's design studio-pedagogy, where there is a need for more interaction between students and educators within different levels of education.

The first higher educational institution in Iran – *Darolfonoon* [the place of techniques] – was established during the Ghajar Dynesty (1779-1924) under the supervision of its Prime Minister, Mirza Taghi-khan Amir Kabir, in 1846. At this time, the world-reknowned Iranian painter and artist, Kamalolmolk, had organised an art school in which painting, *miniature*, *tazhib*, and carpet design were taught. In 1931 – and under the world-wide influence of modernisation – a group of Kamalolmolk students, who were painters and architects went to Europe – many to France – to study Western Art and Architecture. Upon their return to Iran in 1938 they established an architectural institution, the "High School of Architecture" or the H.S.A. During its first year, twenty students were accepted after passing an entrance exam into the school. The location for this institution was the old school which had been established by Kamalolmolk.

In the meantime, the first university with a modern academic higher educational programme, containing six educational Schools, was opened in Iran. This university was established in Tehran in 1934; and, it was named the University of Tehran. In 1939, the organisers of the H.S.A. initiated the establishment of an academic School of Architecture within the University of Tehran. Although it was not possible at the time to add an independent school to the existing six schools, the university agreed to supervise the new programme, called the Fine Arts School (FAS).

The F.A.S. was initially located in an old mosque, the Marvi Religious School, in Tehran. However, the size and location of the school soon became unsuitable. Therefore, in 1942 it was transferred to the basement of the School of Engineering Building on the University main campus. At that time the Director of the programme was Andre Godard, the French Architect and Archaeologist. Subsequently, the need for extension of the university programmes was felt; and, the Iranian Parliament approved the expansion from six to nine educational Schools.

Thus, the School of Fine Arts was established in 1949 with the programmes in Architecture and Painting. The site for the School was chosen to be in the South-Eastern corner of the Main Campus. It wasn't long before the original building complex, the architectural *ateliers* and the Administration building, was extended with new buildings for a library, auditorium, exhibition halls, classrooms, offices, and studios for sculpturing and painting. Gradually, other programmes were added to the existing school programmes.

These included: Sculpturing in 1959, the postgraduate programme in Urban Planning in 1964, and Music and Theatre in 1965. However, the post graduate programme in Urban Planning was withdrawn in 1969; and subsequently replaced with graduate programmes in Urban Design and Urban Planning in 1971.

Up until the 1970s, the school programmes as well as teaching staff were very much under the influence of Western educational models – particularly those of France, Germany, and Italy. For example, in the Architecture programme, the influence of the Beaux-Arts model of education – the ateliers each run by a professional architect, *esquisses*, project *rendu*, peer education, and the curriculum – is apparent throughout these years. However, during the 1970s, after the Beuax-Arts system was abandoned in France, the School of Fine Arts experienced various tendencies through the new generation of educators graduated from various Western countries. Dr. Hamid Nadimi, an architectural educator who used to be a student at the School of Fine Arts during that period, explains the architectural programme of the Seventies in his Doctoral thesis, stating: "... new courses were introduced such as *Urban Design/Planning* and the focus of the school shifted from an artistic/romantic status to 'something else'"(Nadimi, 1996, p. 81). He further explains "This 'something else' would indicate a state of suspense and hesitation. The strong emphasis of the former system on presentation skills was rejected and the *atelier* work was not the great pleasure and delight it used to be. The reduced creative output of the new system resulted in an intellectual vacuum for the more serious contemplation of architectural theory, particularly among the younger students. One of the livelier trends in those years, albeit weak but flourishing, was the tendency towards Persian architecture and its related social/cultural and climatic dimensions". The Author, however, suspects that the reason for that attention to the Persian architecture was mostly due to the Pahlavi's attempt to introduce the Iranian culture to the world, separating the Persian history of Iran from its Islamic history[13]. Particularly during the Seventies, a number of seminars – mostly offered by visiting lecturers concerning the history, theory and practice of Persian architecture – were held at the School of Fine Arts.

After the victory of the Islamic Revolution of Iran in 1978, some changes took place in the higher educational programmes as the High Council of the Cultural Revolution was appointed by Imam Khomeini – the late great leader of the Islamic Revolution in Iran. This council restructured the educational programmes in the universities and also influenced the programmes of the School of Fine Arts. The objective of the council was to bring about quality education in order to train students to fulfil the nation's social/cultural needs. To

[13] The Pahlavi Dynasty ruled in Iran from 1924 to 1978.

achieve this objective, the school environment, as well as the educational contents of the programmes, were required to undergo some changes to reflect the needs and wants of the people emphasising on their local/cultural identities (see Appendix C for the current Architecture curriculum at the University of Tehran).

The Department of Architecture at the School of Fine Arts, since its establishment in 1949 has graduated well over 2000 architects[14]. The current educational programmes in Architecture at this school is based on a Four-year Bachelor of Science degree, a Two-year Master of Architecture, and a Four-year Ph.D. in Architecture. It employs over 40 full-time faculty members and admits over 60[15] entering students – with Mathematics Diploma – per year through a comprehensive Entrance Exam, held annually across the entire nation by the Ministry of Sciences, Technology and Research (M.S.T.R.).

Although the current school curriculum and the content of lecture courses as well as design studios are intended to reflect the needs of architectural concerns of the country with regards to its social-economic conditions, the Author believes that in order to achieve higher levels of success, there is a need for a revision in the educational approaches. He suggests that Architecture educators need to adopt appropriate teaching methodologies with respect to the potentials of students, who come from a very limited artistic background, and they need to stress more on the local identities instead of following some foreign educational systems.

[14] This figure only represents the number of graduates in architecture from the University of Tehran, while there are many other universities, particularly established after the 1978 Revolution, which run architecture programmes in Iran.

[15] These figures were given to the Author by the Education Office of the School of Fine Arts in July 2000.

Chapter 3
Issues Facing Architectural Education

3.1. Introduction

The current issues in architectural education reflect the evolution of a pedagogy which was started by the growth of the middle class and the realisation of the Industrial Revolution which resulted in professionalism in architecture. In the previous chapter, the role of an architect was introduced as a craftsman at the site, however, the formation of professionalism brought a new status for the architect as a designer at the board.

Today, there is a growing recognition of changes in the nature and context of architectural practice and consequently, architectural education. In the established circles of industrial nations, practitioners have become aware of the extent to which the design and construction of buildings has become a complex sociotechnical process. At least in the large firms that tend to dominate the profession, the practitioners are coming to be seen less as individual designers in one-to-one relation with their clients than as the managers of technical teams. New domains of applied science and technology – energy management, ecology, building diagnostics, along with the more familiar fields of structural engineering, lighting, acoustics, soil mechanics, site planning and landscape architecture – are seen to have central roles in the building process, and all of these have put more demand for architectural schools and educational systems.

In order to keep up with growing changes in the profession, architectural education has become the central focus of architectural critics. Throughout the past fifty years, many issues have been identified facing architectural education which range from influences of social/professional events, into shortcomings with curriculum, design studios and the characteristics of design educators/students. These major issues have been categorised by the Author into three groups: those related to the social/professional trends; those related to the educational programmes and architectural curriculum; and those related to the environment/method of teaching – specifically in architectural design studios. A review of these issues along with a look at prospective of the future of architectural education will be presented in this chapter, in order to identify the shortcomings of the current educational programmes and forecast some possible directions for the future of architectural education.

3.2. The Changing Social/Professional Trends

The architect in the Renaissance, like Alberti or Palladio, as the German architect Ungers calls them, were "*un homme de letters*, a humanist, a very educated man, who was able to communicate through writing. There is a difference between communicating orally and ordering your thoughts and writing them down in correct grammar; this requires education, exercise and experience" (cited by Pearce and Toy, 1995, p.127). To be an architect was not only to be a craftsman, but also to be a man who was cultivated and who longed for education. Not only an education in technology, but also an education in the cultural development of mankind, of human thought and so on. Very few people may be found today who have this concept of themselves and the will to become "*un homme de letters*". The architects today have become doers, although they receive an extended formal education, the Author believes, they are more concerned with practical aspects of the profession and tend to be business-oriented professionals. Therefore, one danger facing the profession could be that architects would prefer to provide quality services only for those who are willing to pay the right price.

Professor Jackson (1995), takes this thought one step further and claims that architecture has always relied on myths for its meaning, and argues that since the loss of the collective religious social base from the Renaissance onward, architecture has become an art form for a social elite. He suggests that this process culminated in the formation of an independent profession in the nineteenth century, and finally led to the detachment of architectural concerns from those of the public.

It must be noted, however, that the identification of the Renaissance as a period of loss (of religious social cohesion and unalienated craftsmanship) and of the nineteenth century as the final downfall of a meaningful architecture is a familiar and nostalgic Ruskian theme, only this time it is not capitalism or industrialisation but architects who take the blame (Mitgang, and Boyer, 1996).

As a step to engage in a serious reappraisal of architectural education, one must begin by examining the curricular and institutional practices that help to constitute the identity of an architect. Two recent texts, *Reconstructing Architecture for the Twenty-First Century: An Inquiry into the Architect's World*, by Jackson (1995); and *A Special Report: Building*

Community - A New Future for Architecture Education and Practice, by Mitgang and Boyer (1996), criticise the divide between educators, architects, and the public, and affirm internal professional and educational reform as the route to a better environment. Architectural education needs to look beyond the boundaries of the profession and discipline, toward a larger sense of public purpose. In regards to the relationship of the architectural profession to the everyday public, Jackson (1995) views architects, their training, and ways of practising as introspective, irrelevant, and at times directly oppressive of the lay public, and warns that this era of professional supremacy must come to an end.

The Author suggests that the reason for such a separation between educators, architects, and the public throughout the past century could be identified by a closer examination of the social events during this period. The Industrial Revolution and the foundation of the Modern movement replaced the Romanticism of the 19th century with the rationalism and functionalism of the 20th century. During this period, the French Beaux-Arts and the German Bauhaus domination of architectural schooling was mixed with the American version of academic trend. Some theories of the modern architecture – i.e., Sullivan's *Form Follows Function* or Le Corbusier's *Five Principles in Architecture*[1]- suggested a move towards a global solution to architecture and, consequently, would have required an "International Style" in architectural education. The shortcomings of such theoretical views in architecture, the Author believes, are more apparent today, after experiencing the consequences of those theories on the cities and educational programmes which failed to take into consideration any measures in regards to social-cultural needs and local identities of different regions.

The emergence of *Post-modernism* during the 1970s in America, introduced alternative references for architectural design such as tradition, locality, symbolism, and historicism; issues which were overlooked by the Modernists. Emphasis on these issues had an extreme influence on architectural education – which opened a new chapter in its diary. The term *Post-modernism* should be restricted, however, as Charles Jenks (1987) suggests, to hybrid, "impure" buildings that are designed around historical memory, local context, metaphor, spatial ambiguity, and an intense concern with architectural linguistics.

Historically, however, architecture has been a hybrid – or bimodal – profession, seen on the one hand as an art, with roots in the monuments of the ancient, medieval, and

[1] For more on "form follows function", or the "five principles in architecture" see Curtis' (1982) book on Modern Architecture.

Renaissance worlds and, on the other hand, as a social function, providing structures and spaces within which the life and work of society are conducted. As "artist", the architect is seen as a giver of forms, constrained by the demands and limited resources of his client or patron. As a functional specialist, the architect is seen as bringing his design competence and special knowledge to the fulfilment of individual and social needs. In the world of contemporary architectural practice and education, the two views of the profession tend to polarise, each view suggesting a very different answer to the questions posed by the shifts in architectural practice.

Consequently, architectural education, like architectural practice, has been resolutely pluralistic. Architecture of the later part of the past century tended to have been dominated by the work of "great men", such as Wright (1869-1959), LeCorbusier (1887-1966), Mies (1886-1969), Aalto (1898-1976), Kahn (1901-1974), and by the schools of thought, or better yet, the movements, built up around them. In the past twenty years, however, the several voices claiming to present Architecture have tended to stand not only for different images of desirable buildings, appreciative systems and priorities of attention, but for different views of the design process and ways of framing the architect's role. In his review of architectural education, Donald Schon (1985, p.3) describes it best stating: "Caught in the cross-fire of architectural movement and competing images and paradigms of practice, the architectural schools have tended to take one of two positions – either to ally themselves with one of the competing voices, adopting its images, style, and views, of relevant knowledge or to present a "supermarket" of alternatives, leaving the student (however poorly suited to the task he or she may be) the burden of choice or synthesis".

The Author suggests that one alternative approach which architecture schools could take, is to acknowledge the experiences of other regions/cultures, and put more emphasis on the local issues appropriate to their own geographical/cultural concerns. He believes that the educational system in architecture should provide practical means for students to study and understand their social values and become more sensitive to environmental issues. This would require a better understanding about man, his nature, and his environment. Later, in Chapter 7, there will be an introduction to the role of Human Sciences, and in particular Cognitive Psychology, in architectural design in an attempt to emphasise the important role of man in creating architectural spaces.

The confusions and failings of architectural education today are the results of the failure of the profession at large. This could be overcome, however, if architects and educational systems would give more credit to both practice and theory. The following section will examine issues facing architectural education with regards to the role of theory and research.

3.3. Underestimating the Role of Research

The need of coalition between the academy and practice has long been suggested by the critics of architectural education. Many critics suggest that schools' primary task must be to teach theory to students and they will learn practice later on the job or in the office, although, many others suggest differently. This indicates to the Author that even if it is supposed that the major responsibility of schools are to teach theory, most schools have not adopted appropriate theory courses to train their students. Theories help to identify and express the meaning of architecture. Today, in practice, architects look into linguistics and refer to semiotics[2] to define the meaning of architectural space which they are creating. In order to understand and/or develop a theory, one must have a clear understanding of the philosophical background around that theory. The philosophical thought process and contextual consequences of an era could help in developing theories. However, still today, many architecture schools lack theory, social/cultural, or Psychology courses in their curriculum. As a step to engage in a serious reappraisal of architectural education, the Author suggests, one must begin by examining the curricular and institutional practices that help to constitute the identity of an architect.

One way of increasing enthusiasm for theory is to pay more attention to research. One advocate of this idea was the former president of RIBA, Francis Duffy (1995, p. 120) who says: "When I was in charge of education at RIBA, [I insisted] that it was an ethical obligation of architects to continue to educate themselves throughout their professional lives. This single change in the "Bible" of the Institute that made CPD (continuing professional development) compulsory for all members of the Institute is the most important single act I have been involved with in the RIBA during my time there". He believes that architects have neglected research, and do not know very much in architecture except "a few hints". He further recommends: "The steps forward for the institute are to make sure that the development of teaching skills is taken seriously; that the students who see themselves all too often as separate from the profession are taught to realise that they are part of it, part of its intellect, part of its knowledge base; that the research that will be the basis of practice in the future is seen to be a partnership between schools and practice; and that, in short, we live out every aspect of our professional lives-action, relating design to the world around us, inventing the future, honouring the past, but,

[2] Semiotics is the study of sign language, see more about semiotic in the following chapter.

all the time, relating the concept of professionalism to the ideal of education" (Duffy, 1995, p. 121).

As Thomas Dutton (1991) claims, unfortunately, most teachers are not cognisant of the presuppositions of their teaching practices. Instead, he argues that "architecture programmes are staffed by people (mostly architects) who see the practice and theoretical development of architecture as more important than the theoretical development of education" (1991, p. xvii).

Teymur (1992) raises another timely topic, a neologism that he calls "glocalism". According to him, while recent transformations within the European Community now require that architects work flexibly across international boundaries, most architectural graduates are ill-prepared to produce work that is sensitive to the needs of other cultures. Teymur calls for a new paradigm for both architectural education and practice that responds to the economic integration of Europe. This paradigm which Teymur is suggesting, however, in the opinion of the present Author must be seen in the architectural curricula of any country which has internal as well as external transactions with other regions/cultures within that country or beyond. For instance, China is now being aggressively explored as a new market for North American architectural services. It is not by sheer coincidence that some architecture schools in the United States are suddenly engaged in the task of compiling canonical courses on the "great works" of Asian architecture.

The Author suggests, the task of providing the means of doing research must be facilitated by the universities. This is in terms of supporting materials such as libraries and laboratories as well as providing the students and educators with necessary time and rewards. Rewards could be in the form of financial as well as academic acknowledgements through publishing books and/or articles. However, the universities underestimate the role of research in practice. Teymur aptly points to a troubling paradox that cuts across cultural boundaries: "Architectural education treats research in a mixture of contradictory terms ...architecture schools try to have it both ways: they strive to raise their "research profiles" (or "research ratings") by desperately collating lists of staff publications, but continue to undervalue the combination of work, skills, resources, and the dedication needed to produce those publications" (Teymur, 1992, pp. 24-25).

In order to take positive steps toward encouraging the idea of research and theory at schools, the Author suggests the starting point is the educators, themselves. Of course, the

Author's personal experience in this regard, having seized a golden opportunity to return behind the desks after ten years of teaching, is well worth mentioning. Although at first it seems quite a challenge to return to the books and start a serious formal education after many years of teaching, a lot of unsolved questions – which may have generated idly over the years – will find solutions. Also, the upgrading of academic knowledge is something that educators owe to themselves and to their students. And furthermore, developing the great habit of doing research, investigating, critical thinking, and getting involved more theoretically in the profession have been amongst the most wonderful experiences of this Author. For many years credibility of educators in architecture was mostly judged by students through their professional experiences and building projects which they had involvement with, however, these days a new measure has been taken into account based upon the theoretical literacy and research experiences of the educators. To have credibility in the eyes of young people, Rob Krier (1995, p. 105) suggests, "a teacher must be able to tie theory to practice... The art of architectural composition is illustrated by the example of models: its theories must take into account the laws of construction and the logic of internal planning".

3.4. Deficiencies with Design Pedagogy

Professor Nicholas Weaver[3] in his reply to the Author described the aim in educating an architect is "to develop the conceptual, analytical, imaginative and practical skills necessary for the student to determine human needs and aspirations and to meet or express these in space and form" (Weaver, 1997). Further he introduced the integration between "knowledge" and "application" – varying in proportions in different levels of education – as necessary elements in the atelier principles of education which could bring successive progress for the students of architecture.

Architectural ateliers (studios) are prototypes of individual and collective learning-by-doing under the guidance and criticism of master practitioners, with distant origins in the apprenticeships of the medieval guilds and more recent origins in the Ecole des Beaux Arts of the late 19th and early 20th centuries. Virtually all architecture programmes organise their curricula in terms of a "design studio as centre-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.

[3] Professor Weaver, Deputy Head of the School of Architecture at the University of East London, replied to the Author's questionnaires in Jan. 2000 by submitting a copy of his

Among the advocates of the "studio system", Donald Schon (1985), who is a human scientist, reports about design studio, that this pedagogy is a very appropriate education in all the professions, including medicine, law and even business. For like architecture these professionals also have to deal with complexity, uncertainty, uniqueness and value-conflict. He calls the studio experience "reflection in action". Further he states: "Not only students of design, but all those who seek to learn the artistry of a practise new to them, face an epistemological paradox and psychological predicament. They need to educate themselves to a new competence when they don't yet know what it is they need to learn. And they must therefore take a plunge into doing before they know what to do. Similarly, those who try to help these students need an artistry of coaching, similar in its essentials to the artistry they want to help their students acquire" (Schon, 1985, p. 88).

In a critical analysis of Schon's observations, Professor Broadbent and his colleagues (1998) at the University of Belgrano – in Buenos Aires – argue about some deficiencies with his studies[4], however, they all agree on one point that design studio could offer a 'paradigm' for education in various other fields; those requiring sensitive judgement: 'reflection in action', decision-making, and creativity under constantly changing conditions of conflict and ambiguity.

The Author shares Schon's positive report on studio pedagogy and adds: interacting between students, sharing/discussing views in an informal manner about design, and learning to work in groups and encourage the spirit of team-work are amongst the major contributions of the design studio pedagogy. However, he suggests that the experience of "reflection in action" could only be successful when the students are given some type of guidelines and are informed by a design methodology. Otherwise, he suspects, students' dissatisfaction with their design experiences would grow (see Chapter 12), since many of them feel lost during the design process.

There are many criticisms about the studio pedagogy as Buchanan (1989) argues which are real and need to be dealt with. "The problems of architectural education generally and in the studio in particular, reflect the confusions, the lack of confidence and convincing direction, found in the profession today. But they also reflect the inadequacies and inexperience of many teachers – a considerable number of whom, especially the more

paper – Atelier Principle in Teaching – delivered at the Conference on Project Based Learning at the University of Roskilde, Denmark, in 1997.

[4] Broadbent, et.al., (1998) found deficiencies with Schon's studies about design studio in several ways – i.e., in the size of his 'samples' which were too small, and in his 'Normative Design Domains', which seemed limited, repetitive, and ambiguous.

influential ones, have built very little if anything at all" (Buchanan, 1989, p. 25). With respect to the educators' practical experiences, however, the Author has found some different reactions in the United States. In a survey conducted by Architectural Journal (1999), two-thirds of their participants[5] rejected the idea that all faculty at accredited schools should be licensed architects, explaining that Architecture is a complex profession and the faculty should reflect that richness.

In general, many practitioners criticise the schools, for the fundamental and continuing failure of which is, from their point of view: "their sheer and seemingly perverse inability to prepare students for the real world of practice" (Fisher, 1989; Forbes, 1985; Smith, 1984). The studio system of education is, they say, a fantasy world (Fowler, 1985; Fox. 1984; Gutman, 1987; Pawley, 1983; Stubbs, 1987; Wines, 1984) in which incompetent professors who are the centre of petty personality cults (Rapoport, 1982) encourage bizarrely unrealistic expectations in students (Carolin, 1992) while avoiding the teaching of anything actually to do with the hard realities of life (Heinlein, 1981). Students learn nothing of the members of the construction industry (Muir, 1991). They cannot draw and they know nothing of construction (Carolin, 1992; Fowler, 1985; Gutman, 1987). The suggested remedies are usually along the lines of introducing more "pragmatic" subjects such as management and technical courses or, significantly, a partial return to apprenticeship in some form (Cobb, 1985; Filson, 1985; Mitchell, 1984). (cited by Stevens, 1998, p. 154).

One of the most critical issues involved in a studio pedagogy, the Author believes is the quality of work produced in the studio which seems to be inadequate for all the time, attention and credit units which are given over to design studios. Most students' projects seem to have very little in content but are rich in presentation as if they are taking part in a graphics competition. He agrees with Buchanan (1989) in describing end of year shows becoming progressively more trendy as social events, so studio projects on display have tended to be more subject to fashion – fit only as decoration for such events. Graphically elaborate, visually compelling if inscrutable, they are essentially ephemera.

Another issue in the Author's critique of design studios is the lack of integration of technical subjects with design studios and detachment from the world of practice. Again, Buchanan (1989) claims that construction and detailing also tend to be taught most

[5] The 153 respondents to the survey included designers, such as Richard Meier and Michael Graves, 114 respondents were top executives or firm owners; at least 20 were both educators and practitioners; and 15 were recent graduates who are junior positions in architecture firms.

unsatisfactorily – particularly application in the studio. Typically parts of some design projects are selected to be blown up into working details. But this is just another shallow graphic exercise that essentially contradicts proper architectural discipline. Each material and component selected and each detail developed should assert an influence throughout and be influenced by all other aspects of the design. With regards to the importance of understanding the constructional aspects of what students design, Buchanan (1989, p. 25) states, "this is why skilled architects tend to think in construction and detail right from the earliest sketches and often prefer to finalise all details before starting layout drawings".

As the Author has found, there are also some reservations about the interaction between the student and educator in the studio pedagogy. Argyris (1981), by tracing the studio tradition's historical link to the master-apprentice model, has characterised this pedagogical format as the "mystery-mastery" approach. Argyris suggests that the instructor has mastered the craft of architecture, yet the process by which the instructor arrives at this mastery remains a mystery. In a different perspective, Groat and Ahrentzen (1996, pp. 166-167) claim that "this mode of teaching/learning may have a differential impact on female and minority students; not only is the master nearly always a mister, but women may be less comfortable with a format that privileges persuasion over dialogue", and minority students may resent the Eurocentric design emphasis that "channels students into becoming custodians of the status quo" (Grant, 1991) (Cited by Groat and Ahrentzen, 1996). The Author's experience in this regard with his students at the University of Tehran suggests that some students who come from rural areas – with little experiences with modern architecture – have difficulties to adapt themselves to the studio life and/or design projects suitable for urban spaces. Therefore, during the first couple of years of their education, some of them lose their interest in architecture and the rest will learn to adapt themselves to urban life and lose their own identities.

Critiques of architectural education have raised many questions about the quality of education in architecture, and probably the most critical issues involving students with different background are reflected by Crysler (1995) who claims that students learn to subordinate their other identities to the task of becoming a professional. He states that: "Bombarded with complex assignments, working under highly pressurised conditions, the student is constituted as a target for a one-directional flow of skills and knowledge without the interference of gender, race, class, or sexual orientation" (Crysler, 1995, p.208).

In the context of genders in the design studio environment, "various authors have suggested that the presence of a "critical mass" of female faculty or students (and comparably for minorities) may foster a "comfort factor" that mitigates such negative social dynamics. But to date, it remains unclear what compositional mix is sufficient to generate such a comfort factor" (Groat, Ahrentzen, 1996, p. 166).

Unlike the "American style" Design studios in which students within each educational level work in separate studios (with very little contact between students within different levels), some remarkable experiences have been reported by some British schools in which they conduct "vertical studios". In her reply to the Author's questionnaire, Professor Wendy Potts, the Head of the School of Architecture at the University Portsmouth, states that: "since 1993 which we have developed vertical studios (all years) running horizontal design programmes, the Staff/Student Ratios has doubled and studio space has halved."[6] She further explains the new achievements of the "cross year studios" by stating: "To run studios in this way we have had to refine and develop studio-teaching methods. We have had to learn how to share with and to teach these methods to part-time colleagues joining us. We have had to rethink the ways in which design programmes/briefs are developed and communicated and we have had to define and clarify mechanisms for assessment. There is strong student support for this model with students citing the benefits of teamwork, of peer support, of better communication throughout the School and of a clearer understanding of the 'goal' of architectural education".

The Author welcomes the Portsmouth's experience as a successful model for the design studio pedagogy in which students within different levels learn to work together and assist the one another in educational exercises (very much in the line of *Tallabegi* system of teaching/learning discussed in the previous chapter). In addition to the advantages of the Portsmouth's model introduced by Professor Potts, the Author believes that "cross year" design studios could overcome many problems raised earlier, in the sense of quality teaching and integrating 'theory' with 'practice' by getting more educators (with different backgrounds) involved to work with a small groups of students (ranging from 12-18 students). The Author could not more agree with Professor Potts who states: "...to continue to change and evolve [in education] is healthy", and it is necessary for design studios to re-evaluate their educational approaches every so often to overcome their educational shortcomings.

---

[6] Professor Potts sent an attached paper – The Design Studio as a Vehicle for Change: 'The Portsmouth Model' – describing their experience at Portsmouth with her reply to the Author's questionnaire in Jan. 2000.

3.5. Future Directions of Architectural Education

These days there are emerging some new movements of thinking in architecture around the globe which have, formed or are in the process of forming, architectural schools with an aim to overcome the existing problems of architectural education. For instance, two of such movements emerged in the '90s with different ideologies: One, by Portuguese architect Tomas Taveira[7], to set up a University of Architecture with the idea of promoting architectural thinking and related fields; and the other which has actually been driven by the Prince of Wales. The new school of Wales Institute of Architecture was established by the Prince of Wales in 1992, to instil the values he had described in *A Vision of Britain*. The Foundation Course is based on the crafts to counter the mechanistic architecture he dislikes so much and to develop *human* values. Although much of the Course is based on the crafts and there is very little 'theory', the Author believes that the general philosophy of the school (which is influenced by *A Vision of Britain* and an emphasis on spiritual values, for instance: *Man, Building and the Cosmos*) could be sufficient aims to start a new educational direction in this century.

There are also some striking or rather revolutionary ideas as well which suggest a total change in the educational system. One of these ideas is expressed by the American architect, Garry Stevens (1998, p. 165) who says: "If the profession really wanted better practical training from the education system, then the best response would undoubtedly be to close the university-based schools and either institute part-time schools outside the universities (like the original AA) or return to the apprenticeship system, with perhaps a supplementary period of training in technical subjects such as structures and building services, although whether even this is necessary is a moot point, given the responsibility of engineers in law for these areas. This is most unlikely to happen. In the European Union, bureaucratic requirements will not only insist on a degree, but one a certain length. In the United States, universities will not abandon a market as long as it is profitable. The inexorable pressure of credential inflation also militate against an abandonment of the universities".

In the meantime, various thoughts have been expressed by architects about the future of the profession which all seem to reflect their philosophical views. For example, with regards to the issue of technology, Richard Rogers, (cited by Pearce and Toy, 1995, p. 126) writes: "In the past we had Vitruvius and the position that a building could attain perfection through a complete control of its proportions and composition. The exercise of architecture was the exercise of creating a perfect and unchangeable object. This concept of built form

[7] Explained by Broadbent, (1995, p. 22).

related to the philosophy of a society wishing to define and fix relationships. The twentieth century has been the transformation of philosophy away from static and hierarchical relationships (within society and between Man and God) to our present post-Einsteinian position where the philosophy of change now dominates thinking. This philosophical change has also motivated architecture and this shift in thinking has been accompanied by a complete transformation of the technology of building which has further undermined the principles of traditional architecture".

One major event during the past two decades, the Author has observed, has been the progressive application of computers and the Internet technology in education. The new horizons have been opened to the students of architecture to research, draw, design, share ideas, and get help throughout their education. However, as Duffy (1995, p. 121) suggests: "I think we have not come to terms with the enormous consequences of the use of information technology in architecture, which enables us to rethink the process by which buildings are designed and erected". Earlier in the 20th century, Heidegger said: "All distances in time and space are shrinking. Man now reaches overnight, by plane, places which formerly took weeks and months of travel...Yet the frantic abolition of all distances brings no nearness; for nearness does not consist in shortness of distance, by virtue of its picture on film or its sound on the radio, can remain far from us. What is incalculably far from us in point of distance can be near to us. Short distance is not itself nearness. Nor is great distance remoteness" (Cited by Pearce and Toy, 1995, p. 9). Further in the same text Toy concludes: "This is an important point for education. If the possibilities of information are both boundless and immediate while location and certainty are key, how can the educator enable the students to achieve the nearness of which Heideggar speaks. In this respect we should first question what nature or purpose such as nearness might have".

Dr. Jens Pohl, an architectural educator at California Polytechnic State University, in his recent correspondence with the Author in January of 2000, stressed the use of computer-aided design systems in architecture and stated, "We will increasingly utilize intelligent computer-aided design systems that are capable of assisting architects in the design decision making process". As far as his prediction of what architects will design in the near future, he states: "Telecommuting will become the preferred arrangement for many companies and employees. This will require new kinds of office building facilities. ... Increasingly the home will also serve as an office and work space". In his prediction about how will architects learn to become architects? Dr. Pohl states: "Increasingly all persons, including professionals and architects, will be judged on their performance and not on their qualifications. Apart from the normal discipline-based skills that are required to successfully perform building design and construction management services, architects also need to acquire broadly-based business skills (i.e., financial management, effective promotion and marketing, assessment of business opportunities, relationship building, etc.). In addition, architecture schools must recognize that a significant percentage of their students will either never enter the architecture profession or will make a major career change during their life. Design skills and experience, which really translate into an ability to deal with complex problem situations are becoming highly marketable skills as society increasingly tackles more and more complex problems (see the enclosed paper on Complex Adaptive Systems). Under these circumstances architecture schools, and universities in general, have an important role to play in ***continuing education*** (i.e., post-professional education)".

The Author, too, shares in the belief that future technology will be extremely influential in the profession and architectural education; however, he cautions that if the future tools (i.e., computers) are misunderstood and miss-applied, they may take over the spirit of the designers and consequently the profession. Therefore, he insists on the application of modern technology as a tool to achieve man's objectives, provided that however, these objectives must be developed based on a true understanding of man and his environment. In most countries today, architectural education has come to function as an alternative form of general liberal arts education. Students choose architecture, as they also choose history or classics, when they have no intention of becoming practising architects. Architecture should be seen, in this view, both as a form of professional training and as an alternative form of general higher education. But if the schools of architecture have to play this dual role, then the directions they should develop remain vague and uncertain.

Chapter 4
Investigating for an Architectural Theory

4.1. Introduction

After reviewing the background of architectural education and the problems facing it, in order to develop viable solutions toward defining an appropriate design methodology and teaching methodology in architecture, the Author will initially need to investigate more about Architecture and its theories. Architecture has been described in many ways throughout the history. In most descriptions, critics have tended to define architecture through the physical elements which form its presence. However, in this chapter, the Author will make an attempt to define architecture in a different approach through the means by which architecture is being judged by. Within the discipline of architecture, theory is a discourse that describes the practice and production of architecture and identifies challenges to it. Theory overlaps with but differs from architectural history, which is descriptive of past work, and from criticism, a narrow activity of judgement and interpretation of specific existing works relative to the critic's or architect's stated standards. In an attempt to define architecture, this chapter will examine the definition of architecture through the means of history, semiotics, and theory. Later in this chapter, a section will be dedicated to review the development of architectural theories, in particular, those contributing to the establishment of architectural design.

4.2. Defining Architecture

Most architects and architectural critics have tried, at least once during their professional lives, to define architecture. Even in architecture schools, one popular exercise in theory classes has been to ask students to define architecture. Many famous architects have defined architecture within different stages of their professional lives. A list of such definitions for architecture is compiled by Francis Ching (1996, p.8) quoting different architects and stating:

"**Architecture** is an art for all to learn because all are concerned with it. – John Ruskin.
Architecture is the masterly, correct and magnificent play of masses brought together in light. – Le Corbusier.
The only way you can build, the only way you can get the building into being, is through the measurable. You must follow the laws of nature and use quantities of brick, methods of construction, and engineering. But in the end, when the building becomes part of living, it evokes unmeasurable qualities, and the spirit of its existence takes over. – Louis Kahn.
Architecture also exists without necessary assistance from an architect; and architects sometimes create buildings which are not **architecture**. – Norval White."

Obviously there are various approaches for defining architecture, and many of them include both the physical appearance and the mental perception of space. However, the most popular approach has been through associating it with either the arts or sciences. According to which dictionary one uses, *architecture* is defined as the art, or science, of building, or as one of the fine arts; that is to say it is concerned with the aesthetic arts as opposed to the useful or industrial arts such as engineering. Two well-known critics and theorists of the 20th century, John Ruskin[1] and William Morris[2], contributed to this debate. In general, they agree that the distinction between architecture and building could be summarised as:
Building + Art = Architecture.

The Author, however, does not consider this approach for defining architecture as sufficient, since he argues that in practice there is a very fine line separating the arts and sciences. He suggests that the two subjects of arts and science are intertwined and inseparable. Today one speaks of the art of engineering and creative process of the production line, while it is also common to hear one speak about the importance of technology and science for creating arts. Although architecture is influenced by arts and sciences, it is not appropriate to define it only through these means. Later in this research – in Chapters 11 and 12 – the Author will reflect the views of some educators and students in defining whether architecture is being more influenced by arts or science, in an attempt to compare the views of students with their educators about the subject of architecture.

Another way to define architecture has been through associating it with what architects and designers build (eg., banks, hotels, office buildings, and so on). However, in this respect

[1] John Ruskin (1819-1900), was an English writer and critic. His major writings include: *The Seven Lamps of Architecture* and *The Stones of Venice*.
[2] William Morris (1834-1896), Poet, writer, designer and revolutionary, was a major influence on architecture in both Britain and the USA.

too one could argue that great works in the history of architecture, for example, the medieval cathedrals were not built by architects but by monks and patrons – are they – then, not architecture? There is a great controversy about the existence of architects in the Middle ages, so how could it be possible to associate architecture with what architects build? Taking this further, Conway and Roenisch, (1994), draw attention to the contribution of vernacular architecture as an inspiration behind both British and American domestic revivals of the 1880s. However, vernacular architecture has generally been studied separately from "polite" or monumental architecture and has been seen as a branch of anthropology, of construction history, or of social history. The Author was fascinated by Bernard Rudofsky's *Architecture Without Architects* (1965) when he first saw the book during his educational years in the 1980s. The book introduced examples of magnificent building solutions which were made by ordinary people. Even today, the Author recommends this book and the lessons from that train of thought – 'going vernacular' – to his students struggling with their design exercises as a viable alternative in most design projects.

When people think of architecture, they are very likely thinking about some type of construction. This has been examined by Conway and Roenisch, (1994, p. 12) who suggest: "The word architecture derives from the Greek word for 'builder' (*archi* meaning 'chief' and *tecton* meaning 'builder') and until quite recently, within the last 150 years, the role of the architect included surveying and building, as well as military and civil engineering". In the early works of great masters there are indications of close correlation between architecture and other construction projects. Conway and Roenisch further add: "Vitruvius, the Roman architect active in the first century BC, included a whole range of examples of civil and military engineering in his influential ten-volume book, *De Architectura*. Similarly the important renaissance architect Palladio included designs for civil engineering as well as for churches, palaces, farms, and villas in his *Quattro Libri dell' Architectura* (1570). It was only with the increase of specialisation within the building industry that the architect ceased being a tradesman and achieved professional status, a process that in the west had its roots in the 18th century" (Conway and Roenisch, 1994, p. 12).

One clear characteristic of architecture, the Author suggests, is the multi-disciplinary identity of its existence. Architecture plays a vital role in the social, cultural, and economic features of a society and architects need to know about these issues. Architecture is not an isolated activity: today it can only be carried out within a network of other political, social, and economic institutions such as local authority planning, housing and environmental health departments, financial institutions such as banks and insurance companies and the changing legislation which may at one time promote development and at another seek to control it. It is necessary to understand these institutions in order to understand the factors which affect the built environment. If architecture is seen solely as the province of architects, whether heroic or not, then it is likely that people may not only misunderstand their role in creating the built environment, but also become suspicious of their activities and blame them if they do not like the results (Conway and Roenisch, 1994).

What architects create, the Author suggests, is far more than simply a physical space which fulfils functional needs of the users. This creation also has to satisfy one's psychological perceptions of a space through appropriate connections with the social/cultural issues across the spectrum of time. Therefore, the most effective way to define architecture is through understanding the history of what people's experiences have been in the past and applying them in an appropriate interpretation, through design, for the present needs of the users whilst also making it suitable for future generations. The activities of design shall be directed with a thoughtful aim and philosophy on the part of the architect to make a purposeful architecture which has meaning for its users.

In a different approach, without defining architecture through its physical elements and/or requirements, the Author has made an attempt to describe architecture through the issues of history, theory, and meaning which influence one's perceptions of architecture.

4.2.1. Through History

Architecture could be considered one of the earliest professions which has served man and his environment. The *Ten Books on Architecture*, written by Vitruvius some two thousand years ago (translated in 1914), could be considered as the most valuable document which demonstrates the use of theory in architecture. They are great lessons from the history of architecture which help one to better understand the evolution of architecture and its seeking aims throughout the history of mankind. The ambiguous uses of the term "historicism," however, encompasses various ways of dealing with the issue of tradition. Alan Colquhoun (1981) describes "historicism" can be applied to three quite separate objects: the first is a theory of history; the second, an attitude; the third, an artistic practice. He further exposes the paradoxes of the historicist view, in particular the belief in inevitable progress towards some true expression of the time. Colquhoun describes this belief as the substitution of an "emergent ideal" for the fixed ideals of classical world view. In this view, he also notes at the role of historic thinking in the concepts of architectural style and periodisation. Colquhoun's other two types of historicism, an attitude and an artistic practice, help explain postmodern architecture's eclectic pluralism. The attitude is one of sympathy towards the culture and customs of the past. The artistic practice is sampling forms of imagery freely from the various styles, all styles being conceived as equally valid. In his description of today's architecture, Colquhoun explains the vital role of criticism and states: "History provides both the ideas that are in need of criticism and the material out of which this criticism is forged. An architecture that is constantly aware of its own history, but constantly critical of the seductions of history, is what we should aim for today"(cited by Nesbitt, 1996, p. 209).

E.H. Carr in *What is History?* (1964) explains that history begins today, but one of the main difficulties about studying the recent past is the sheer volume of information available and the problem of determining what is significant and what is not. In its initial stages any historical study involves collecting facts, but facts by themselves tell nothing to people. In order to make any sense of those facts they must be selected, ordered, evaluated, interpreted and placed in context. In this regard, Conway and Roenisch (1994), explain that interpretations do change and people look at the past quite differently according to their present concerns and outlook. Different facts from the past become significant and affect their interpretations, and these in turn affect how they see and understand the present. However, people need to try to be as objective as possible, while recognising that their ability to be so is affected by their present assumptions and the limits of their historical period and place.

Conway and Roenisch (1994), further insist that people need to understand how they have arrived at today and that means that they need to see today within the context and perspective of the past. They underline that understanding history helps people to understand how they have arrived at today, it empowers them to work for a better future and prevents them from passively accepting what they find unacceptable, whether as the users of architecture, as architects or as architectural critics. Architecture affects everyone and Conway and Roenisch suggest: "so we all need to take responsibility for it, but we can only do so when we understand more about it. Architecture is something to be enjoyed and shared. If it is shared more widely because more people understand it, take it seriously and are not frightened by it, then the chances are that the urban environment will improve and architects will no longer be seen as responsible for all that we dislike but as part of a team which enables us to achieve our ideas." (Conway, and Roenisch, 1994, p.28)

The Author suggests that the study of history, whether contemporary history or the distant past, encourages one to think critically about both today and yesterday. It is only by understanding the past that one can understand the present. And it is only by understanding how past and present interact that one can hope to build a better future. Without that perspective in architecture, architects become prisoners of their present, for their understanding will be limited, so they will be unable to foresee alternatives, or recognise the possibilities of choice.

4.2.2. Through Semiotics

Semiotic, or the subject of meaning in architecture (Broadbent, Bunt, and Jenks 1980), is another valuable characteristic in defining architecture. Buildings are experienced in terms of their form, their structure, their aesthetics and how the immediate users[3] and others use them. This constitutes the reality of one's physical experience, but buildings not only have an existence in reality, they also have a metaphorical existence. They express meaning and give certain messages, just as the way people dress or furnish their homes gives other people certain messages about them. The Author suggests that what is built is not the only object of architecture, its reality varies widely according to the point of view from which it is perceived and criticised. This perception could include a wide range of issues, for example, some people may judge architecture based on their feelings about its existence in the environment.

Among the most popular contemporary buildings today in western Europe in terms of the numbers of people visiting them are *Pompidou Centre* in Paris (by Renzo Piano and Richard Rogers, 1974), *Lloyds Insurance*, London (by Richard Rogers, 1986) and the *Staatgsgalerie Extension* in Stuttgart (by James Stirling and Michael Wilford, 1984) (Conway, Roenisch, 1994). The high number of visitors does not necessarily mean that these are the best buildings in Western Europe, but the Author believes that these buildings are successful in terms of reflecting the messages that their architects had intended to communicate to their users. Conway and Roenisch, explain post-modern architecture of today as being essentially about communication. "Postmodernism", they state, "was initially a reaction against the high-rise apartment blocks, the commercial developments and the use of concrete that is associated with modernism in the 1960s. Such architecture alienated people, said the postmodernists, because it did not communicate; so postmodernism set out to communicate. This it does by borrowing styles from previous periods, or by 'quoting' details from adjacent buildings and the surrounding environment" (Conway, Roenisch, 1994, p.25).

---

[3] By immediate user, the Author means those users who are directly involved with the designed spaces in comparison with other users who are not directly involved. For example, in a hospital design, the immediate users are patients and physicians in comparison to visitors who would be considered as indirect users.

As Professor Broadbent (1985) indicates, the first reading of any object is semiotic. One recognises architecture as being a certain kind, of a certain period, by a certain designer and so on. Therefore, major elements of architecture, i.e., space, surface and structure are analysed within the semiotic categories: pragmatic, syntactics and semantics. This enables one to penetrate much further than mere aesthetic analyses of architecture as space. Broadbent (1973) recognises the importance of the "social contract" in language; it is a set of conventions that allows the linguistic sign to function, and produces consensus about meaning. Nevertheless, Broadbent writes that the social contract is absent from architecture and that this absence is what differentiates architecture from language. Although he maintains that buildings can "undoubtedly" be read as signs, Broadbent notes that architecture should not just be read visually, he stresses that architecture effects all of the senses. The Author, too, finds human senses very influential in architectural design and later in the following chapter he introduces sensory factors as one his major design factors influencing an architectural design solution.

Contemporary architecture today, however, as a result of various meanings and messages communicated by architects, has created an exhibition of spatial extravaganza in most metropolitan cities. Pellegrino, (cited by Nesbitt, 1996, p.55) states: "Contemporary space is surreptitiously transforming itself in many dimensions: spatial redefinition, changing interdependencies, different emphases, new configurations and new relationships between appearance and substance, newly defined movements and other imbalances". Although the contemporary architecture has developed some different images, the Author believes that it has preserved some stable architectural characteristics. He describes these characteristics as the internal and external identity of a space. These characteristics take form based on many influencing issues (also see *design factors* at the end of Chapter 6). Some of these issues have direct influence on the inside of a space and some on the outside, and some on both. For example, in most buildings, *climate* would have an influence on the outside character of a space (eg., the use of sunshades in an arid climate), while the needs of a *user* would most likely influence the characteristics of the inside of a space (eg., arrangement of space inside a bank), and some issues such as circulation would effect both inside and outside characters (i.e., vertical circulation at Pompidou Centre). This is similar to what Conway and Roenisch, (1994) suggest that buildings have *intrinsic* meanings which have resulted from their spatial and visible forms and *extrinsic* meaning which have evolved out of tradition and social use. The way in which the form of particular buildings relates to their function is part of their extrinsic meaning (i.e., house, bank, terminal, ...). They further indicate that buildings evoke an emphatic reaction in people through these projected experiences, and the strength of these reactions is determined by one's culture, beliefs and expectations. Further, Conway and Roenisch give an example of dramatic roof lines of Sydney Opera House which, beyond its physical form, carries a symbolic message which refers to the building's maritime position and to the sailing boats in Sydney Harbour.

The Author claims that the application of semiotics in architecture could be investigated in the manner of perceiving a space. Architects direct their 'users' to how and what they should experience in their designed spaces. Therefore, he suggests semiotics of architecture – as the investigation of structures of meaning – and semiology, as the investigation of the production of meaning, shall be applied to architecture in order to give meaning to the users' perceptions. This control of perception is what makes the role of architects different from those of builders. Architecture shall facilitate users beyond their physical/functional needs of a space and satisfy their mental and cultural endeavours as well.

4.2.3. Through Theory

Theory, the Author suggests, takes form under the influence of some philosophical viewpoints and attempts to describe a phenomenon. Examining architectural theories could help to develop a better understanding about what architecture is and what it should be. Many designers have described architecture and their theoretical views about design. However, many of them, in practice, betray their theories. This is what Professor Lang (1987, p. 19) cautions when he observes "the *professed* positions of designers [are] different from what is *practised* by them".

There are several theoretical viewpoints expressed about architecture throughout the history, in order to demonstrate the wide range of architectural theories, the Author has made an attempt to provide a brief look at some contemporary theories. This section introduces some of the contemporary viewpoints on architecture which have been categorised under different philosophical backgrounds. Each of these viewpoints has attracted many architects who find their philosophies in architectural design in one way or another related to these theories and have contributed to the growth of those thoughts.

These thoughts are grouped under the current most regarded architectural movements of the present time: Post-Modern, Post-Modern Ecology, Traditional, Late Modern, and New Modern (suggested by Jencks and Kropf, 1997). Some statements from a couple of architects within each category have been selected by the Author to represent the trains of thought within each category, followed by some keywords compiled by the Author to describe the essence of each theoretical viewpoint.

- *Post-Modern*

Charles Jencks (1997): "General Values: 1- Multivalence is preferred to univalence, imagination to fancy. 2- 'Complexity and contradiction' are preferred to over-simplicity and 'Minimalism'. 3- Complexity and Chaos theories are considered more basic in explaining nature than linear dynamics; that is, 'more of nature' is nonlinear in behaviour than linear. 4- Memory and history are inevitable in DNA, language, style and the city and are positive catalysts for invention" (1996, lecture made for architecture students at UCLA).

Itsuko Hasegawa (1991, p. 14): "One of my aims is to reconsider architecture of the past, which was adapted to the climate and the land and permitted human coexistence with nature, and to see human beings and architecture as part of the earth's ecosystem. This includes a challenge to propose new design connected with new science and technology".

Keywords: History, complexity, ecosystem, technology.

- *Post-Modern Ecology*

Eugene Tsui (1999, p. 12): "Evolutionary architecture can be defined as an architecture that implements the evolutionary practices of nature as a synthesis of billions of years of evolution applied to immediate needs and circumstances of form, function and purpose. It is the highest and most advanced architectural design evolution, because it takes into account all the various natural forces and human concerns in a way that is ecologically and humanly productive. An evolutionary approach to design allows us to apply principles that have developed in nature over great spans of time without references to past and present stylistic aesthetics".

Christopher Day (1990, p. 15): "Architecture has responsibilities to minimise adverse biological effects on occupants, responsibilities to be sensitive to and act harmoniously in the surroundings, responsibilities to the human individualities who will come in contact with the building, responsibilities not only in the visual aesthetic sphere and through the outer senses but also to the intangible but perceptible 'spirit of place'".

Keywords: Revolutionary design, ecology, nature.

- *Traditional*

Roger Scruton (1994, p. 74): "Post-modernism is a reaction to modernist censoriousness. It 'plays' with the classical and gothic details which were forbidden it by its stern parent, and so empties them of their last vestiges of meaning. This is not the rediscovery of history, but its dissolution..."

Allan Greenberg (1994, p. 57): "A Classical approach to design fulfils architecture's most basic responsibility: to communicate to citizens the mission of our civic, religious, and educational institutions..."

Keywords: Classic, tradition, history.

- *Late Modern*

Tadao Ando (1991, p.75): "Architectural creation is founded in critical action. It is never simply a method of problem-solving whereby given conditions are reduced to technical issues. Architectural creation involves contemplating the origins and essence of a project's functional requirements and the subsequent determination of its essential issue".

Richard Rogers (1985, p. 16): "Today problem solving involves thinking at a global scale and using science as the tool to open up the future. Science is the means by which knowledge is ordered in the most efficient way so as to solve problems..."

Keywords: Essence, science, knowledge.

- *New Modern*

Peter Eisenman (1992, p. 21): "The electronic paradigm directs a powerful challenge to architecture because it defines reality in terms of media and simulation, it values appearance over existence, what can be seen over what is. Not the seen as we formerly knew it, but rather a seeing that can no longer interpret. Media introduce fundamental ambiguities into how and what we see".

Mark Wigley (1988, p. 11): "Deconstruction is not demolition, or dissimulation. While it diagnoses certain structural problems within apparently stable structures, these flaws do not lead to structures' collapse. On the contrary, deconstruction gains all its forces by challenging the very values of harmony, unity, and stability, and proposing instead a different view of structure: the view that the flaws are intrinsic to the structure. They cannot be removed without destroying it; they are, indeed, the structure".

Keywords: Deconstruction, appearance, media.

Reviewing the above statements indicate that there are multi-dimensional aspects of architecture which could interest an architect. They suggest to the Author that architectural design theories are just as live as people in different societies with different needs and values. As people are different and their perceptions of life and living differ from one to another, so it is with schools of thoughts in architecture. Therefore, as mentioned earlier, due to the complexity of issues involved in today's societies, architectural thoughts enjoy a wide range of issues and concerns. It is difficult, and the Author believes it would be inappropriate, to attempt to generalise all of these concerns about architecture under one prescription for defining architecture. It is best to have various viewpoints otherwise architecture becomes boring and, as a consequence, life could become boring.

One diligent effort, however, has been made recently by David Capon (1999) in his two-volume books on *Architectural Theory,* to define architecture through applying philosophical views; an effort well worth mentioning here as an alternative approach to defining architecture. Instead of defining architecture, Capon (1999a) defines "good architecture", influenced by Aristotle's model of distinguishing between *elements, causes,* and *principles*[4]. He argues the logical way to define good architecture would be to "first define the elements of architecture; second, discover the causes which in some way constitute the good; and only then, as a composite of the two bring them together as the principles of good architecture" (Capon, 1999a, p. 181). He further indicates that his model of good architecture may be compared with definitions stated by others using different names. Capon's model of good architecture is consisted of: *elements, causes,* and *principles* of good architecture. This model will be introduced here as an approach in an attempt to provide a better understanding about architecture.

4.2.3.1. Elements of Good Architecture

Capon (1999) proposes a series of categories into which all possible answers to questions like "What is Architecture?" could be arranged. He examines Aristotle's ten categories[5] which by the end of the Classical era had been reduced to six: *Substance, Relation, Quantity, Quality, Acting* and being *Acted upon*. He corresponds *Substance* to construction and materials; *Relation* to context; *Quantity* to form; and *Quality* to meaning. The Categories of *Acting* and being *Acted upon* were collected under one category by Plotinus, although he further examines subsequent developments by Kant and Hegel which prefer to maintain two separated categories: *Activity* relating to the functioning of the building; and *Acting* relating to will or spirit.

Capon's categorisation of the six elements of good architecture takes form under two major categories (Capon, 1999a, P. 181):

---

[4] For all references of philosophers and their categories mentioned in this section refer to Capon, 1999, Volume One.

[5] Aristotle's ten categories of predicate that could be attributed to any subject include: acting, acted upon, time, substance, possession, quality, relation, place, quantity, and position (Capon, 1999a, p.52).

"PRIMARY CATEGORIES

Greek categories	*Architectural elements*
Quantity..............................	Form, Pattern, Structure, Geometry, etc.
Activity..............................	Function, Needs, Effects, Exchange, etc.
Quality..............................	Meaning, Association, Resemblance, Style, etc.

SECONDARY CATEGORIES

Substance............................	Construction, Materials, Design, etc.
Relation..............................	Context, Community, Nature, Feeling, etc.
Will..................................	Spirit, Power, Politics, Attitudes, etc."

4.2.3.2. Causes and Virtues of Good Architecture

Capon (1999a) explains that in order to define the causes for a good architecture, it may be useful to turn Aristotle's statement around and ask what good itself consists of. He compares the types of good relative to mankind discussed by Aristotle in a general way, with the type of good relative to building. In his model, Capon compares Aristotle's six categories of good with those of the ancient Greeks (i.e., Plato's *Justice, Temperance, Wisdom, Duty, Love,* and *Courage*) which were developed through the Middle Ages. Capon compares between Greek virtues, on the one hand, and these stated values of professional practice, on the other, in his two major categories defining causes of good architecture (Capon, 1999a, p.183):

"PRIMARY CATEGORIES

Greek virtues	*Professional values*
Justice................................	Impartiality, Objectivity, etc.
Temperance...........................	Efficiency, Efficacy, Ability, Achievement, etc.
Wisdom................................	Integrity, Honesty, Propriety, Truth, etc.

SECONDARY CATEGORIES

Duty..................................	Obligations, Responsibility, etc.
Love..................................	Regard, Respect, Sympathy, Participation, etc.
Courage..............................	Motivation, Encouragement, Conviction, etc."

4.2.3.3. Principles of Good Architecture

Finally, Capon (1999a) uses his previous models of *elements of good architecture* and *causes of good architecture* in describing his principles of good architecture. This time, after Aristotle's model for good performance - *Spectacle* (awe), *Melody* (harmony), *Character* (sympathy), *Thought* (propriety), *Composition* (care), *Plot/action* (efficiency) – Capon abstracts *principles* from codes of professional ethics and adds them to the elements of architecture to arrive at a similar set of six principles of good architecture. He describes principles of good architecture under two categories and in six principles (Capon, 1999a, pp. 187-188):

"PRIMARY CATEGORIES
Principle 1: To the element of Form we should bring a requirement for Objectivity or Impartiality, to give: IMPARTIALITY OF FORM,
Principle 2: To the element of Function we should bring a requirement of efficiency and Economy, to give: EFFICIENCY OF FUNCTION,
Principle 3: To the element of Meaning we should bring a requirement for Propriety and Integrity, to give: INTEGRITY OF MEANING,
SECONDARY CATEGORIES
Principle 4: To give the elements of Design and Construction we should bring a requirement of Responsibility and Obligation, to give: OBLIGATIONS OF CONSTRUCTION,
Principle 5: To the elements of Context and Community we should bring a requirement for Regard and Sympathy, to give: REGARD FOR CONTEXT,
Principle 6: To the elements of Will and Spirit we should bring a requirement for Motivation and Conviction, to give: MOTIVATION OF SPIRIT."

The Author believes that Capon's effort in defining good architecture should be credited for, among many things, its attention to philosophy and attempt to form an architectural theory. However, his major point of reference in his studies – comparing architectural theories and issues with those of Vitruvius': *Firmitas* (firmness), *Utilitas* (commodity), and *Venustas* (delight) – deserves a second thought. Today there is a controversy over separating the three elements of Vitruvian description of architecture; separating commodity and delight seems to imply that delight serves no fundamental purpose. At least those interested in the subject of physical environment certainly agree that aesthetic functions must be perceived as among other functions served by the physical environment (Broadbent, 1975; Mukarovsky, 1981; Lang, 1987). Commodity and firmness are certainly major contributions to delight (e.g., a beautiful building gains its beauty very likely through the appropriate use of structural systems and its functional suitability. Professor Jon Lang states, "The mistake of too many modern architects was to believe that the two were the sole contributors" [to architecture] (Lang, 1987, p. 23). Capon further, in the second volume of his book, reviews some definitions of architecture expressed by a number of 20th century architects through their various texts in different years. Capon (1999a) makes an attempt to categorise their views under the three Vitruvian categories[6]. The Author has compiled these architectural definitions inside Table 4.1.

Table 4.1 Definition of 20th century architects of architecture. These terms are compared with the original Vitruvian categories (Introduced by Capon, 1999b, pp. 349-353, compiled by the Author)

Vitruvius, + 2000 years ago	***Firmitas* (Firmness)**	***Utilitas* (Commodity)**	***Venustas* (Delight)**
Geoffrey Scott, 1914	Construction	Convenience	Aesthetics
Auguste Perret, 1923	Material	Use	Beauty
Le Corbusier, 1923	Construction	Utilitarian needs	Custom/tradition
Le Corbusier, 1923	Construction	Needs	Mathematics/harmony
Le Corbusier, 1923	Constructing	Living	Conceiving
Le Corbusier, 1923	Economy	Sociology	Aesthetics
Walter Gropius, 1924	Technology	Economy	Form
Walter Gropius, 1924	Construction	Economy	Design
Walter Gropius, 1924	Technical	Economic	Aesthetic
Walter Gropius, 1924	Technical	Social	Aesthetic
Walter Gropius, 1924	Structure	Function	Intellect
Ludwig Mies van der Rohe, 1928	Technical	Economic	Cultural
Ludwig Mies van der Rohe, 1938	Material	Functional	Spiritual
Ludwig Mies van der Rohe	Technical	Economic	Architectural
ASNOVA, 1931	Technical plausibility	Economic feasibility	Plastic expression
Nikolaus Pevsner, 1943	Construction	Function	Style
Reyner Banham, 1960	Structural	Social	Academic
L. Benevolo, 1960	Technical	Social	Cultural
Christian Norberg-Schulz, (1963)	Technical	Functional	Aesthetic
Christian Norberg-Schulz	Physical	Social	Cultural
Christian Norberg-Schulz	Techniques	Building task	Form/semantics
Robert Venturi, 1966	Structure	Programme	Expression
N. L. Park, 1968	Construction	Function	Aesthetics
N. L. Park, 1968	Physical	Behavioural	Conceptual
George Baird, 1969	Technique	Function	Form
Charles Jenks, 1969	Technics	Function	Form
L. Ligo, 1974	Technics	Function	Form
David Canter, 1977	Physical attributes	Actions	Conceptions
R. Krier, 1982	Construction	Function	Form
M. Foster, 1983	Structure	Design	Style

Table 4.1. indicates to the Author that the most common definitions with respect to the three Vitruvian categories are that: *Firmness* would best correspond to some issues such as construction and technique; *Commodity* as economic/social; and *Delight* as form/aesthetic

[6] The original terms *firmitas, utilitas,* and *venustas* were, after a change in their order initiated by Alberti, interpreted by Henry Wotton as "commodity, firmness and delight".

issues in architecture. These findings will be applied by the Author, later in Chapter 6, when he introduces some design factors which influence an architectural design solution.

Although Capon's approach does not clearly define architecture, it is an indication of complexity of the issues involved in architecture. Therefore, it could be suggested that a 'good' architecture is a solution which would satisfy most of design issues in a harmonic manner. In short, the Author defines architecture as *the art of forming space*, however, in this definition too, each of the terms: *art, form,* and *space,* could represent a wide range of issues which deserve a full investigation. The variety of issues and concerns introduced about architecture, however, indicates to the Author that an architectural design solution should be developed by examining the interaction between different design issues. Most design issues influence one another and in order to develop a comprehensive design solution, it should be noted that designers need to consider all of these issues in an interactive manner. Therefore, the Author suggests that the process of architectural design requires a viable design methodology in which 'interaction' between different design issues plays a major role in it. Before developing an architectural design methodology, however, the Author needs to investigate more about the subject of architectural theory and how can they be developed by designers.

4. 3. Developing An Architectural Theory

Theory, in general, can be characterised by several attitudes towards the presentation of its subject matter: for the most part it is *prescriptive, proscriptive, affirmative,* or *critical* (Nesbitt, 1996). Prescriptive theory offers new revived solutions for specific problems; it functions by establishing new norms for practice. It promotes positive standards and sometimes even a design method. Proscriptive theory is similar to prescriptive theory, however, the standards state what is to be avoided in design. Functional zoning is an example of proscriptive theory. Critical theory evaluates the built world and its relationships to the society it serves. It often has an expressed political or ethical orientation and intends to stimulate change. In this chapter, however, the intention is to develop a better understanding about architectural design related theories which would assist designers in developing design methodologies.

The Author believes that design professions have a poor history of scholarship, in comparison with other professions, and they depend almost entirely on other fields for their knowledge base. Although some part of this is due to the interdisciplinary nature of design and architecture, the major part reflects the minimal enthusiasm of the architects in their attitudes towards reading and writing architectural literature. The reason for this shortcoming could be the prevailing tendency of most architects to use visual communication; many architects prefer to draw and build/create instead of read and talk about architecture.

With respect to the architectural thought process, Professor Jon Lang (1987, p. 3) argues "despite the rise of Post-Modernism in its many forms – a largely unidimensional change in design concerns – much of the current practice in the environmental design professions is based on ideas about architecture and urban design inherited from the major schools of architectural thought associated with the Modern Movement". He further gives a list of these schools which include: the *Futurists* of Italy, who were particularly concerned with "technology" and "new transportation" modes, the *De Stijl* group of Holland, the *Cubists* of France, the *Rationalist* and *Constructivist* schools of thought in the Soviet Union, who were concerned with "abstract expressionism", and the *Bauhaus* in Germany with its concern with "functionalism". In America, however, the ideas of Louis Sullivan and Frank Lloyd Wright influenced, but deviated from, the European schools of architectural thought.

The Author suggests, since the late '70s and early '80s, due to the growth of Post-Modernism, there has been a shift in the attitudes of many designers toward symbolic aesthetics and social concerns. This change of attitudes has developed much interest in the development of theories and investigation (for example see the collection of contemporary architectural thoughts compiled by Jencks and Kropf, 1997). Reviewing these thoughts suggest that together, theories and research could be, and have been, necessary tools for designers and architects.

Among the few recent architectural theory books (Capon, 1999; Nesbitt, 1996; Lang, 1987; Bazjanac, 1974), the Author has found Professor Lang's thoughts of defining and categorising architectural theory most comprehensive and appropriate for this research[7]. With regards to defining theory, Lang (1987, p. 13) describes it as, "...an ambiguous word. It means different things to different people. To some people a theory is a system of ideas or statements – a mental schema – that is believed to describe and explain a phenomenon or a group of phenomena. This schema may be an untested act of faith or, ideally, one that has been tested using scientific methods". He refers to this type of theory as "positive theory". The term *positive theory* is used because it consists of positive statements, assertions about reality. Lang further explains that "theory" is used in at least three other

[7] For example, unlike Capon's (1999a) one dimensional approach of viewing [at] architectural theory, Lang (1987) provides a broad view of architectural theories; and he stresses on the importance of conducting research – very much in the manner which the Author suggests.

ways. It can refer to a *model*, a way of perceiving reality that imposes a structure on that reality. Theory can also refer to a prediction that a certain outcome will be achieved by a certain action; such predictions have been referred to as *hypotheses* in this research. The other type of "theory" is a prescription for action which Lang calls *normative theory*, which is built on positive theories.

The two most influential types of theory, *Normative* and *Positive* theory, on the formation of a design methodology in architecture will be discussed here in order to draw a clearer picture on the subject of architectural theory.

4.3.1. Normative Theory

Jon Lang (1987) states that *Normative theories* are based on perceptions of how the world works, but they are based also on perceptions of good and bad, right and wrong, desirable and undesirable, what is working well and what is working badly. Normative theory is based on an ideology or worldview if this is not explicitly stated. The normative theory of many action-oriented professions, such as engineering, nursing, and architecture, generally consists of "deontic" statements. The reason is simple: having guidelines and principles simplifies the process of making decisions.

"Design principles", "standards", and "manifestos" are examples of normative theory in architecture. They are based on an ideological position to investigate what good architecture should be. One example of normative theory was discussed here earlier by introducing Capon's (1999a) investigation on defining "good architecture". In that investigation, Capon's discussion consisted of the overtly value-laden statements of philosophers, politicians, and architects, among others, on what ought to be "good architecture".

With regards to the deficiencies of the design principles, Lang states, "The design principles used throughout the design fields are based on some positive assertions about the nature of the built world and human experience. These assertions are based largely on the insights and personal experiences of the individual professional rather than on a well-formulated and systematic body of shared knowledge based on the systematic research and/or the cumulative experience of practitioners" (Lang, 1987, p. 16).

Designers' normative positions are based on what they know and believe about the world and how the design process should be conducted. "Normative positions are shaped by designers' world views, which are shaped, in turn, by the cultures – the broad societal and the narrower professional cultures – to which they belong" (Lang, 1987, p. 25).

Although using some 'norms' and 'standards' in design is necessary in some stages of the design process, however, it is not enough. The Author believes that "normative" theories could lead to unfortunate results in design and would limit creativity. An appropriate architectural theory in design should reflect the dynamic spirit of design by engaging investigation and designing for specific conditions of man and his environment. This way, the Author believes, designers could explicitly express their thoughts in design and the architectural solutions created by different designers would differ from one another.

The Author suspects that due to the underestimated role of the design process in architectural design education, "normative" theories were considered as the prevailing approach in many educational environments. But right now, students themselves do not settle for a "normative" approach, by which they would collect some facts and rules and develop a solution based upon their findings. Students seek to explore new possibilities in design and constantly look for alternative solutions.

4.3.2. Positive Theory

The term *Positive Theory* should not imply that it is also coincides with the tenets of positivist epistemology, which holds that no truth exists beyond the bounds of possible verification and falsification (Ricouer, 1977). The goal of positive theory is to avoid bias, to look for alternative explanations, and to apply the rules of scientific method to observation and explanation.

Positive theory, the Author suggests, could encompass designers' understanding of the natural and the built environments and their roles in people's lives. It is concerned with understanding the processes of design in which various design issues will be investigated and based on the conditions of the users and their environmental needs, some architectural design solutions are created.

Positive theory in the design fields, as for other applied decision-making fields, consists of two components, *substantive theory* and *procedural theory*.

4.3.2.1. Substantive Theory

Substantive theory is concerned with the nature of the phenomena with which architects and other designers have to deal with in their works. The concern is with the nature of the environment at both a molecular and molar level, its qualities and how it functions, and what it affords people for activities, physiological support, and aesthetic experiences (Lang, 1987).

Substantive theory can thus be divided into two principal and interrelated components, *natural environmental theory* and *person-environment theory.*

- "*Natural environmental theory* deals with the physical, chemical and geological nature of the surroundings of people and other organisms". Its goal is to describe and explain the nature of materials, the nature of geometry, the nature of structures, and the nature of the interplay between natural forces (wind, rain, sun, for example) and the artificial environment (Lang, 1987, p. 18).

- "*Person-environment theory* might better be called 'organism-environment theory', for it should deal with the description and explanation of what the three-dimensional layout of the environment affords different organisms for their habitats" (Lang, 1987, p. 18).

4.3.2.2. Procedural Theory

Procedural theory is concerned with the nature of praxis in the environmental design fields. It is concerned with design methodology, the study of the process of designing. In fact the objective of the development of procedural theory is to have a body of knowledge that can enhance both environmental design education and practice. "The processes of designing can be subjected to detailed, if not scientific, scrutiny, although they seldom have been. This does not mean that the design process can be scientific – by definition, design cannot be scientific. It means rather, that the process can be described and explained using the methods of scientific or quasi-scientific research" (Lang, 1987, p. 19).

The origins of positive procedural theory in environmental design seem to have begun with the work at the Hochschule for Gestaltung at Ulm during the period 1956-1965[8]. The concern there, however, was with making the process "more scientific" through the development of new normative models of the process, rather than with conducting scientific research on how the process is carried out and the results achieved (that is, the environmental quality) as a consequence of carrying it out in different ways (Wingler, 1969).

[8] There will be more on Hochschule work in Developing Design Methodology, in the following chapter.

Procedural theory, the Author believes, could be a promising approach for architects who are interested to seek and explore for solutions in design. It provides an opportunity for designers to take 'interaction' between different design issues into consideration during the design process. Instead of developing design solutions for the sake of producing a product, "procedural" positive theories introduce the importance of the interaction between design decisions in order to develop a comprehensive design solution. Those interested in building procedural theories, however, ought to turn to the literature in other fields and to their own experiences in order to develop some initial hypotheses about the process. For example, the Author in this research takes advantage of discussions in cognitive psychology, in an attempt to provide a better perspective on the human thought process during the design process (see Chapter 7).

Chapter 5
Reviewing Design Methodologies

5.1. Introduction

The terms 'design method' and 'design methodology' have been used interchangeably by designers and educators. However, the Author suggests that the difference between the two need to be acknowledged. The term *design method* refers to techniques and procedures of designing (e.g., the use of graphic method of communication during the design process); while, *design methodology* refers to a broad strategy, plan of action, and a process of choosing and applying particular design methods and techniques (i.e., utilising the realms of analysis, synthesis, and evaluation in the design process). Later in Chapters 10 and 11, there will be some questions asked from design educators with regards to 'design methodology' and 'design methods'. Although the responses to those questions indicate that many educators have a misunderstanding about the two terms, the Author will make an attempt to use these terms in their appropriate place, except for cases in which he is referring directly to some original texts.

Although the subject of the design process seems like a new concern of this past century, architectural history records that Vitruvius expressed his views about the process some two thousand years ago. Vitruvius (cited by Lang, 1987, p. 37), has stated: "architectural designing is the process of selecting parts to achieve a whole". Looking back through the history, architects and intellectuals have expressed some thoughts on the issue of the design process. For example, Alberti (1485) thought about the design process very much in the manner of Vitruvius, Descartes (1637) developed a set of ideas for structuring his own creative efforts in his Discourse on method. Following Descartes, architects such as Laugier (1753) described the process of designing as one of decomposing a problem, solving the components, and then synthesising the partial solutions into whole ones. Many refer to this as the rational method. This line of thinking has influenced designers up to the present time. Le Corbusier, for instance, describes his own design process in very much these terms in *vers une architecture* (1923). It is a decomposition/composition process involving a number of steps: the formulation of the problem in terms of the functions to be housed; the formulation of design standards; and the composition of these into built form.

Today's architectural values, however, after experiencing over fifty years of *Modernism*, are gradually shifting toward developing more respect for man and his environment. In order to understand man and his issues of concern, architectural theoreticians have to involve other related fields which are concerned with human studies and human sciences. With this respect, Professor Lang (1987) suggests that *behaviour scientists* who are concerned with man and his environment could be of great assistance to designers. This would indicate that the future design methodologies should seriously consider incorporating a better understanding about man and his environment.

Many architects and critics, today, suggest that the design process is a process of 'learning-by-doing'. They consider it as an experience of "reflection in action". This would suggest that both "reason" and "intuition" could play a major part in this process. Design methodology, therefore, is the field of study that is leading one to an understanding of these processes and of the overall structure of environmental design praxis and its subcomponents (Grant, 1975, 1982; Schon, 1984).

Based on the collected data, various types of design methodologies has been categorised by the Author under the two major models of: 'systematic' and the 'environmental' which will be examined in this chapter.

5.2. The Systematic Model

The Design methodology, as discussed earlier, provides a broad view of setting a strategy for dealing with design and is influenced by the philosophical theories of its time. Throughout the history of architecture, there has been a direct reflection of the social values and human needs in the product of architecture. In a way the Author suggests that architectural values can be judged by the social events, moral values, and peoples' needs at any particular period of time. For example, the high presence of the government and religious activities in people's life during the Middle ages and before that, could be compared with today's other social priorities in most people's lives in most countries. The results of the former developed an architecture with a focal point of cathedrals and religious buildings in comparison to the architecture of today with a variety of forms housing activities in relation to the current needs of a society (i.e., high-rise buildings, civic centres, and etc.). The architectural values of the first part of the past fifty years, the Author believes have been influenced by the post war reconstruction era and a crave for a simple and faster life style. These events in the Western world are best symbolised by Modernism which also introduced *International Movement* and *Modern Architecture* to the entire world. In architecture, the Modern Movement brought "...a tension between two apparently contradictory ideas – biotechnical determinism on the one hand and free expression on the other"(Colquhoun, 1981, cited by Nesbitt 1996, p. 254). Some features of the Modern architecture could be identified by the use of new materials and construction techniques, the use of *open plan* in design which influenced both residential as well as work spaces, and the use of machine and automobile which changed the scale of the spaces and the cities. The growing applications of Engineering activities during the 1960s, however, required some "systematic" and reliable processes in design. The Engineering methodology of design during that period greatly influenced other design fields, especially architecture. The architectural design process and architectural education for many years were under the influence of this methodology. In the Author's opinion, however, the Modern movement took place without a full understanding of the ramifications of their designs for environment or human behaviour. As a consequence, most buildings around the world which belonged to that theoretical perspective have been torn down or abandoned today. The Author sees this as an indication that the theories of the Fifties and Sixties are expiring – it implies more than mere regeneration of ageing building structures – and, as a consequence, the design methodologies have to change.

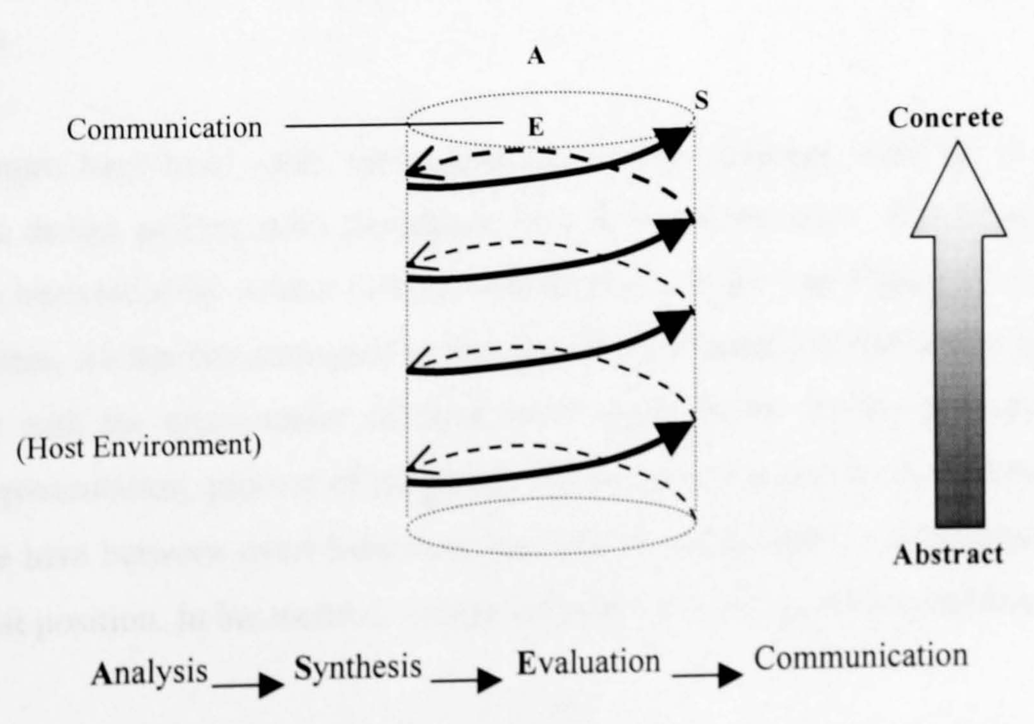
In dealing with the design process, there are many approaches today. Some designers, the majority perhaps, perceive the design process to be a purely intuitive, indescribable one. Others see it as a rational process, and still others regard it as an argumentative one. However, most critics, as Heath (1984), who look at the process agree that it is divided into a number of phases. Different people work through these phases in different ways. There are two specific approaches, however, which could be identified in the systematic model of design methodology which include: the 'stage-phase', and the 'rational' approach.

5.2.1. The Stage-Phase Approach

The Author has introduced the term *stage-phase* approach in design methodology to describe a group of processes in which activities are examined in a manner of procedures and sequences involving different stages of the process. In most cases, a linear procedure is involved which means the start of one activity is dependent upon previous activities reaching their end. Many models go into details explaining different phases of design, (Green, 1962; Culter and Culter, 1982; Sanoff, 1977; Preiser, 1978; Zeisel, 1981), though they often tell the designer more about what to do than about the fundamental intellectual activities involved in praxis; they are "normative" in character.

In reviewing the background of the design process, Professor Broadbent (1973) in his comprehensive book on *Design in Architecture*, states, "By the early 1960s, system engineering, ergonomics, operational research, information theory and cybernetics, not to mention the new maths and computing, were all available to the design theorist in highly developed forms, and influenced the emergence of design methods" (Broadbent, 1973, p. 252). These design methods were, and the Author believes in some cases they still are, the principles of design education in most architectural schools around the world. One advocate of these methods, Morris Asimow, (1962), wrote his book, *Introduction to Design*, the first book in a projected series edited by James Reswick, of the Case Institute of Technology, under the general title of *The Fundamentals of Engineering Design*. Asimow outlines a general process for solving problems, which he calls the design "process", consisting of: 1- *Analysis,* 2- *Synthesis,* 3- *Evaluation and decision,* 4- *Optimisation,* 5- *Revision,* 6- *Implementation*. In his text, Asimow (1962) distinguished two structures in the design process: a vertical structure involving sequential phasing activities, and a horizontal structure in the form of a decision-making cycle common to all phases (as shown in Figure 5.1). The chronological sequences of steps, or phases, in the vertical structure proceeded from a definition of need, through feasibility study, preliminary design, detailed design, production planning, and finally production itself. Furthermore, within each design phase there was a sequence: preparation for design, design of subsystems, and so on. Overall, the general process, or sequence of activities, was seen by Asimow to advance from abstract considerations to those that are more concrete and particular. Numerous feedback loops – relationships between phases along which information about the design situation was seen to flow – were incorporated to account for the observable trend of tracing back through the process in order to respond to new information or difficulties (Asimow, 1962).

Figure 5.1 Iconic model of a design process (Watts, 1966; Mesarovic, 1964 – redrawn by the Author).



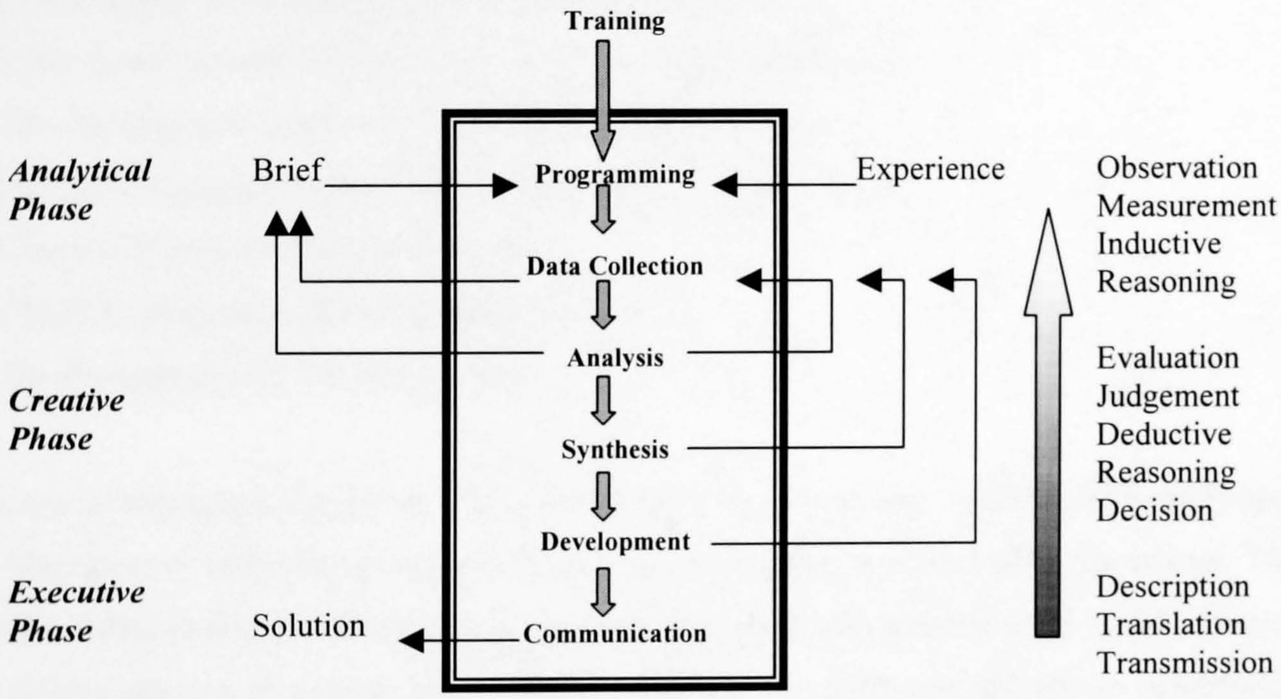
Asimow represented the horizontal sequences as a cycle that began with analysis and proceeded through synthesis and evaluation to communication (Asimow, 1962). He saw this cycle as repetitious, or iterative, both within and between the various phases of activity. Parenthetically, Asimow's speculation about the structure of design activity is roughly congruent with the "iconic model" proposed in various forms by Mesarovic and others (Watts, 1966; Mesarovic, 1964).

Similar propositions were advanced during the late 1950s/early 1960s by designers and theoreticians at the *Hochschule fur Gestaltung* at Ulm in southern Germany (Maldonado and Bonsiepe, 1964). In the work of Hans Gugelot, Tomas Maldonado and others, various staged-process models of design were proposed and used as a basis for design education and product designs for clients like Lufthansa and Braun (Maldonado, 1972; Broadbent, 1973). During Ulm's second "scientific design" stage, the "art" and intuition which had been stressed before were to be replaced by analytical methodology. Gugelot's design method was formed of six stages: 1- *Information stage,* 2- *Research stage,* 3- *Design phase,* 4- *Decision stage,* 5- *Calculation,* and 6- *Model making* (Gugelot, 1963).

In the meantime, the first *Conference on Design Methods* was held at Imperial College, London, in 1962. Broadbent (1973) indicates that the organisers included a professor of Building Science, two engineers, two industrial designers, an artist, a typographer, two architects and an agronomist. Although the conference was meant to bring in different professionals together and break down the barriers among activities, the final outcome was not too successful and each speaker was anxious to preserve the identity of its own profession, and keep outsider out. Many people presented papers in the 1962 conference including: Alexander, Norris, Thornley and Jones; whose works will be introduced in this chapter. However, as Professor Broadbent (1973) suggests, the common viewpoint of the conference on the process of design can be outlined as: 1-*Analysis*, 2- *Synthesis*, and 3- *Evaluation*.

Some attempts have been made, throughout the history of design methods, to equate the stages of a design process with the phases of a decision sequence. The most notable of which was introduced by Archer (1963), with feedback loops (see Figure 5.2.). As Figure 5.2. illustrates, Archer has attempted to plot the whole sequence of the design process in a flow chart with the enumeration of three interrelated realms for the process – namely external representation, process of activities, and the problem solver. A distinction begins to be made here between overt behaviour and the cognitive realm – a departure from the behaviourist position. In his method, Archer introduces a process which involves: *training,* *programming, data collection, analysis, synthesis, development, and communication,* with some feedback loops. These feedback loops help to break the linear system and allow for some review, though the Author believes this model does not allow a fully interactive process amongst all stages of design in a simultaneous manner; one stage still has to finish before another can start. Also, Archer's model of the design process limits interaction among design activities into specific periods and there is not a continuos interaction throughout the process.

Figure 5.2 Archer's model of the stages of a design process (Archer, 1963, redrawn by the Author).



Jones (1963) described one method which brought some new insights to the subject of the design process. He discusses design process as a method of resolving a conflict between logical analysis and creative thought. Jones suggests that one must be careful to separate out imaginative ideas and designs from logical statements of information and requirements. These may be kept physically apart, perhaps on opposite sides of the same folder. Jones' model, a spiral form, is similar to the Iconic model (in Fig. 5.1) of the design process introduced by Watts and Mesarovic (Broadbent, 1973).

Among similar proposals by other designers and theoreticians, the work of Denis Thornley (1963) at the University of Manchester deserves mention. His model, which clarifies the design process for educational purposes, was incorporated among the professional practices of the Royal Institute of British Architects, RIBA. *The Design Method in Architectural Education*, which Dennis Thornley described at the 1962 conference, was the result of studies initiated by him at the University of Manchester. According to Thornley (1963) design stages consisted of:

1- The Accumulation of Data.

2- The Isolation of a General Concept or "Form".

(a) The Essential Purpose of the building.

(b) The relationship of the Building to the Individual.

(c) The Relationship of the Building and its Occupants to the Surrounding Social and Commercial Pattern.

(d) The Relationship of the Building to its Physical Surroundings.

(e) Economics.

(f) Preliminary Consideration of Spatial and Formal Organisation.

(g) Preliminary Consideration of Structural Organisation.

(h) The Establishment of the "Form" into the Final Organisation.

3- The Development of the "Form" into the Final Scheme.

(a) Detailed Consideration of Spatial and Formal Organisation.

(b) Detailed Consideration of Structure.

(c) The Development of Architectural Values.

4- The Presentation of the Final Scheme.

The use of charts and diagrams, first introduced by Jones and later continued by the School of Manchester, initiated the importance of planning and programming in design. The Author believes that the development of charts and diagrams make a great contribution to the design process in architecture. The use of charts and diagrams affords an opportunity for designers to conduct a visual analysis of the elements of their designs. This way, designers could evaluate the relation between spaces and draw conclusions about the physical planning of spaces in a visual-analytical way.

The *Manchester Method,* first initiated by Thornley and later continued by Bell and Buttle, actually forms the basis of the *Process of Design* section in the RIBA *Management Handbook* (1991); which outlines:

1- Programming (brief, draft program, program)

2- General Study (meaning, form-finding, evaluation)

3- Development

4- Refinement

The RIBA Handbook also contains an alternative , *the Plan of Work.* It is not merely a sequence of events which an architect might work through on his own, but it indicates the contributions which other members of the team might make. The staging in the RIBA's Plan of Work is as follows:

A-Inception, B- *Feasibility*, C- *Outline proposals*, D- *Scheme design*, E- *Detail design*, F- *Production information*, G- *Bills of quantities*, H- *Tender action*, J- *Project planning*, K- *Operations on site*, L- *Completion*, M- *Feedback*.

Similar to Manchester Method, the design stages here comprise two cycles: a feasibility study, and the scheme design. However, there is a statement between stages "D" and "E" to the effect that the brief should not be modified after this point, and a further warning after detail design that *"any further change in function, size, shape, or cost after this time will result in abortive work"* (RIBA, 1991).

In the United States, The American Institute of Architects, the AIA, also describes the design process in a rather stage-phase fashion. According to Duerk (1993) the AIA's model of the design process includes the following six steps:

1- *Pre-Design*, including programming, feasibility studies, master planning, and developing prototypes;
2- *Schematic Design*, developing preliminary design ideas and concepts;
3- *Design Development*, providing architectural drawings and identifying architectural organization;
4- *Construction Documents*, including shop drawings, specification writings, and construction details;
5- *Construction Administration*, supervising construction and making revisions;
6- *Post-Design*, including post-occupancy evaluation, user's manuals, and evaluation research.

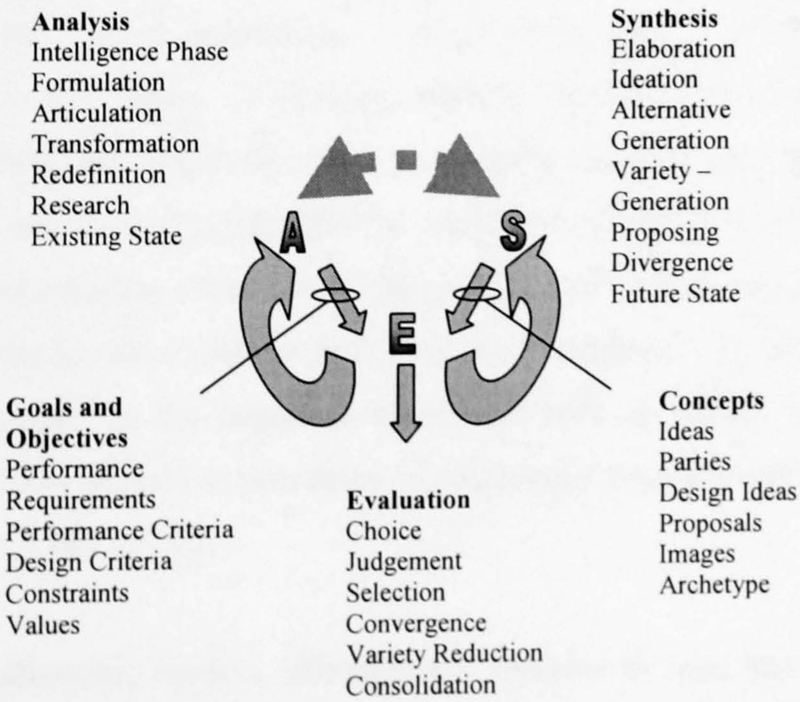
Many models of the design process are derived from an individual's own experience or are adapted from models of the decision process developed for other fields. A typical model derived from a practising professional's own experience was developed by Herbert Swinburne (1967). It is based on his office experience in designing buildings. Swinburne's (1967) phases are: *definition, analysis, synthesis, development, implementation, operation*, and *evaluation*. Among others, Mario Salvadori (1974) has a similar image of the overall process. He divides architectural praxis into *programming, schematic, preliminary design, working document*, and *construction phases*.

John Zeisel (1981) a sociologist concerned with environment-behaviour interaction, has conceived of the design process in somewhat different terms. He speaks of *imaging, presenting*, and *testing* to clarify the different purposes that information gathered during programming must serve. Imaging is the synthesis portion of the process, the development of a conception of what the future state must be. Presenting is the act of making the image available to other people, whether through drawings, modes, or computer videos. Testing is the evaluation portion, when the images (concepts) are determined to be appropriate or inappropriate for meeting the criteria set forth in the design program. Analysis comes in the form of gathering and using data from these three steps.

In most stage-phase design process approaches reviewed in this research, different stages were used to separate design activities and some procedures were adapted to indicate the priority of starting different activities. However, the Author argues with such linear models and does not find them comprehensive enough to capture the interactive nature of architecture to provide a sufficient design solution for complicated number of design issues.

One most notable model, and very similar to the Author's views, is introduced by Donna Duerk (1993). In her model, Duerk introduces an interactive process between *Analysis, Synthesis,* and *Evaluation*. In her model (see Figure 5.3), Duerk illustrates that good design ideas do not automatically follow analysis. Also, in her model, she emphasises goals and concepts in design and their relationships with each of the three major elements of the design process.

Figure 5. 3 The Design Process: Analysis, Synthesis, and Evaluation (Duerk, 1993, p. 18, redrawn by the Author).



The Author finds Duerk's model closest to his own interactive perspective on the architectural design process. In her model, Durek introduces the products of analysis as the goals and performance requirements (criteria for making choices) that are necessary to evaluate the concepts (design ideas) that develop from the synthesis activity.

Duerk sees a cyclical relation between activities which set no order of priorities. However, one major difference found between the Author's model (which will be discussed later in the following chapter) and Duerk's, is in the separation of activities. The Author does not agree with separating design process realms and putting them under specific categories of *Analysis, Synthesis,* and *Evaluation*. He would rather to define them as inseparable. For instance, in Duerk's model under *Analysis* one finds *Intelligence, Formulation,* and so on. Would there not be a considerable amount of *synthesis* and *evaluation* involved within *Analysis* which would influence *Intelligence* and *Formulation*? On the contrary, the Author suggests that in formulating design questions and design strategies, designers would involve their evaluative senses and/or perceptual judgements.

5.2.2. The Rational Approach

In many early models of environmental design praxis (those developed in the 1960s), the decision process is considered to consist of a discrete set of operations that take place in a unidirectional sequential order. These models owe a considerable intellectual debt to the "rational" models of decision-making in other fields (Simon, 1957, 1960, and 1969). They are perceived by some to be based on "the assumption that the ideas and principles of scientific method can be applied to them" (Bazjanac, 1974). In 1957 Newell, Shaw, and Simon published a paper entitled "Elements of a Theory of Problem Solving" that ushered in quite a different line of explanation. This position quickly became known as the *information processing theory* of problem-solving (Newell, Shaw, and Simon 1957). Instead of regarding the cognitive realm as eluding analysis and therefore irrelevant, proponents of the new theoretical perspective sought to explain problem-solving behaviour by way of basic information processes. "They maintained that an adequate explanation of observed human behaviour could be provided by a "program" of primitive information processes that account for the cognition associated with an action. In other words, the primacy of essentially cognitive processes in explaining problem-solving behaviour was reasserted" (Rowe, 1983, p. 51).

One of the most influential models, although now rejected by him, has been that proposed by Christopher Alexander (1964). His model, which is applicable to all the environmental design professions, divides praxis into two major phases: analysis and synthesis. The analytical phase in his approach consists of decomposing a problem into components that are as independent of each other as possible, establishing a hierarchy among them, and then finding patterns of the environment that meet the requirement of each component of the problem. The process of designing is seen as the synthesis of these parts into a whole. Alexander proposed some mathematical routines for the decomposition component of the analysis phase and introduced the concept of "pattern" as a way of linking problem components with solutions. It is the decomposition algorithm based on highly simplistic linkage criteria that Alexander has rejected; the concept of pattern as a central part of a designer's thought processes has been developed by him and his colleagues in a number of publications (1967, 1969, 1975, 1977, and 1979).

Lang (1987) describes Studer's (1970) model as one successful attempt which has attracted the attention of many architects and educators, since it is perceived as a general "ideal type" model against which any process can be measured. Studer's (1970) basic steps include:

1- Defining the requisite behaviour system;
2- Specifying the requisite physical system;
3- Realising the requisite physical system;
4- Verifying the resultant environment-behaviour system.

In modern architectural terms, the first step is to define the function, the second to design the form, the third to build it, and the fourth to evaluate the function-form relationship. Studer's model makes explicit many of the things designers claim they are doing intuitively in practice. The normative approach of Studer, the Author believes, is more like a computer program. It either works and one proceeds, or he/she has to back track and start all over. However, in architecture, sometimes the decisions are not so easily made. A more flexible model of the design process, which would allow for some interrelation between activities, is required.

Of course with the advancements in computer technology and programming, computer aided approaches to design could be categorised in this rational approach. One most recent event has been the establishment of Intelligent Computer-Assisted Design System (ICADS) which is in the CAD Research Center at Cal Poly, San Luis Obispo, California. This centre has been intensely focused on the design and implementation of collaborative decision-support systems. In these systems human decision makers and computer-based agents opportunistically assist each other in exploration, analysis and solution of problem situations in which there are many variables with complex relationships and dynamic information changes (URL–1, CADRC).

The basic problem with this approach, the Author suggests is the elimination of human capabilities, as a result of which, less attention is paid to the person-environment relationship. Variables in the computer knowledge-base system are limited to the inputs given by a programmer, and in a real life, there are far more complex issues involved in architecture. However, the Author welcomes the application of computers in the design process in its capacity as a tool to make the final decision-making easier for the designer.

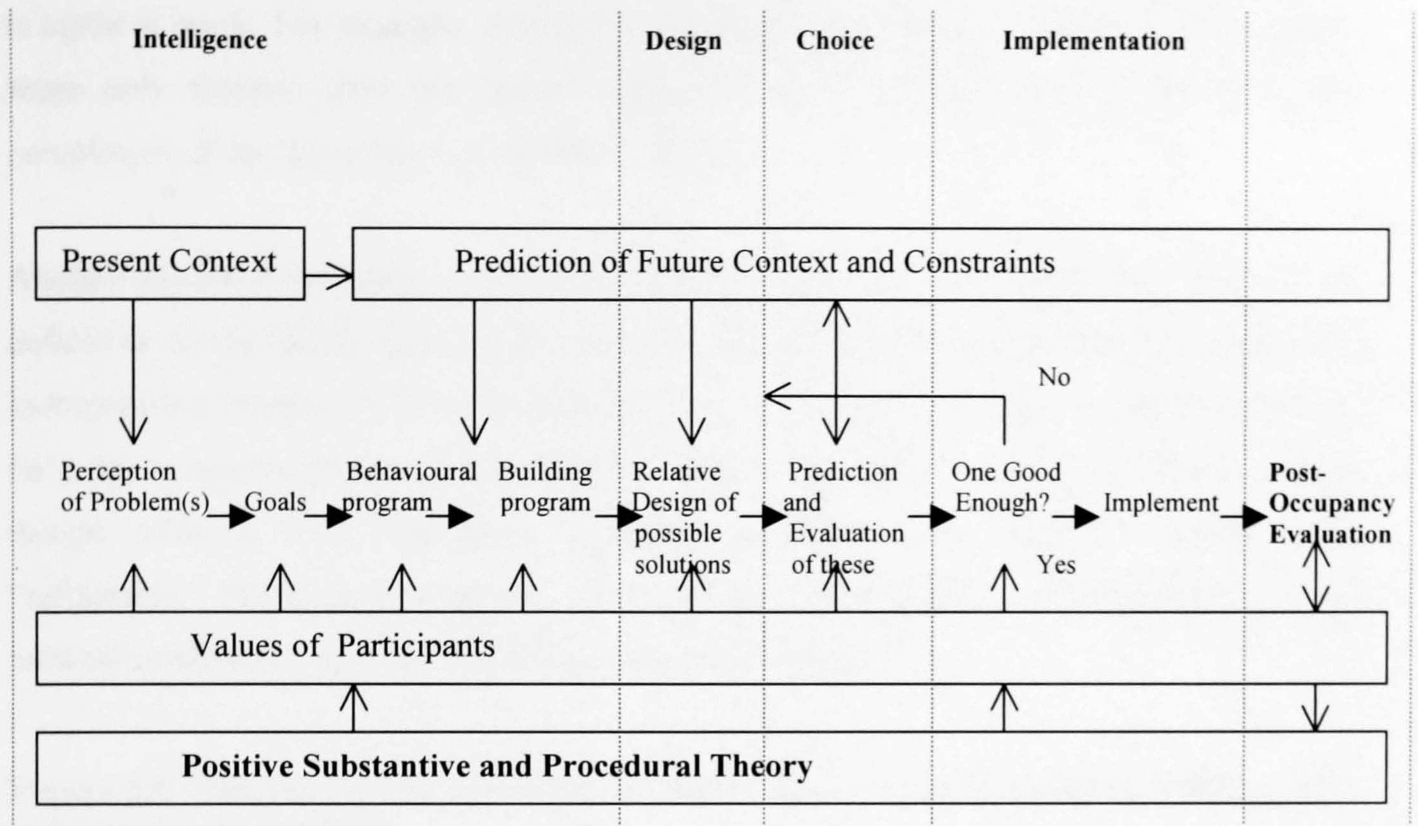
5.3. The Environmental Model

The term 'environmental model' is suggested by the Author to those design methodology models which reflect environmental issues in them and are concerned with the role of Human sciences in design.

One advocate of the environmental design concerns after Broadbent (1973, 1988), Bazjanac, (1974), and Zeisel (1981), has been Jon Lang (1987). He sees the design process as an argumentative process involving conjectures and evaluation of these conjectures. To develop a more generalised understanding of the decision process, environmental designers first turned to the work of cognitive psychologists and operations researchers – people such as John Dewey (1920), Herbert Simon (1960, 1969), and Churchman *et al.* (1967).

In these fields the decision process is broken down into a number of phases that go by different names but can be characterised as follows: an *intelligence phase* aimed at understanding what the purpose of the whole activity is; a design phase during which possible solutions are generated (or selected from a known set); a *choice phase* during which these solutions are evaluated; an *implementation phase* in which the decision is carried out, and possibly, a *postimplementation evaluation phase* in which results are evaluated leading to an intelligence phase, and so on. Lang (1987) claims that the major phases of the environmental design process can well be considered to be those of any general decision model, since environmental design is one of a family of decision processes. "*Intelligence, Design, Choice, Implementation,* and *Postimplementation Evaluation* are the basic phases of the environmental design process, although people more involved in professional praxis may prefer to call them *Programming, Design, Evaluation and Decision, Construction,* and *Postoccupancy evaluation*"(Lang, 1987, p.45). This process does involve a considerable amount of backtracking when more information is needed or when the designer cannot solve a set of design requirements simultaneously (Zeisel, 1981) (see Figure 5.4).

Figure 5. 4 A General Model of Design Praxis (Lang, 1987, p. 45, redrawn by the Author).



The goal of any Intelligence activity in design praxis, as Lang (1987) defines it, is to identify and understand the problems being addressed. He introduces these activities as:

Identification of the problem situation,

Identification of the groups of people,

Identification of constraints,

The formulation of goals,

Designing the behavioural program,

Designing the physical layout requirements,

Evaluating the present environment,

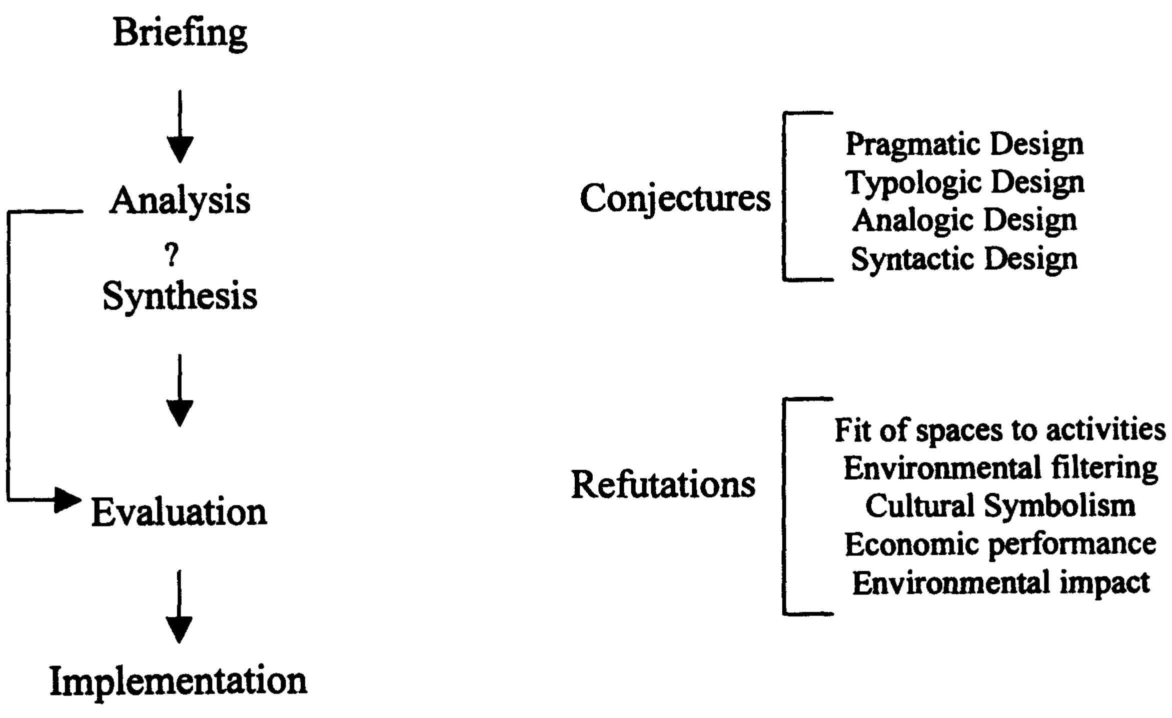
Designing building programmes.

The Author finds the environmental approach to be one of the most appropriate approaches since it shows that perceptions and definitions of a problem occur in a specific physical and social context. As indicated in Fig. 5.4, in this model, design proposals are created to work in this future environment, and their potential efficacy is predicted and evaluated in terms of images of the future. A decision is then made upon consideration of whether or not to go ahead with the scheme or to return to do more work on defining the problem. If a go-ahead is given, then detailed specifications, in drawings and words, of the potential solution are designed and evaluated. After this the design is implemented and some sort of post-occupancy evaluation takes place.

One criticism about this model, however, could be again the linear movement between the activities, even in its interactive form. As one notices, in this model too, a linear procedure is again at work. For example, during the *Intelligence activity*, the 'behavioural program' stage only follows *after* the 'goals' stage, which in turn, can only commence after completion of the 'perception of problem' stage.

Another model of the design process was introduced by Professor Broadbent (1988). In his definition of the design process, he provides one of the most comprehensive models by incorporating Popper's (1963) "conjecture" and "refutations" to the earlier models of the 60's. By "conjectures" he means different design types which influence an architectural design solution, i.e., Pragmatic, Typologic, Analogic, and Syntactic Design[1]. By "refutations", however, he examines the fit of spaces to activities, environmental filtering, cultural symbolism, and environmental impact (see Figure 5.5).

Figure 5.5 The environmental model of the design process (Broadbent, 1988, p. 467, redrawn by the Author)



Professor Broadbent (1988, p.459) explains how his model of the design process is different from those of so called "linear" ones. "The process I described was by no means a linear sequence. I presented, rather, a 'map' of 'design territory'". Later in the same text he underlines that the design process could start at any point in his model. The Author finds Professor Broadbent's model closest to his which will be introduced as an 'interactive' model of design methodology in the following chapter.

[1] For more on Design Types, see Chapter 8.

Chapter 6
An Alternative Design Methodology

6.1. Introduction

Since the 1960s and the development of great engineering projects in the world, a great deal of attention has been given to the problem of design methodology and the design process. Although at first design methodology used to be viewed as a branch of problem-solving, very soon architects and other designers discovered the need for a wider procedure by which they could explain their design thoughts. Many designers believe that the intuitive methods of design traditionally used by architects are incapable of dealing with the complexity of the problems involved in a design problem today. The Author suggests that in an architectural pedagogic environment, the need for a design methodology, due to the complexity of the issues involved in a project, is inevitable. However, it is necessary to select a design methodology which would not limit students' activities and/or creativity during the design process. In conventional design methodologies, different stages of the design process are outlined for designers as if they do not have any choice but to follow the sequential process. On the contrary, the Author is in favour of a design methodology in which design activities could be conducted in a simultaneous/interactive manner, without considering any priorities during the process.

In an attempt to propose an alternative design methodology, this chapter will first examine various definitions offered by architectural intellects on the subject of design methodology. It will also present a section on the influential factors for developing a design solution in order to introduce the interactive context of a design environment.

6.2. Developing an Alternative Model

Before presenting his alternative approach of defining a design methodology, the Author has put together some of the most valuable definitions of design methodology as reviewed in this investigation (see Table 6.1).

Table 6.1 Various views of the design process under the five-step model (Compiled by the Author)

	Intuition	Preparation	Proposal	Evaluation	Action
H. Rittel, 1972	•Identify the problem	•Collect info. •Analyse info.	•Creative leap •Work out solutions	•Test solution	•Communicate and implement
J. C. Jones, 1970 (Design method)	•Idea	•Information •Analysis	•Synthesis	•Evaluation	•Optimisation
AIA, (Duerk, 1993) (Basic and supplementary Services)		•Predesign services	•Schematic design •Design development		•Contract documents •Bidding •Administration of contract •Postdesign services
Guenter and Corkill, 1970 (Systematic Approach to Architectural Design)	•Basic definition •Preliminary program	•Investigation, analysis •Program abstraction	•Synthesis and development •Volumetric design proposal	•Reevaluation and modification	
Thornley #1, 1963 (Student design)		•Accumulation of data	•Isolation of general concept or form •Development of form		•Presentation of solution
Thornley #2, 1963 (Student design)	•Program formulation	•Investigation •Assessment of design possibilities	•Creation •Refinement and presentation		
G. T. Moore, 1970	•Problem identification	•Analysis of user needs •Programming	•Design synthesis	•Selecting from alternatives	•Implementation •Postoccupancy evaluation
M. Asimow, 1962		•Feasibility	•Preliminary design •Detailed design Plannig		
RIBA, 1991 Architecture services	•Inception	•Feasibility	•Outline proposals •Schematic design •Detail design		•Production information •Bills of quantity •Tender action •Project planning •Operation on site •Completion •Feedback
Geoffrey Broadbent, 1998	•Briefing	•Analysis	•Synthesis	•Evaluation	•Implemenation •Postoccupancy evaluation
John Lang, 1987 (Basic phases of the environmental design process)	•Intelligence		•Design of alternatives	•Choice	•Implementation •Postoccupancy evaluation

Table 6.1 illustrates various viewpoints on the subject of the design process or design methodology under the five stages of: *intuition, preparation, proposal, evaluation,* and *action* which tend to be common phases in all definitions. By reviewing Table 6.1, the Author found that various key tasks exist during each phase of a design methodology; they include: *Identification, Investigation, Analysis, Alternatives, Synthesis, Design, Evaluation,* and *Implementation.* The emergence of an important subset of identifiable common tasks is indicative to the Author that special consideration should be made to fully incorporate and respond to these key tasks in the formation of his own design methodology.

Although the above definitions help the Author to establish a concerning list of data related to design methodology, he finds these models insufficient to fulfil the complex nature of the design process. He suggests that most of these approaches tend to give directions to designers as far as showing them the priority of design activities and that could take away the creativity of a designer by feeling obligated to produce some type of work in a prescribed way. The Author believes that a directive sequential design process is not appropriate, at least not in a pedagogic environment, and that designers should be free to choose when and how to tackle a design problem. This criticism has long been with the early models of the design process, as Horst Rittel (1972) and Vladimir Bazjanac (1974) have expressed their disapproval with sequential design processes for over thirty years. Bazjanac for instance states: "The criticism of the early models of the design process can be summarised in the following way: (a) design is not a strictly sequential process, and (b) design problems are 'wicked'[1] and a linear step-by-step procedure applied to them cannot by itself yield any solutions" (cited by Lang, 1987, p. 43).

The complex nature of the design process has presented designers and students of architecture with a great challenge. Bryan Lawson (1993), for instance, argues that design process is rather a recent phenomenon; in the past much architecture was created by a less self-conscious process. Vernacular architecture of the past he states: "reflects an era of gradual stability when designs could evolve simply through a process of gradual modification. Such a process led to many artefacts of great beauty that continue to be much loved for their simple and direct expression of purpose" (Lawson, 1993, p. 7). He later in the same text states: "Nevertheless, design remains a nerve-racking business, and any sensible person would probably regard it as a ridiculous way to earn a living. There are no procedures that will guarantee a result in the infallible ways of doing things and no right answers. There is never enough time, and often you cannot get all the information you would like. Somehow it usually all comes out all right in the end" (Lawson, 1993, p. 10).

On the contrary, the Author believes that the design process has always been with man. Even in the vernacular architecture, which may seem a rather maverick and/or unintentional process of design. The design process does not have to involve all the charts and activities which were presented in this literature as key components. Rather, simply having an understanding of what happens during the process, can be of a great advantage.

[1] According to Horst Rittel (1972), there are three types of problems: *wicked, tame, and well-mannered*. By "wicked" he meant those problems that have no definitive formulation, no stopping rule for knowing when to cease asking questions about the nature of problems, no definitive set of operations to solve them or to evaluate solutions. Each problem is

The way in which a designer finds a procedure to fulfil his theoretical needs in reaching a solution is a matter of personal inspiration. It involves analytic as well as creative thoughts and activities of a designer, combined in a rather simultaneous way, to go through the process. Designing is a very delightful activity since it involves both the designers knowledge and their emotions. It is not a "nerve-racking" business and it is a very exciting way to earn money by pleasing one's own desires and those of the client.

One pedagogic approach for looking at the design process is to consider it as a learning process. In this process the designer tentatively formulates a hypothesis about the nature of the problem and then searches for a solution. The act of designing raises new problems or a redefinition of the problem. The designer keeps on learning more about the problems and more about the solution (Bazjanac, 1974). According to Colin Rowe (1983), the designer's role is similar to the work of detectives in novels. This view of design recognises that different people have different values and thus different images of good life and good architecture.

In order to understand people's values and needs, the Author suggests that designers ought to bring new measures to their design theories. The sets of design principles that traditionally have constituted architectural theory have been concerned primarily with the delineation of a system of logic in which the components of the environment are related to each other rather than to human experience. Where human experience is taken into consideration, as Lang argues, "...it is understood as the experience people are supposed to have, not what they do have (Lang, 1987, p. 16).

The Author believes that one great opportunity for designers to understand people, their values and their environment is through human sciences. Although the term *human sciences* has been expressed under different names: *behavioural science, environmental psychology, man-environment relations, environmental sociology,* or *human ecology*, the major task in all of them is common; developing an understanding of human activities, attitudes, and values. It could concern many fields such as human anatomy, anthropology, sociology, psychology, and even economics and political science. The fundamental goal of the human sciences is to build "positive" theory; they help one to understand the present and what the trends in society are. They can help designers to predict the outcomes of their design proposals for the future better than they do now. The creation of these proposals is not and cannot be a scientific endeavour.

---

unique and experimentation with solutions is impossible except in dealing with repetitive units.

Application of human sciences could contribute in several ways to design theory. These ways could be categorised as: (1) theories and models that enhance understanding of design processes and the relationship between people and the physical – particularly the built – environment; and (2) research methods. These could be accomplished through the two sets of design theories which already have been discussed; procedural and substantive theory. The former has to do with knowledge about the processes of analysis, creation, and evaluation; the latter, with knowledge about the world, people's use of it, the way people relate to each other in the world, and their attitudes toward it.

As mentioned earlier, the process of carrying out research could reveal new insights into a design problem, and designers ought to utilise it as a decision-making tool. The basic ways of obtaining information for creating design theory and for programming are through interview and observation. Though it should be noted that there are diverse ways of interviewing and observing, i.e., *systematic observation, statistical observation, behaviour mapping, measuring and scaling, time log, design log, questionnaire, survey, photodocumentation, group processes, squatters, focus group, case study, simulation, full-scale mock-ups,* and etc. (Sanoff, 1991; Duerk, 1993).

The Author would argue with those designers who refuse to use information from other sciences and get involved with research for fear that it would take the creative role of the design away from them. On the contrary, the Author believes that using interdisciplinary studies and conducting research would provide a broader perspective from which designers could better address design issues. The use of research has been with architects for a long time; many famous architects used to conduct research, basically by observation, to understand their clients, their environment and other design issues. For example, Hanna and Hanna (1987, p. 20) wrote of Frank Lloyd Wright, "Mr. And Mrs. Wright were able to observe our children as they played with Iovanna [Wright's daughter]; to note our habits of housekeeping, family cooperation, recreation; and to learn about our research, writing, and teaching" (cited by Duerk, 1993, p.40). Not every residential designer would get a chance to live with their clients and examine their behaviours, but the lesson gained from this example could be very educational for designers and young students who may never get to see the site or the people for whom they are designing for.

Through his personal teaching and practising experience in architectural design, the Author has found that no design theory could be presented without the consideration of its context. By context, he means all the influencing factors on a design solution (i.e., users, the environment, society, and etc.) which have an interactive relation with one another. He also sees a further interaction between the context of a design problem and the design process, very much like Asimow's "host environment" introduced in the previous chapter. The following section, therefore, is prepared to introduce the influential factors which constitute the context of a design process.

6.3. Contextual Factors

The term *contextual factors* is introduced by the Author to include all the elements which influence a design process and specifically, the architectural design solution. Design factor means any matter, concern, question, topic, proposition, or situation that demands a design response in order for an architecture to be successful. It is a topic that makes a difference in a particular design – a concern that requires the designer to take action and make decision. In architecture, design factors are consisted of several design issues. Some of the design issues such as circulation, safety, territoriality, privacy, image, energy use, flexibility, and visibility are considered as generic ones. Each of these concerns is valid for any building design, although the relative importance or priority of each issue will vary for each project.

Many architects refer to design issues and have developed a personal checklist of issues. Checklists of design issues may be found in the works of Pena (1987), Palmer (1981), Preiser (1985), Duerk (1993), and research topics listed by White (1972). The topics in these checklists cover a range of concerns including issues of response to the site, cultural issues, behavioural expectations, and building messages to be delivered.

Pena's "Problem Seeking" (1987) divides design factors into categories of *Form, Function, Economy,* and *Time*. Some of the issues listed are efficiency, security, identity, physical comfort, and maintenance.

Palmer (1981) surveys a number of programming models and creates his own format for organising information. He divides design factors into *Human Factors, Physical Factors,* and *External Factors*. His list of design issues includes such items as organisation (structure), circulation, energy use, and cost constraints.

Duerk (1993) distinguishes between *Issues* (e.g., Audibility, Circulation, Comfort, Convenience, Durability, Economy, …), *Facts* (e.g., Site, User, Context), and *Solutions* (e.g., Slopped roof, entry, …). She introduces her model of design issues as the categories for organising design information with *Facts, Values, Goals, Performance, Requirements,* and *Concepts* on one axis and the *Issue List* (i.e., privacy, security, territoriality, etc.) on the other axis.

The Author suggests that the interaction between these design factors with one another and with the design process develop the context and influence the environment of a design process. By compiling the findings of others, already discussed in this chapter and Chapter 5, and based on his teaching experiences, the Author has developed a list of ten design-factors. Each design factor includes various related design issues which influence the design process and the design solution. They include:

1. *SPACE AND USER:* Architectural issues concerning: Organisation of a space in accordance to the requirements of the *users*, (i.e., client, occupants, visitors, passer-byes,...)
2. *CLIMATE AND NATURAL FORCES:* Architectural issues concerning: Sun angles, temperature, precipitation, winds, earthquake, tornado, hurricane, flood, ...
3. *SOCIAL AND CULTURAL INFLUENCES:* Architectural issues concerning: History, religion, culture, arts, aesthetics, thoughts, designer objectives ...
4. *MATERIAL AND CONSTRUCTION:* Architectural issues concerning: Availability, durability, reliability, skills, knowledge, ...
5. *NATURAL ENVIRONMENT:* Architectural issues concerning: Geography, topography, soil, vegetation, ...
6. *BUILT ENVIRONMENT:* Architectural issues concerning: Neighbourhood, architectural characteristics, roads and access, utilities and infrastructures, ...
7. *BUILDING SYSTEMS:* Architectural issues concerning: Structural / Mechanical / Electrical Engineering.
8. *SENSORY SYSTEMS:* Architectural issues concerning: Views, noise, feelings, security, privacy, ...
9. *RULES AND REGULATIONS:* Architectural issues concerning: Country/State/City/Building regulations, ...
10. *TIME AND BUDGET:* Architectural issues concerning: Investments, interest rates, development opportunities, seasons, work hours, ...

The importance of these issues in forming a design solution will be examined later in Chapters 11 and 12 with the help of *questionnaires*. However, at this stage, it is more important to acknowledge the effects of these factors as the *context* where in the design process is directly influenced by them. Contextual factors include the environment which surrounds a designer's thinking process during the design process. In the design process, however, every design factor is interrelated to the one another. For example, the 4th *Factor*, *Material and Construction*, can never be judged or selected in an architectural design problem without considering the other nine factors. It is as important to consider the spatial quality of the material (1st Factor); as it is its appropriateness in a climate (2nd Factor), social acceptability (3rd Factor), appropriateness to its site (5th Factor), belongings to its neighbourhood (6th Factor), structural behaviour (7th Factor), visual appearance (8th Factor), permitted usage (9th Factor), and its costs (10th Factor).

The Author observes that decisions are highly interrelated in the design process and the designer needs to consider many items at once. Such a characteristic in the design process calls for an interactive mode of making connections between different realms of the process, and therefore, he is led to seek for an 'interactive' model of the design process.

6.4. The Interactive Model

Unlike the conventional models of the design process which look at this process in a sequential manner, the Author suggests that the design process should be looked upon in an interactive manner, moving back and forth between different design activities. In this model, the design process could be considered as a very personal activity in which a designer attempts to *understand* a problem, *idealise* alternatives, and *present* a solution. Although this statement suggests a three-step activity, these stages are not independent from the one another. The Author suggests that the acknowledgement of an interaction between these three stages under the influence of their context (i.e., the ten influencing design factors), would afford a better opportunity for designers to fulfil their design theory objectives. He describes each of the stages of his interactive model in the following statements:

- *UNDERSTANDING:* This includes *Identification*[2] of the problem, *Presentation* of images which already exist in the mind of the designer, *Evaluation* of those images, *Collection* and manipulation[3] of more data, *Analysis* of data, *Presentation* of ideas which are collected and *generated*, *Evaluation* of those ideas, and back to the *Collection* of more data, *Presentation* of more ideas, and *Evaluation* of those ideas.
- *IDEALISING:* This includes *Collection* and *Development* of *Alternative* ideas, *Analysing* those alternatives, *Evaluation* of ideas, *Selection* of the most appropriate solution.

[2] The *Italic* terminology's are adapted from the conventional models, listed in Table 6.1.
[3] By manipulation of data, the Author means to change data to fit the physical requirements of a specific problem.

- ***PRESENTING:*** This includes *Analysing* different methods of presentation and *Implementation* of solution, *Generation* and *Selection* of construction ideas, *Supervision*, *Revision* and *Evaluation* of the Post-occupancy.

Unlike the conventional models which separate the three realms of analysis, synthesis, and evaluation in a sequential process, the proposed model defines an interaction between the three realms of *analysis, synthesis,* and *evaluation* within each stage of the process. The problem with a sequential process is that designers are supposed to start a design project in accordance to the directed sequences (i.e., first they have to analyse a problem, then synthesise it, and then evaluate it). However, in the interactive model, designers can start at any stage and/or realm without any predetermined procedure. This model provides an opportunity for an interaction between the three realms within each stage in a simultaneous and inseparable manner.

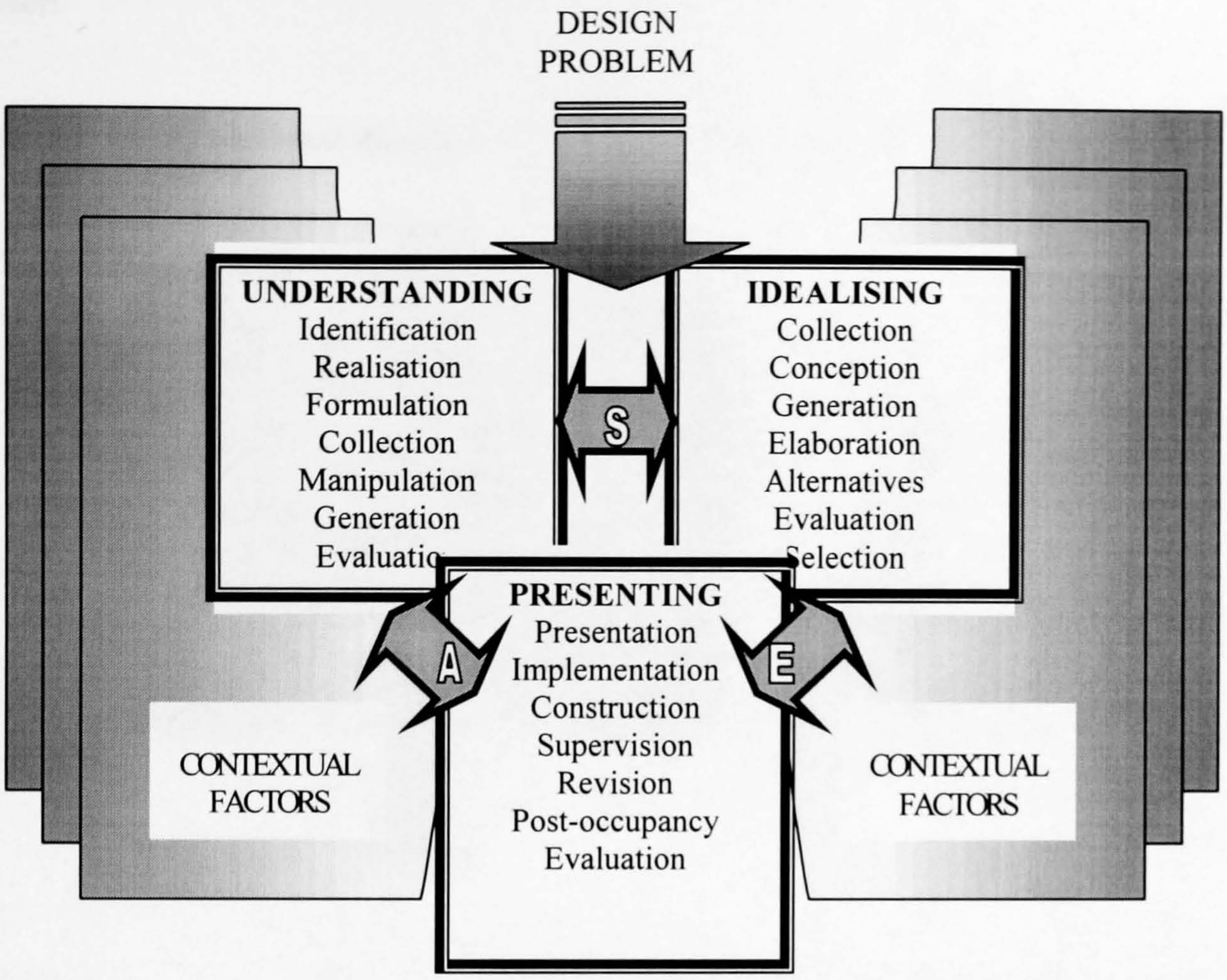
For example, during the *Understanding* stage, there is a need for generation and evaluation of ideas to take place in a collaborative form with the analysis of a problem. That means under the new model, students do not have to start on a project, let's say, two weeks by the site analysis and the next two by conducting precedent studies to see what others have done in the past. In the proposed methodology, students are encouraged to produce all design activities simultaneously. Meaning that they should analyse a site by developing working/spatial solutions for any specific site conditions, and conduct precedent studies in order to better analyse their given site and find design solutions for their design questions. Therefore, the major difference between the two approaches is that in the conventional process students are designing in a structured environment not knowing the link between different design stages/exercises, while in the proposed model, students are encouraged to use their time more efficiently and produce creative works through finding an interaction between different activities in the process.

The proposed model puts more demand on the educators' tasks requiring them to work just as hard as their students throughout the process. They need to deliver more lectures to the students, review students' design activities more regularly, and develop some creative design exercises in order to keep the interaction going[4].

Figure 6.1, illustrates the interactive design process model proposed by the Author in which the interaction between the stages of the model with their context is illustrated.

[4] For more on educators' strategies, see Chapter 13.

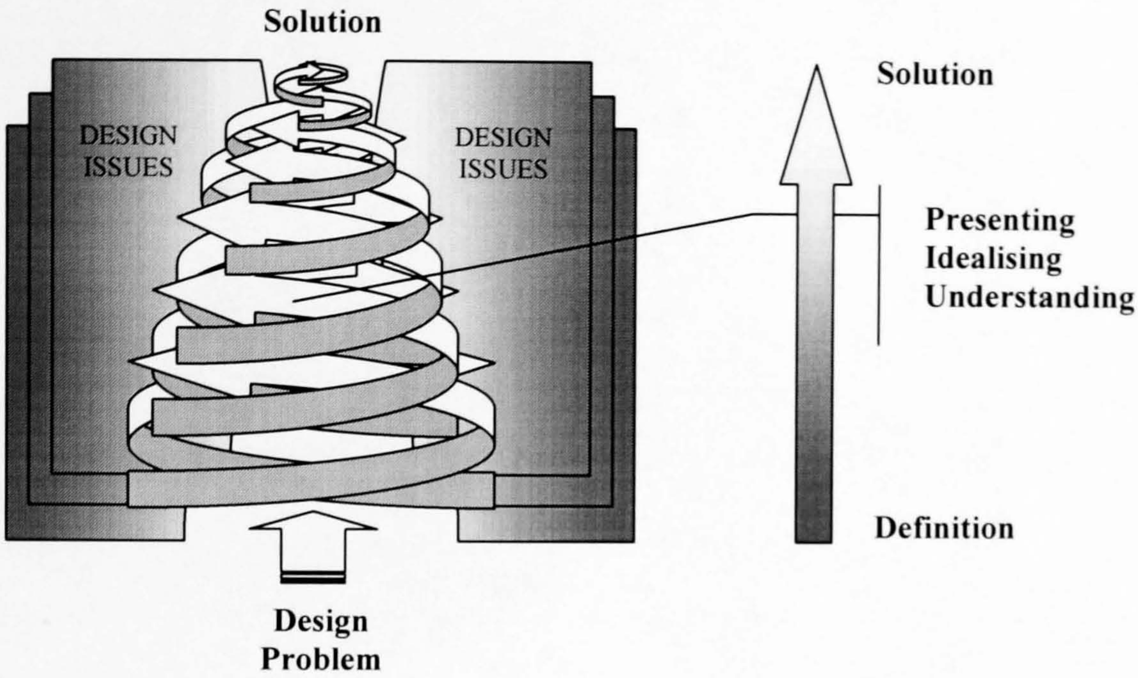
Figure 6.1 The Interactive Model of the Design Process, within the context of design factors (proposed by the Author).



In this diagram, the Author has overlaid the three stages of understanding, idealising, and presenting, indicating the inseparable interaction between the realms of analysis, synthesis, and evaluation within each stage. He has also illustrated an interactive relation between the products of the three realms indicating that the process enjoys a cyclic nature. Notice, when the *design problem* is entered, it does not go into the *understanding* stage, but it enters the entire cycle of *understanding, idealising,* and *presenting* stages simultaneously. By that, the Author intends to emphasise that a design problem could enter the process at any point (very much like Broadbent's description in the previous chapter) and an early solution could be generated at an early stage of the process. Very often the Author has observed that in his design studios, when he is explaining a new problem to students, some of them start drawing doodle sketches what appertaining to the problem he is outlining. This indicates that ideas could be generated before analysing a design problem.

As indicated in Figure 6.1, the proposed design process is surrounded by contextual factors which influence the design solution. The Author suggests that the number of the design factors decrease as the process proceeds from *definition* into final *solution*.

Figure 6.2 Cross sectional diagram of the Design Process (proposed by the Author).



Throughout the process, the Author suggests an interaction between the three stages of understanding, idealising, and presenting help designers to tackle design problems simultaneously. As the problem reaches a final solution the extent of design activities decrease and designers focus more on a final solution. Therefore, the perimeter of the cyclic design activities decrease and the proposed cyclic model, in three dimensions, takes the form of a cone. Figure 6.2 demonstrates that when designers start a project, during the identification stage of the project, the cyclic perimeter of the design activities is larger than when they approach the final solution. This 'conical' model is different from the conventional version suggested as the "iconic" model which was in a cylindrical form all the way through the process (see Figure 5.1 in the previous chapter).

In this diagram, the Author indicates that the three stages of understanding, idealising, and presenting, in a cyclic form move vertically, from *Definition* to *Solution*. Definition, in this model includes all the existing images and present ideas which already exist, or are collected, modified, and generated by the designer with respect to the goals and objectives of a problem[5]. Solution, on the other end, is not one final point; suggesting that the final solution in an architectural design problem is not an optimum solution but rather an attempt to approach a final solution. This is why when designers look back at their drawing boards, or even their finished spaces they usually are not satisfied with the final solution

[5] For more on images, see Visual Thinking in Chapter 8.

and they find some ways to improve them. Lawson, (1993, p.10) writes about design solution, "Unlike crossword puzzles, design problems do not have any obvious way of deciding when the design on the drawing board is the 'right' one. Like everything else to do with the design process, this is a matter of judgement supported by experience".

Chapter 7
Thinking and Problem-solving

7.1. Introduction

Designers' thinking process during the act of designing ought to be looked at more closely. Some studies already indicate that there are reasons to believe that understanding more about the human mind and his thinking process, would lead to a better understanding of events during the design process (Lawson, 1990; URL-2, Caldwell, 2000). Garcia, (1982) indicates that psychological theories suggest that creative acts depend on the nature of the brain and nervous system – certain abilities, for instance, are associated with certain components of the brain. It is also hypothesised that some people have better wired-in processes than others. It is a fascinating experience for architectural students, educators, and designers to review the methodological studies which the sciences can provide them throughout various stages of architectural education. Psychology, sociology and the other human sciences have a great deal to offer analyses which may be applicable in design. Most interdisciplinary discussions thus far have been made investigating the applications of philosophy in architecture; however, not too many studies have been conducted to review psychological applications in architecture. One particular interest of the Author has been the subject of cognition and human thinking during the act of the design process. This initial interest has turned into a necessity for a better understanding of his students and his design teaching in recent years. Obviously there are several issues involved in an architectural design process and in order for one to develop a solution, many obstacles must be overcome. To tackle these obstacles properly, designers need many thinking skills to analyse, synthesise, and evaluate a problem. It is necessary in teaching, especially in design, for the educators to activate students' modes of thinking to produce effective results. In this regard Edward de Bono (URL-3, 2000), states, "The habit of teaching 'Critical Thinking' is valuable but totally inadequate. There is a need for constructive, generative and creative thinking. Reacting and judging is not enough".

This chapter examines various subjects related to thinking and designing. First there will be a review of psychological theories and their applications in design. This will be followed by a section which examines thinking and various issues related to the way designers think.

7.2. Contribution of Psychology

In Western civilisation, interests in human cognition can be traced to the ancient Greeks. Plato and Aristotle, in their discussions of the nature and origin of knowledge, speculated on memory and thought. These early discussions, which were essentially philosophical in nature, eventually developed into a centuries-long debate. The two positions were "empiricism", which held that all knowledge comes from experience, and "nativism" (or rationalism)[1], which held that children come into the world with a great deal of innate knowledge. The debate intensified in the 17th, 18th, and 19th centuries, with such British philosophers as Berkeley, Locke, Hume, and Mill arguing for the empiricist view and such continental philosophers as Descartes and Kant [although he was not exclusively a "Nativist", he was trying to reconcile Rationalism and Empiricism] propounding the nativist view. Though these arguments were at their core philosophical[2], they frequently slipped into psychological speculations about human cognition (Anderson, 1995).

Thinking is an activity that has long intrigued psychologists and philosophers. The application of thinking in architectural design is involved in problem-solving, decision-making, and designing. In the development of theory about problem-solving[3], Peter Rowe (1987) indicates two distinct themes can be seen at work. Beginning toward the end of the 19th century with *associationism*, a mechanistic type of doctrine can be observed to recur that sought to explain problem-solving behaviour through the use of irreducible lawlike relationships deemed to govern mental processes. By contrast, other efforts were made to explain problem-solving in more behavioural and *nonmentalistic* terms. This chapter will review the background of design activities through the light of psychological influences on the schools of thought in design. This review will take form under the five most important events – Associationism, The Wurazberg School, The Gestalt Movement, Behaviourism,

[1] "Nativism" used for psychological discussions here is equivalent to "rationalism" used more widely in philosophical discussions.
[2] Some architectural educators are inspired by the thoughts of Philosophers such as Kant, not to mention the Phenomenology of Husserl and specially Heidegger, Derrida's Deconstruction etc.
[3] The term *problem solving* has been used by many authors, such as Rowe, to indicate the act of reaching a design solution. However, the Author differentiates between problem-solving in design and designing.

and Cognitivism – which have formed or influenced current design thoughts in architecture.

7.2.1. Associationism

At the turn of the century associationism was the prevailing doctrine in most quarters concerned with theoretical speculation about problem-solving. The associationist view of creative problem-solving was both *atomistic* and *mechanistic*. It was atomistic in the sense that it postulated that ideas took the form of elements, analogous to basic physical entities, and that these elements were hooked together from thoughts or insights about problems. It was mechanistic in the sense that simple laws of contiguity, again based on models of atomic structure in the physical world, were used to account for the association of elements – ideas – to form thoughts (Newell, Shaw, and Simon, 1957).

By 1900 a controversy developed between two opposing camps of experimental psychologists. On one side were the adherents of many of the basic tenets of associationism, such as Wilhelm Wundt, who maintained that mental images, sensations, and feelings were a necessary part of understanding and learning. For instance, after its introduction into one's language, a word will call up a picture in one's mind of what it stands for. On the other side were those, such as David Hume (1930) or the Austrian Brentano, who maintained a psychological theory that stressed the role of mental acts such as intending and focusing attention. For them a word, for example, has meaning not because it is accompanied by a mental image but because it is accompanied by a mental act (Boring, 1950; Bloor, 1983).

The Author compares associationism theories with the fact that designers associate certain architectural spaces with their existing pictures from those spaces in their minds. For example, in designing an amphitheatre, designers would automatically recall the great theatres of Roman period, with or without, considering the actual activities involved in those theatres.

7.2.2. The Wurazburg School

During the first decade of this century, speculation from the Wurzburg School in southern Germany, principally under Kulpe, Ach, and Buhler, began to replace the doctrine of associationism (Humphrey, 1963). Originally followers of Wundt produced results that suggested when subjects are given complex tasks such as translations, mental arithmetic, and problem-solving, they arrive at answers without any accompanying imagery or other sensations. Thus they tended to side with Brentano and the "act theories". From these findings a number of new and useful concepts emerged. Instead of the association of ideas, the Aufgabe ("task" and hence "determining tendency") was seen to be the controlling mechanism in problem-solving behaviour (Humphrey, 1963).

In his review of Wurzburg, Rowe (1983, p. 43) states, "One major technical contribution of the Wurzburg School was the use of systematic introspection as means of describing problem solving behaviour. Subjects were asked to reconstruct their sequences remained fresh in their memories. This kind of approach toward data gathering gained wide adherence during subsequent technical developments of the field".

The Author suggests Wurzburg's influence on architectural design could have originated the *form follows function* of Sullivan. When an architect is asked to design a space, one will most likely start by analysing the function of that space and generating ideas around those activities in order to design architecture.

7.2.3. The Gestalt Movement

The Gestalt movement in psychology, beginning in the 1920s with the work of Kohler, Koffka, Wertheimer, and others, has made a wide variety of contributions to the understanding of human thinking, not the least of which in their celebrated work on visual perception (Kohler, 1929; Koffka, 1935; Wertheimer, 1945). Gestalt is a German word meaning "form" or "configuration". Gestalt psychologists "… suggested that we perceive whole units rather than pieces of sensation, that the whole of a sensation is more than its parts" (Slavin, 1991, p. 132). In Gestalt argument, thinking can either be "…based on creating a new solution to a problem, [which] is called productive thinking because a new organisation is produced; …[or] on applying past solutions to a problem, [which] is called reproductive thinking because old habits or behaviours are simply reproduced (Mayer, 1983, p. 42). The main tool Gestaltists used for understanding the "highly complex mental processes, [productive thinking in their words] … was the idea that problem-solving involves recognising or restructuring the problem (Mayer, 1983, p. 77)." The proponents of the movement rejected the mechanistic doctrine of associationism, although they maintained the central value of phenomenal observation of environmental stimuli in explaining problem solving behaviour. An idea of holistic principles for organising information, embodied in the concept Gestalten, replaced the discrete mechanistic view of prior positions. (Rowe, 1983)

Among others, Bartlett (1961) sought to explain creative thinking in terms of the idea of schemata, suggesting that there are certain fixed arrangements within the brain, strongly associated with past responses to general types of stimuli or cognitive experiences (Bartlett, 1961; Broadbent, 1966). "We can also see that this position remains fundamentally mechanistic and mentalistic in its doctrine" (Rowe, 1983, p. 44). Gestalt theory postulates the existence of mental processes that are capable of global apprehension and synthesis; these processes occur simultaneously and are affected by the value structure of the social environment. While these views are disparate, they do suggest certain characteristics of the intuitive processes at work in the brain (Garcia, 1982).

Gestalt theory focused especially on perception, rather than on thinking or learning, and the importance of perceptual organisation was particularly stressed. Thus, in dealing with thinking and problem-solving, as Gilhooly (1996) suggests, the Gestalt theorists emphasised the way in which the problem was perceived as a determining factor in task difficulty. "The solving process was described as one of perceptual restructuring in which the problem comes to be seen in such a way that the solution is obvious" (Gilhooly, 1996, p. 6). For the Gestalt theorists problem-solving involved 'insight', which was an appreciation of how the solution was necessitated by the nature of the problem; this insight would come through a restructuring of the subject's perception of the problem.

One application of the Gestalt psychology's "wholeness" theory in architectural design, the Author suggests, may be traced when designers generate overall pictures of their thoughts about a design. For example, when a designer is involved in design of a shopping centre, one uses modular blocks to represent different department stores during the master planning stage. Although these blocks are representing different floor plans and different activities, this generalisation/simplification of forms helps designers to reach to a final solution by looking at the design problem as a whole and developing initial solutions for it.

7.2.4. Behaviourism

The early behaviourists (e.g. Watson, 1913) changed the focus of psychology from conscious experience to observable behaviour (Gilhooly, 1996). Looking briefly at the history of psychology shows that "behaviourism" arose in the early twentieth century in reaction against structuralism and functionalism, two approaches to psychology that focused on the study of conscious experience. The chief methodology of these approaches was introspection or self-report of one's own thoughts and images. Early behaviourists such as John Watson and Edward Thorndike regarded the study of conscious experience as a dead end and the method of introspection as non-scientific. According to behaviourism, the proper subject matter of psychology is activity rather than structures. All behaviourists are concerned with analyses of observable stimulus and response events. The methodology for behaviourist learning theorists is primarily the scientific experiment in which stimulus variables can be objectively manipulated and response variables can be reliably measured (Hamilton, et al., 1994).

The behaviourist position began as a reaction to what proponents termed the mentalism of earlier doctrines. Peter Rowe (1987) indicates that behaviourism was a fundamental rejection of all attempts to study inner mental processes in which distinctions were made between a concept of mind and a concept of body. Instead, the behaviourists postulated that human behaviour, including problem solving, could only be adequately explained in nonmentalistic, concrete terms. By concrete terms they meant observable, measurable, and replicable patterns of physical behaviour.

Investigations within this position quickly gave rise to the now familiar stimulus-response, or S-R, models of behaviour, founded on the assumption that given a particular external stimulus, one could predict a certain response with complete assurance. Therefore, from the standpoint of the working methods of the behaviourists, mental processes did not matter. Behaviourists embarked upon a far-reaching program of correlating environmental stimuli with what they could document as consistent patterns of behavioural response. This position took strong hold in psychology and related disciplines, especially in the United States after Watson returned from Europe in 1913, bringing the central ideas out of the laboratories of Pavlov and the like (Watson, 1930).

Behaviourism reached its apogee in the work of Skinner during the 1930s and 1940s and became generalised, even popularised, into the idea that behavioural malfunctions and pathologies could be cured by appropriate environmental modification (Skinner, 1953). In the more specific realm of problem-solving theory, the behaviourist position gave rise to, or certainly supported, the development of phase, or rigid-state, models of creative problem-solving behaviour (Arieti, 1976; Ghiselin 1952; Gregory, 1966). The aim behind the models was to identify and describe each phase and the sequence of phases. Although a number of variations were developed, each model in one way or another incorporated four fundamental steps, or discriminable phases of activity. They were (1) *preparation* for the task or situation at hand, (2) *incubation*, (3) *illumination* or inspiration, and (4) *verification*, involving the testing of proposed solutions. These phases, were later described (Dickerson and Robertshaw, 1975; Lang, 1987) as the four basic processes involved in the creative work in design in which:

- "*Preparation* refers to intelligence activities,

- *Incubation* to the largely unknown intellectual processes that involve the digestion of perceptions of the problems and the development of scenarios for searching for a solution,
- *Illumination* refers to the apparent insights the designer has into the nature of the problem and its potential solutions,
- *Verification* is the process by which the designer concludes that a viable potential solution has been found" (Lang, 1987, p. 57).

This general view of problem-solving activity dominated the literature in the field, at least within the United States, for several decades, until the end of the 1950s. Theoretical enterprise was strongly based on the observation of human behaviour. At the same time there were, of course, some exceptions to this position. Koestler's speculations about creative thinking arising from the "bisociation of two mutually incompatible contexts" hark back to the Gestaltist idea of schemata. To summarise Koestler's view: (1) normal thought proceeds within a frame reference, associative context, or type of logic; (2) in normal personal dealings one operates within many such frames of reference, but only one at a time; and (3) creating involves relating two normally independent frames of reference, or in Koestler's terms the "bisociation of matrices" (Koestler, 1964, Perkins, 1981). The "Behaviourist Learning Model" defined by Koestler includes: Gradual learning by trial and error, Acquisition of skills through reinforcement, Chained responses stamped in bit by bit, and Motivation = reinforcement by need – or drive-reduction, or anticipation thereof (Gage and Berliner, 1991).

The Author suggests implications of Koestler's Learning Model could be viewed in the architectural design process. For example in design of a house in a hot and arid climate, Koestler's "gradual learning by trial and error" may be viewed in the testing of different directions which the floor plan could be oriented toward the sun; "acquisition of skills through reinforcement" can be observed in the use of computer applications in calculating heat gains of the building; "chained responses stamped in bit by bit" may be characterised as using an overhang roof and other shading devices on the facade of that house in order to reduce the solar gain; and finally "motivation = reinforcement by need – or drive-reduction, or anticipation thereof" can be portrayed as motivating students to consider natural cooling systems in their design in order to cut on energy costs.

7.2.5. Cognitivism

While behaviourism was primarily a movement of American psychology, cognitivism has been more heavily influenced by European psychology – first by the German Gestalt movement of the early twentieth century and then by Swiss psychologist Jean Piaget and Russian psychologist Lev Vygotsky. American cognitive theorists, such as Tolman and Bruner, and information processing theory have incorporated European influences yet maintained their own distinct brand of cognitive theory.

As behaviourism arose out of a negative reaction to mentalistic approaches that had previously characterised psychology, "cognitivism" arose out of negative reaction to behaviourism. Specifically, cognitive psychologists eschew the behaviourist approach of analysing behaviour into molecular or elemental units. They believe that such reductionism is too simplistic to provide adequate explanations of complex human behaviour. In addition to viewing behaviour in more moral or global terms, cognitivists also insist that human behaviour is purposeful and goal directed. A third major difference between the two perspectives is that the cognitive approach focuses mainly on processes such as perception, thought, and consciousness and looks at behaviour only to infer laws of mental activities. The behaviourist approach is primarily focused on formulating laws of behaviour per se. A final way in which some cognitivists differ from behaviourists is in their willingness to postulate complex explanatory concepts that are not always clearly and precisely linked to objective stimulus and response variables (Anderson, 1996).

Gilhooly (1996), in his description of cognitivism indicates that cognitive psychology broke away from behaviourism in response to developments in information theory, artificial intelligence, and linguistics. He suggests that the currently dominant information-processing approach takes the computer as its key metaphor for the mind. In cognitive aspects, this approach sees people as computer-like systems that code, store, retrieve and transform information. Within this approach, models for thinking in particular tasks have been proposed in greatly varying degrees of details. An intermediate level of analysis in terms of broad steps and decisions (flowchart level) has been the most prevalent and useful. Most information-processing models for various tasks accept certain limitations on cognitive capacities. More specifically, it is generally accepted that processing is serial at the problem-solving level and that, while long-term memory is vast, working memory is very limited. These memory and processing limitations are key elements of what Gilhooly (1996) refers to as the "standard model" for thinking.

Robert Sternberg (1997) suggests that cognitivism views the mind as a super-sophisticated computer. Some cognitivists emphasise the step-by-step nature of human thinking, others the fact that many operations can occur simultaneously or in parallel. But the computer metaphor unites almost all of them. And as in the past, psychologists such as Philip

Johnson-Larid (1988, 89) have argued that today's metaphor is the final one – that now we understand how the mind works.

The Author suggests that the differences between the behaviourists and cognitivists somehow reminds one of the changes that architectural design education has gone through during the past century. This comparison may be highlighted by the Beaux-Arts school of design influence since the beginning of the last century until recently which encouraged the intuitive methods of producing an end product as the most valuable part of design. In contrast, the current design methodology exercised in most schools tends to give credit to the actual process which a student goes through in order to solve design problems and develop a design solution. Today's solutions could address far wider range of issues than once was considered under the Beaux Arts' "hit and miss" search for the outcome (Lawson, 1990). The demand for such a process is due to the complexity of the issues involved in architecture and it deserves a thorough understanding and consideration of all issues influencing man, his natural – and built-environment.

The goal of cognitive psychology is to understand the nature of human intelligence and the mechanisms governing human thought. It is not yet known in sufficient detail how intelligence is organised in the brain. Nevertheless, the human mind is a particularly interesting device that displays remarkable adaptiveness and intelligence. Later in this chapter there will be an attempt made to discuss human brain, its nature, and its contribution in architectural design, however, the following section will first look at the subject of thinking and introduce its various forms.

7.3. Thinking and Creativity

The term 'thinking' refers to a set of processes whereby people assemble, use and revise internal symbolic models. These models may be intended to represent reality (as in science) or conceivable reality (as in fiction), or may even be quite abstract with no particular external interpretation intended (as in music or pure mathematics). With respect to the growing events in psychology which have influenced designing throughout the years, looking back a bit farther there is evidence indicating that thinking and design have been an issue of concern for many years. Professor Broadbent (1995, p. 11) introduces Plato's five ways of thinking as:

"*The Intelligible World*: The world of the intellect in which ideas can be developed-as in geometry- by the sheer exercise of reasoned thinking…

The Sensible World: the world of the senses in which we gain from experience of the world around us. But the senses may be deceived by optical illusions, hallucinations, conjuring tricks and so on, therefore we cannot trust them.
Divine Revelation: the belief in some kind of God, possessed of all knowledge and maker of all that exists in the world.
Pragmatics: the use of models or other mechanical devices.
Creative Imagination: on the grounds that artists and poets think in ways which again may subvert his 'pure intellect'".

Later on the same text, Broadbent suggests, "There is no way an architect can work at the level of pure thinking entirely in Plato's 'Intelligible World', nor can he ignore the World of the Senses; indeed everything he does is going to affect the senses of those who use his buildings. One hopes that he will display a few things more pragmatic than the actual processes of building as well as creative imagination. And in the most sublime of cases, no doubt Divine Revelation".

One clear issue in designing, however, indicates that creativity plays a major role during the design process (Lawson, 1990; Broadbent 1988), and creative thinking is an essential part of the design. There are many definitions for creativity, the Author, however, prefers to define it as 'an original and better solution to a problem'. But in order to be creative in design, the Author argues that there are two major elements which deserve close consideration: the creative people, and creative approaches of dealing with a design problem. Each of these issues need to be studied closely by educational planners. Professor Lang (1987, p. 59) suggests, "the research on creative people may tell us something about the attitudes required to think creatively; the research on the processes may suggest how we can develop our own thought processes".

Research on creative designers is most closely associated with Donald MacKinnon (1962, 1963, and 1967) and Frank Barron (1965). Creative architects – those whom the members of the profession regarded as the most creative – were found by MacKinnon to be highly productive and highly intelligent people with a great need for achievement. They are also people who value their independence highly, have a high degree of tolerance for ambiguity, value intellectual and cognitive matters, and who are very concerned with their adequacy as individuals. It must be noted that high intelligence (as measured on standard I.Q. tests) may be a prerequisite for creativity; but it cannot be equated with high creativity. In other words, one could be intelligent but not creative (Lang, 1987; Lawson, 1990).

Creative thinking, on the other hand, is an essential part of the design process. Rickards (1980) has reported on a discussion at the Manchester Business School where two points of view were held. Is creativity part of the design process, or design was part of the creative process? Whatever the case may be, the Author believes that the important issues of creative thinking, by the students, and creative methods of design – based on creative approaches taught by educators – should match one another. In this regard, he suggests there should be some investigation into the way people think. The following section, therefore, will introduce different types and styles of thinking in order to develop a better understanding about the thought process required in architectural design.

7.3.1. Types of Thinking

Thinking is an internal symbolic activity. This activity may be tightly directed to specific goals, as in problem-solving, or it may be free-floating, as in daydreaming. Thinking directed towards problem-solving involves exploring a symbolic model of the task to determine a useful course of action without overt, and possibly costly, trial and error. Following Duncker (1945), problems were defined as arising when an organism has a goal that it does not know how to reach.

Problems can vary in the degree to which they are well or ill defined. Most research has focused on well-defined problems (drawn from puzzles, games, logic, maths) but it is hoped that results from these studies will be relevant to ill-defined problem-solving to extend that people such problems by first converting them into well-defined variants. The Author suggests that architectural design problems contain both well-defined (i.e., what types of spaces are required in design of a house), and ill-defined problems (i.e., how to put these spaces together to respond to the needs of the users and other requirements of the project). Gilhooly (1996), however, suggests that there are "adversary" and "non-adversary" problems. In non-adversary problems the solver has to manipulate inert materials (concrete or symbolic) to reach a goal, whereas in adversary problems there is an additional layer of complexity caused by having to counter a rational opponent whose goals are contrary to those of the solver.

Another distinction that has become increasingly important in problem-solving research is that between "semantically rich" and "semantically impoverished" problems (Chi et. al., 1982). In semantically rich problems, the solver brings a mass of relevant knowledge to bear, but in semantically impoverished problems, the solver has little or no prior knowledge to solve the problem. After a long period of neglect, the solving of semantically rich problems has become an area of intense study in psychology over the past decade. In the architectural literature of the past decade, too, the application of semantics has been widely used by the architects and architectural critics in explaining design directions (Papadakis, Broadbent, and Toy, 1992).

In general thinking types could be categorised into three major groups of: problem-directed thinking, undirected daydreaming and creative thinking (Gilhooly, 1996). Each of these types of thinking will be briefly introduced in the following sections.

7.3.1.1. Directed Thinking

Directed thinking is associated with solving small-scale well-defined non-adversary problems such as puzzles. The person faced with a novel laboratory puzzle spends some time building up a symbolic model of the task materials, available operations and the desired goal (Simon and Hyes, 1976). Two kinds of problem representation that could be used in modelling a problem are state-action and problem reduction.

With a state-action representation Gilhooly (1996, p.56) describes: "the solver explores the consequences of alternative actions forwards from the starting state", whereas for the problem reduction representation he suggests to break the overall problem into "more manageable sub- and sub-sub-problems". For example, the application of the "state-action" representation in design of a large art gallery, the Author suggests, could be to start the design task by developing various conceptual images for the gallery instead of designing from the inside requirements of the spaces. On the other hand, in a "reduction" representation approach, a designer could break down the problem into smaller segments. Therefore, instead of dealing with the design of a large art gallery at once, he/she could begin reviewing the characteristics of smaller exhibition areas and study the most appropriate ways to exhibit each artwork and/or the way to visit them.

7.3.1.2. Undirected Thinking

From early times a distinction has been made between broad kinds of thinking. According to this distinction, on the one hand there is thought directed toward some end or goal, and on the other hand undirected thought, such as occurs in daydreaming. A related influential distinction was made by Freud (1900), between primary and secondary process thinking. Primary process thinking is characterised as wish fulfilling, unfettered by logic or reality, and operating in accord with the pleasure principle of immediate gratification (though the gratification obtained may be in imagination only). Secondary process thinking, in contrast, is reality respecting, seeks real rather than imaginary satisfaction and is governed by logic. Secondary process thinking also ultimately serves the pleasure principle but does so with due respect to the reality principle of obtaining what is possible and safe, deferring gratification when necessary. In Freud's theory, night dreams are nearly pure representatives of primary process thinking and daydreams predominantly so, while real problem solving would predominantly involve secondary process thinking. Similar distinctions have been made by many writers throughout the history. Later in this chapter, a selection of such distinctions between the two kinds of thinking will be illustrated in Table 7.4.

As Klinger (1978) has argued, thoughts may be independently, directed or not, realistic or not, related to current external stimuli or not, and so on. Of these characteristics the major feature of daydreaming seems to be a lack of persistent direction. Daydreams are not necessarily unrealistic but tend to drift from one topic to another, whereas thinking in problem solving is checked against feedback concerning progress toward the current goal and attention is 'locked' on to the problem materials (Klinger, 1971).

One application of undirected thinking in design, the Author suggests, could be illustrated by students' design ideas which are generated regardless of the restricted project programme. The Author considers these undirected thinking experiences quite valuable during the design process and students and educators of design should invest more energy and time to stimulate these thinking experiences and benefit from them in design exercises.

7.3.1.3. Creative Thinking

Gilhooly (1996) suggests one way to study about 'creativity' is to study about the thinking type that generates creative products. He assumes that creative products are defined as being both novel and valuable, in some way. Studies of individuals acknowledged to be creative (i.e., to have a tendency to make creative products) noted tendencies towards dominance, radicalism and high intelligence as conventionally measured (Cattel and Drevdahl, 1955). In the sciences, creative individuals tended to be first-born or only sons (Roe, 1952). Artists and writers do seem to display higher than average rates of manic depression and more than the general population (Jamison, 1995). Aspects of manic thought promote rapid work and unusual associations which may be beneficial.

Personal accounts by scientists and artists suggest four broad phases in creative work that Wallas (1926) labelled "preparation", "incubation", "illumination", and "verification".

Preparation- In this stage the problem solver familiarises themselves with the problem and engages in conscious, effortful, systematic and usually fruitless work on the problem. Although this stage may well not lead to solution in itself, it is widely believed to be very important in influencing the likelihood that the next stage will result in a useful idea. Much personal testimony indicates that inspiration will not be forthcoming without this preliminary labour or, as Edison, the prolific inventor, is reported to have said, "No inspiration without perspiration".

Incubation- This is a period during which the task is set aside. No conscious work is done on the problem during this stage. In the other hand, it may be that this is simply a necessary rest period which enables a later period of conscious work to proceed more effectively than it would have without the break. Wallas suggests that this phase could be made more or less effective, depending on the intervening activity. Light work on minor problems or duties could be beneficial.

Illumination- This is the point when a fruitful idea occurs to solver which the 19th century scientist Norman Helmholtz (1912) calls it a 'happy thought'. The inspiration is not usually a complete solution to the problem but points to the direction in which the complete solution may be found. This phase may be preceded by a vague feeling of 'intimation', a feeling that the solution is nigh. Wallas (1926), suggests that if thinkers can recognise this feeling, then they should relax, cut out possible distractions and let the inspiration come. If the intimation feeling is not recognised, then the possible inspiration may be lost as a result of distracting stimuli.

Verification- This stage is much like preparation, in that conscious work must be done to develop and test the inspiration.

The Author suggests that in order to allow students to develop creative thinking during the design process, it is necessary for design educators to consider the above four phases during the process. The proposed 'interactive' design methodology, discussed in the previous chapter, enjoys a freedom of activities in which students decide when they are ready to commence different design activities and they choose their preferred strategies to tackle a design problem.

There are various schemes for increasing idea production. Many studies have focused on Osborn's (1953) brain storming method, which involves deferment of idea evaluation until after a period of free-wheeling idea production. Brain storming seems to be beneficial on many problems and appears to work for both groups and individuals. However, from many experiments it seems that the group version of the method is inhibiting compared with individual brainstorming (Stein, 1975).

7.3.2. Styles of Thinking

The Author defines a style of thinking as a 'preferred way of thinking'. It is not an ability, but rather how people use the abilities they have. Therefore, people do not have *a* style, but rather a *profile* of styles. But society does not always judge people with equal abilities as equal. Rather, people whose styles match those expected in certain situations are judged as having higher levels of abilities, despite the fact that what is present is not ability, but fit between those people's styles and tasks they are confronting. Investigating about different styles of thinking, would develop a better understanding about how architectural designers think. Further, it would help to develop a better understanding about students of architecture, and appropriate teaching and assessment methods in architectural design.

Robert Sternberg (1997) introduces his *theory of mental self-government* in relation to examining thinking styles. He suggests that styles are often confused with abilities, so that students or others are thought to be incompetent not because they are lacking in abilities, but because their styles of thinking do not match those of the people doing the assessments. He emphasises in teaching, there is a need to take into account student's styles of thinking if one hopes to reach them. So-called gifted adults, he states, "are probably, in large point, those whose styles match their patterns of abilities" (Sternberg, 1997, p. 158). Sternberg's theory is best suited for the worlds of education and work. He states, "If we don't take styles into account, we risk sacrificing some of our best talent to our confused notions of what it means to be smart or a high achiever, when in fact some of the smartest people and potentially highest achievers may only lack the style that we just happen to prefer (Sternberg, 1997, p. 160).

Table 7.1. illustrates a summary of styles of thinking in which Sternberg (1997) introduces the metaphor of governments; which have various *functions* (e.g., legislative, executive, judicial), *forms* (e.g., monarchic, hierarchic, oligarchic, anarchic), *levels* (e.g., global, local), *orientations* (e.g., external, internal), and *leanings* (e.g., liberal, conservatives). Similarly, styles need to take into account these various aspects of individual functioning.

Table 7. 1 Summary of Styles of Thinking (Sternberg, 1997, p. 27).

	Functions		Forms	
	Legislative		Monarchic	
	Executive		Hierarchic	
	Judicial		Oligarchic	
			Anarchic	
Levels		**Scope**		**Leanings**
Global		Internal		Liberal
Local		External		Conservative

The Author underlines that the basic idea of the theory of mental self-government is that the forms of government in the world are not coincidental. Rather, they are external reflections of what goes on in people's minds. They represent alternative ways of organising one's thinking. Thus, the forms of government one sees are mirrors of the minds of the people they represent.

7.3.2.1. Functions of Mental Self-government

Sternberg (1997) states that the mental self-government serves three functions: Legislative, Executive, and Judicial. The executive branch carries out the initiatives, policies, and laws enacted by the legislative branch, and the judicial branch evaluates whether the laws are being carried out correctly and if there are violations of these laws. People also need to perform these functions in their own thinking and working (Sternberg, 1997, pp. 20-21).

- Legislative people like to come up with their own ways of doing things, and prefer to decide for themselves what they will do and how they will do it. They like to create their own rules, and prefer problems that are not prestructured or prefabricate. The legislative style is particularly conductive to creativity, because creative people need not only the ability to come up with new ideas, but also the desire to. Unfortunately, school environments do not often reward the legislative style.
- Executive people like to follow rules and prefer problems that are prestructured or prefabricated. They like to fill in the gaps within existing structures rather than to create the structures themselves. The executive style tends to be valued both in school and in business, because executive stylists do what they are told, and often do it cheerfully. They follow directions and orders, and evaluate themselves in the same way the system is likely to evaluate them, namely, in terms of how well they do what they are told.

- Judicial people like to evaluate rules and procedures, and prefer problems in which one analyses and evaluates existing things and ideas. The judicial stylist likes activities such as writing critiques, giving opinions, judging people and their work, and evaluating programs. Schools often short-change the judicial style.

7.3.2.2. The *Forms* of Mental Self-Government

Styles of government come in different forms, and so do the styles of people's mental self-government. Four of these forms are the monarchic, the hierarchic, the oligarchic, and the anarchic. Each form results in a different way of approaching the world and its problems (Sternberg, 1997, pp. 22-24).

- A Monarchic person is someone who is single-minded and driven. The individual tends not to let anything get in the way of his or her solving a problem. They can be counted on to get a thing done, given that they have set their mind to it.
- The Hierarchic person has a hierarchy of goals and recognises the need to set priorities, as all goals cannot always be fulfilled, or at least fulfilled equally well. They tend to fit well into organisations because they recognise the need for priorities.
- The Oligarchic person is like the hierarchic person in having a desire to do more than one thing within the same time frame. But, they tend to be motivated by several, often competing goals of equal perceived importance. Often these individuals feel pressured in the face of competing demands on their time and other resources.
- The Anarchic person seems to be motivated by potpourri of needs and goals that can be difficult for him or her, as well as for others, to sort out. They take what seems like random approach to problems; they tend to reject systems, and especially rigid ones, and to fight back at whatever system they see as confining them. Although anarchic individuals may have trouble adapting to the worlds of school and work, especially if the environment is a rigid one, they often have greater potential for creative and contribution than do many of the people who find the anarchics so distasteful.

7.3.2.3. *Levels, Scope,* and *Leanings* of Mental Self-Government

Thinking styles can differ in level, scope, and leaning. Two extreme poles of these levels include global and local; scopes include internal and external; and leanings of mental self-government include liberal and conservative (Sternberg, 1997, p. 24-26).

A- Levels of Thinking Styles

- *Global* individuals prefer to deal with relatively large and abstract issues. They ignore or don't like details, and prefer to see the forest rather than the trees.

- *Local* individuals like concrete problems requiring working with details. They tend to be oriented toward the pragmatics of a situation, and are down-to-earth. The danger is that they may lose the forest for the trees.

B- Scope of Thinking Styles

- *Internal* individuals are concerned with internal affairs – that is to say, these individuals turn inward. They tend to be introverted, task-oriented, aloof, and sometimes socially less aware.

- *External* individuals tend to be extroverted, outgoing, and people-oriented. Often, they are socially sensitive and aware of what is going on with others. They like working with other people wherever possible.

C- Leaning of Thinking Styles

- The *Liberal* individual likes to go beyond existing rules and procedures, to maximise change, and to seek situations that are somewhat ambiguous. The individual is not necessarily "politically" liberal.
- The *Conservative* individual likes to adhere to existing rules and procedures, minimise change, avoid ambiguous situations where possible, and stick with familiar situations in work and professional life. The individual will be happiest in a structured and relatively predictable environment.

Some applications of the theory of mental self-government "thinking styles" in architectural education, the Author suggests could be implemented in the selection of students, educators, teaching methods, and the method of assessment. Frank Barron's study (1965) was concerned with the personality characteristics of creative architects as measured on the Minnesota Multiphasic Personality Inventory. His studies found that creative people are likely to be somewhat self-centred and moody, particularly steadfast in maintaining their independence of judgement, and somewhat insensitive to the opinions of others. These characteristics, the Author suggests would best fit Sternberg's model of those creative students who are *legislative, monarchic,* and *liberal.* But do all students in architecture have similar characteristics? It would be best to consider them as coming from different backgrounds and implement flexible approaches in dealing with them.

Very often architectural students' creative abilities are discussed as a necessity to succeed in this profession. But very seldom other variables of the educational system (i.e., the educators, their teaching and assessing methods) are examined. Table 7.2. shows various methods of instruction and the thinking styles that are most compatible with them. The major point of this table is that different methods of instruction work best for different styles of thought. If a teacher wants to reach and truly interact with a student, he/she needs the flexibility to teach to different styles of thinking, which means varying teaching style to suit different styles of thought on the part of students.

Table 7.2 Thinking Styles and Methods of Instruction (Sternberg, 1997, p. 116).

Method of Instruction	Style(s) Most Compatible with Method of Instruction
Lecture	Executive, Hierarchical
Thought-based questioning	Judicial, Legislative
Co-operative (group) learning	External
Problem solving of given problems	Executive
Projects	Legislative
Small group: students answering factual questions	External, Executive
Small group: students discussing ideas	External, Judicial
Reading	Internal, Hierarchical

As the Author has highlighted in Table 7.2., according to Sternberg's model, the best fitting teaching style for architectural design which would include both *problem solving* and *projects*, is executive, and legislative style. This would mean a prestructured method to satisfy the former, and a none-prestructured method to satisfy the latter. This indicates to the Author that due to the multi-directional quality of the topics involved during a design process, sometimes based on rigid data and standards, and sometimes with lax and creative bases, a design educator should be a flexible person and apply both methods in accordance to the students' potentials and also with respect to different stages of the design process.

Another important subject to be considered in an educational environment is the method of assessment. Very often students' works are miss-judged by their educators due to a misconception of the work or misunderstanding of the style of thinking by their students. Stenberg has also looked into the issue of assessment in his model of *mental self-government*. Table 7.3. illustrates various methods of assessment, main skills required to develop the work, and the styles of students with which they are most compatible.

Again, in this Table, the Author has highlighted the architectural design types of activities. Therefore, in an architectural design course which involves projects and portfolios, for analysis skill projects, Sternberg's model suggests judicial students will benefit most; for creativity skill projects, legislative students; for teamwork skill projects, external students; for working by self projects, internal students; for organisation skill projects, hierarchical students; and for high commitment skill projects, students with a monarchical style of thinking will benefit most.

Table 7.3 Thinking Styles and Methods of Assessment (Sternberg, 1997, p. 120).

Method of Assessment	Main Skills Tapped	Most Compatible Style(s)
Short-answer and multiple-choice tests	Memory Analysis Time allocation Working by self	Executive, Local Judicial, Local Hierarchical Internal
Essay tests	Memory Macro analysis Micro analysis Creativity Organisation Time allocation Acceptance of teacher viewpoint Working by self	Executive, Local Judicial, Global Judicial, Local Legislative Hierarchical Hierarchical Conservative Internal
Projects and Portfolios	Analysis Creativity Teamwork Working by self Organisation High commitment	Judicial Legislative External Internal Hierarchical Monarchic
Interview	Social ease	External

The Author indicates that one problem which is facing architectural education and design studio pedagogy today, is the method of assessment. He observes that – although a variety of projects which involve different styles of thinking are usually given to design students – during their final assessment, most instructors tend to consider the creative aspects of presentations most important. This would give a wrong signal to students indicating, no matter what you do, or don't do throughout the term, your final grade will be based on your final presentation and not your efforts during the design process. As a result, the Author cautions, some students will lose their enthusiasm to design for an educational system which has judged them only on their creativity level during the final presentation – or they may simply spend more time on developing pretty drawings. Consequently, presentation becomes more valuable than the actual content of the project. In any case, the Author believes that the profession will lose some valuable talents by misjudging them.

7.4. Modes of Thinking

There has been debate about whether explanation of behaviour should make reference to the structure of the mind, or to the structure of the environment, or both. The main goal of the Author, however, is to introduce the structure of the human mind and emphasise the capabilities of the human thought process in relation to the design process. As mentioned earlier under the subject of directed and undirected thinking, from classical times, it has been known that the human brain has two distinct ways of thinking and knowing (see Table 7.4).

Table 7.4 Two Types of Thinking described by intellectuals (URL-2, Caldwell, *et al.*, 2000)

	Left Brain	Right Brain
Maslow	Rational	Intuitive
Bruner	Rational	Metaphoric
Koestler	Associative Thinking	Bisociative Thinking
De Bono	Vertical	Horizontal or Lateral
Bronowski	Deductive	Imaginative
Shopenhauer	Objective	Subjective
Freud	Secondary Process	Primary Process
Jung	Causal	Acausal
Langer	Discursive Symbolism	Presentational Symbolism
Neisser	Sequential Processing	Multiple Processing
Kubie	Conscious Processing	Preconscious Processing

In Table 7.4, Caldwell and et.al. (URL-2, 2000) introduce some terminology used by some scientists, intellectuals, and authors with respect to the two types of intelligence or cognitive styles. This Table illustrates that one mode of thinking is associated with the left brain which consists of rational, associative, deductive, and objective thoughts; while the other mode is associated with intuitive, bisociative, imaginative, and subjective thinking. Whatever these thinking modes are labelled, the effective use of these two distinctive processes is vital for all creative human thought and production. Artists, scientists, engineers, business persons, entrepreneurs, inventors, etc. depend on the full functions of the human brain for success. But what is the human brain consisted of? The human brain is made of two cerebral hemispheres. For a number of decades, a symmetrical brain organisation was assumed, with the left hemisphere basically controlling the right 50% of the body and the right hemisphere governing the remaining left 50%.

However, the left brain apparently is in charge in most cases and the shape of the two hemispheres are rather asymmetrical, the left hemisphere is slightly larger. The two hemispheres are joined by the Corpus Callosum, a thick network of nerve fibres (Iaccino, 1993).

Since the Nineteenth century, it has been known that tumours and excisions within the left hemisphere produced quite different effects from those in the right. The former produced difficulties of spatial orientation and recognition of faces. In this respect, Roger Sperry (1985) carried out some unique experiments on some patients at the California Institute of Technology, in the 1950s. Sperry claimed that people have two independent minds within one head, the left brain controlling the right-hand side of the body and the right brain controlling the left-hand side. By studying such split-brain patients, psychologists have been able to identify the separate functions of the right and left hemispheres. Various information is processed by different parts of the brain in different ways. For instance, studies indicate that the processes of visually perceiving a word take place in a different part of the brain than the processes of thinking about the meaning of a word (Poizner, *et al.*, 1990).

All human action and thought process is controlled and dominated by one of the two hemispheres. Dr. Betty Edwards (1992) does not report left-handedness would improve a person's ability to gain access to right-hemisphere functions such as drawing from her observations as a teacher. However, she claims that left-handers statistically are more prone to stutter and to experience the reading difficulty called dyslexia. She also reports that experts suggest that bilateral distribution of functions may produce superior mental abilities. Left-handers she suggests excel in mathematics, music, and chess. "And the history of art certainly gives evidence of an advantage for left-handedness: Leonardo da Vinci, Michelangelo, Raphael, and Picasso were all left-handed" (Edwards, 1992, p. 39).

The dominant theories about the differences between the two hemispheres have evolved in several stages during recent decades. First it was thought that the difference between the hemispheres depended on the modality of behaviour; The left hemisphere was viewed as normally specialised for language and reasoning, the right hemisphere as specialised for such modalities as music and vision (Kimura, 1961). This view became generalised into the distinction between a calculatingly "rational" or "analytic" hemisphere on the left and a creatively "intuitive" or "holistic" one on the right (Bever, 1970). According to this view, language is left–hemisphered because it is analytic and vision is right-hemisphered because it is holistic, and so on.

Different hemispheric functions have recently been discussed in terms of another distinction, namely, a "left-analytic" versus a "right-holistic" (visuo-spatial) mode of information processing (Iaccino, 1993). According to this definition each hemisphere is specialised for a different type of thinking or "cognitive style", with the left side employing a more sequential, analytic thought process and the right a more holistic, gestalt frame of reference. Subscribers to this view further noted that the left cognitive style is more representative of the logical, rational type of thinking exercised in Western societies, whereas the right style is more applicable to the intuitive, mystical thinking of cultures and religions in the East. Although the Author, who is from the East and has received his architectural education in the West, does not believe in generalising cultures this easily, it may still be worth identifying some thoughts rising from scholars in relation to different natures of thinking between the East and the West. One of the most striking thoughts in this respect comes from Ashbrook (1988) who distinguishes: "Architecture, like religious belief, is an expression of the culture's dichotomised view of life. In Eastern traditions, the dome construction pervades and highlights the Gestalt expansiveness (or right mode) of knowledge, which has no beginning or end. However, Western societies have more focused buildings (i.e., spiral towers) pointing upward to the heavens; these structures symbolise the orderly, finite, and more rational left side of knowledge" (cited by Iacinno, 1993, p.3).

Edwards (1992) identifies the left hemisphere as being responsible for the sense of time, writing, and reading, while she identifies the right hemisphere as being responsible for images, drawing, inventing, and dreaming. Using this theory, Edwards has written books and lectured courses on how to become more effective in drawing by using the characteristics of the right hemisphere. The Author has compiled some characteristics of the two hemispheres in Table 7.5.

Table 7. 5 Comparison of Left-Mode and Right-Mode characteristics of brain (compiled by the Author).

	Left	Right
Caldwell, et al., 2000, URL-4	Parsing	Holistic
	Successive or Sequential	Simultaneous
	Logical Expression	Gestalt Expression
	Focal Perception (naming objects)	Orientational Awareness
	Analytical	Synthetic
	Sense of Time	Present Centeredness
	Aggressive	Passive
	Discrete Representation	Diffuse Representation
	Literal	Metaphoric
	Linguistic/Symbolic	Visio-Spatial (Configurational)
	Intellectual	Sensuous
	Verbal Intelligence	Performance Intelligence
	Abstract Reasoning	Concrete Perceptual Insight
	Quantifiable Knowledge	Existential or Experiential Knowledge
	Mathematical Calculation	Apprehension and Transformation of Patterns and Relations (Visual Thinking)
Edwards, 1992	Verbal	Nonverbal
	Analytic	Synthetic
	Symbolic	Concrete
	Abstract	Analogic
	Temporal	Nontemporal
	Digital	Spatial
	Logical	Intuitive
	Linear	Holistic
Springer and Deutsch, 1998	Verbal	Nonverbal, Visuospatial
	Analytic	Synthetic
	Rational	Intuitive
	Western thought	Eastern thought

This Table introduces some of the most recent thoughts on the subject of the human brain distinguishing the characteristics of the two hemispheres. It suggests that the left hemisphere is responsible for: sequential, logical, analytical, and verbal activities; while the right hemisphere is responsible for: simultaneous, intuitive, synthetic, and non-verbal activities.

Although each hemisphere is capable of performing many tasks in the same way as the other, there are certain functions for which one or other is dominant. The most pronounced of these is the control of language by the left hemisphere. Such is the strength of this, and the overwhelming behavioural consequences of its loss that the left hemisphere has been labelled the major hemisphere (Annet, 1985). In fact, the Author believes the left brain's dominance due to many years of education in schools using verbal and analytical modes, is one big problem with entrant architecture students who are required to demonstrate creativity in their architectural design exercises. Since most students are used to analytical thinking, they tend to apply that ability in design as well. In Chapter 6 the Author introduced his 'interactive' design methodology, however, his proposed model requires the characteristics of both hemispheres to help students during the design process. Therefore, it is essential to distinguish different types of thinking involved in the design process based on their originated hemispheres in an attempt to stimulate the proper hemisphere when needed.

7.4.1. Left Hemisphere's Contribution

The left hemisphere's sequential analytic abilities are somewhat easier to demonstrate than the vaguer abilities of the right. They manifest themselves in the associative thinking in word meaning, the propositional logic of syntax, spelling, symbolic logic, and the use and control of expressive speech (Dimond and Beaumont, 1974). It will also tend to control the modelling of the design in words and numbers as it is defined in the brief and in the more detailed definitions such as performance specifications and detail design specifications (Tovey, 1984). The left hemisphere produces correct details, but they are haphazardly juxtaposed, fragmented and containing superfluous elements (Bradshaw and Nettleton, 1983). In the design process, the time element is significant due to the sequential requirement of responding to each problem: the left mode seems to be essentially serial, it will tend to control the overall schedule and to perceive it as a linear, sequential process (Tovey, 1984, Bryden, 1982).

In the development of design it will almost certainly control optimisation procedures, and the use of ranking and weighting techniques. It will favour the use of checklists and objective evaluation procedures.

7.4.2. Right Hemisphere's Contribution

Right brain superiority is fairly evident in visual tasks. In drawing exercises it maintains the overall configuration, proportion and spatial arrangement, whilst tending to simplify and lose some detail (Dimond and Beaumont, 1974). Right hemisphere dominance has also been identified in many areas of visual thinking in terms of size, shape, appearance, spatial sensibility, perception, recognition and many other aspects which help students to think in a creative mode. It could contribute greatly to creative thinking, visual thinking, drawing, and in appearance design (Tovey, 1984). It could apply to Darkes's (1979) three phases of the design process:

- Decide what is the important aspect of the problem (generator)
- Develop a crude design (conjecture)
- Examine it for more discovery (analysis)

The first stage of this process, the generator, simply consists of whatever sketchy information will allow the formulation of a possible solution. In this, emphasis is on right hemisphere activity both in the perception of what aspects of the problem have this potential and in the development of the conjecture. The right hemisphere calls on the ability to relate the parts to a whole pattern and to complete this from inadequate information. The right mode chooses a simultaneous parallel process. It requires the ability to synthesise and make concrete what may be defined in the abstract (Bryden, 1982, Tovey, 1984).

The Author suggests that the above discussions on the characteristics of the two hemispheres must not encourage the misinterpretation that all thinking activities are strictly decided by either the left or the right hemisphere independently. It is the interaction of the two hemispheres that produces an appropriate thought or action in the design process. For example, when a student is drafting an architectural drawing, left brain is dominating the activity of drafting while the style of drafting is still being influenced by the right brain. Therefore, the Author suggests that even in the left-dominated activity, there are evident signs of right hemisphere activity and vice versa.

Tovey (1984) claims that designing and problem-solving involves both hemispheres in matching analytically processed, symbolically coded problem models with visuo-spatial, holistically processed solution patterns. The evidence suggests that in all higher level mental activities both halves are at work, operating in parallel and exchanging information. Both sorts of thinking are essential in tackling design problems, but the strategy adopted may lead to one or other half of the brain being dominant during the process.

Therefore, the Author suggests that in the design process in order to stimulate the characteristics of both hemispheres and utilise the full capacity of the student's talent, it is necessary to imply a thinking methodology in which complex modes of thinking are involved in a simultaneous manner. In an attempt to establish a better understanding about the ways of developing design solutions in the design process, the following chapter will examine the act of designing and will review various strategies in design.

Chapter 8
Design Thinking

8.1. Introduction

The previous chapter introduced the subject of thinking and some general ways to solve a problem. In fact, so much has been written on the subject of problem-solving and the ways people think during that process. In contrast, very little attention has been given to the subject of designing. Although at first they seem to be similar, in reality, there are more activities involved in designing than in problem-solving. The complex nature of design engages both analytic and creative activities during its process. Therefore, in addition to problem-solving activities, designing requires generating ideas, developing alternatives, evaluating between different ideas and making decisions which are partially based on subjective values. Different approaches in design have been exercised by architects throughout the history of architecture. Although there is a wide range of design approaches, the Author is making an attempt to categorise these approaches based on the thinking processes involved in them.

This chapter will first examine the subject of design types in order to develop an understanding about different approaches in design. Then it will review different types of thinking involved in producing a design solution by studying different design strategies.

8.2. Design Types

There have been different attempts to define design and the act of designing. Although, like architecture, design is difficult to define in a single statement, a better understanding about it could be developed by reviewing different ways in which architects have attempted to discuss the subject of designing. Design has been defined as the effort to generate solutions to problems prior to attempting to implement them (Simon, 1957; Broadbent, 1973). As Michael Tovey (1984) suggests, creative thinking and aesthetics are two parts of design which are particularly resistant to analysis and description in words. For most architects, they are intuitively realised; the idea arrives in some mysterious way, and is felt to be right. Bryan Lawson (1990) identifies some characteristics for a design process, they include: the design process is endless, there is no 'correct' process, the process involves finding as well as solving problems, it involves subjective value judgement, design is a prescriptive activity, and designers work in the context of a need for action.

No matter how intuitive a design process may be, the Author suggests that there are possible ways of categorising design approaches through design types. Professor Broadbent's description (1988), after he revised his earlier (1973) version, of "design types", is the most comprehensive attempt to categorise different approaches in design. Professor Broadbent puts forward that *Types* of design include: *Pragmatic Design, Typological Design, Anologic Design,* and *Syntactic Design*[3].

8.2.1. Pragmatic Design

By pragmatic design, Professor Broadbent means mechanical processes in which one piles stone-on-stone, to see if a structure can be made to "work". He sees no difference, in principal, between those who did that, two million years ago, and those who throw up computer images and then decide which of those they prefer. In a "Pragmatic Design" approach, materials, climate and other physical factors are used as the basis for proceeding, by trial-and-error, to see what can be made to 'work'. The Author sees *pragmatic design* as a method which most architects could use by involving research in the forms of experiments and/or observations to understand and measure the behaviour of the users and the environment they are designing for.

8.2.2. Typologic Design

In a "Typologic Design" – his former Iconic – he means pre-established solutions, from the scale of a door-knob to that of a kitchen-plan, an apartment-plan, an apartment-block plan, a neighbourhood, or the strategic plan for a city. Therefore, one draws on known and established types, penetrating, as far as one can, to the 'essence' of the *type*. The Author sees *typology* as referring to the classification of specimens according to the type of behaviour they exhibit according to the similarity of their purposes and/or their formal structure (i.e., residential buildings, office buildings). This type of design could help

[3] Professor Broadbent explained his descriptions of the four types of design in the interview which the Author conducted with him in December 1999.

architects to establish a foundation in their design solutions by reviewing what is typically accepted by the users.

8.2.3. Analogic design

In an "Analogic Design" the use of images from nature, painting and sculpture, existing buildings and so on is implemented to 'trigger' ideas in the designer's mind. The Author acknowledges most parts of an *analogic design* come from the past (visual) experiences of the designers, albeit that one's current environmental perceptions could contribute a great deal to this discussion. Metaphoric excursions are used to encourage new insights, and the discussion of analogies practised as a way of introducing spontaneous thinking to the problem. LeCorbusier's roof for Ronchamp that looks like a crab shell; Rietvelds's elevations that look like Mondrian paintings etc., are some examples of Analogic design which Professor Broadbent explained in 1999.

Three types of analogy were introduced by Gordon (1961): *personal, direct,* and *symbolic*. Later, Professor Broadbent (1988, p. 350) suggests that in, "personal analogy the designer identifies himself with a tiny aspect of the design problem", in "Direct Analogy the problem is compared with known facts in another branch of art, science or technology", and in Symbolic Analogy (the designer tries to penetrate to the essence of special meaning which he attaches to the problem, usually verbally, and in terms of a 'binary couplet')". The *Analogic type* has also been viewed by others with slightly different definitions. For example, Whitfield, (1975) describes it as *Synectics* procedure which is concerned to bring together disconnected elements, thereby creating a new solution to a problem. In the first instance the problem must be rigorously defined. This is followed by a separation of imaginative thinking from analytical and judgmental thinking.

8.2.4. Syntactic design

In a "Syntactic Design" approach – formerly *Canonic* Design[4] – one works by some rule-based system, often, but not always, geometric. He explains the term prompted, "I have to say, by Peter Eisenman who, in his early houses, uses rules derived from Chomsky's Syntactic Structures to suggest rules for generating 3-dimensional, geometric, architectural forms." The Author extends Broadbent's view of *syntactic design* one step farther to include rule-base thoughts and systems which pertain to designers theoretical perspectives.

[4] Professor Broadbent explained the reason for change of terminology, in 1999, stating: "There, in DiA [referring to his 1973 Design in Architecture], I had in mind Egyptian temples and tombs, Medival cathedrals, Peirce's Semiotics and other phenomena led me to write instead of syntactic Design."

An example of this type could be those architects whose works are associated to a theoretical point of view similar to those which were introduced in Chapter 4 under architectural theories (i.e., *Traditional, Post-modern, etc.*).

Although the above design types are separated, the Author believes that in practice, designers could apply more than one type to their design problems. The following section will examine the way designers think during the process of design and different thinking strategies which they apply in their search for a design solution.

8.3. Thinking and Designing

One must note that there is a difference between problem solving and designing. In problem solving, designers usually investigate for logical solutions to design problems (i.e., solving the problem of drainage in a project); in designing, however, designers implement various individual solutions and create a design solution which addresses to most design problems (i.e., designing a residence, in which many design problems such as drainage are considered within the final design solution). Therefore, designing takes more effort – in comparison to problem solving – on the part of the designer to develop a solution by incorporating creative as well as logical solutions to a design problem. The complex nature of design, however the Author indicates, has developed some thoughts about how to make it easier to solve a design problem. It would be nice indeed if designers could simply break design problems down into their constituent parts, like the clues of a crossword puzzle, solve them and then assemble the solution. However, that is not so simple. As Professor Lawson remarks (1993, p. 10), "The need to think about the whole problem, or at least a great number of issues at once, is another of the features that make designing so challenging".

Nevertheless, designing involves more than analysing and developing logical answers to a problem, and it is different from problem-solving. Most designers agree that in design, a process of analysis, synthesis, and evaluation is at work (Broadbent, 1998; Durek, 1993; Lang, 1987). *Analysis* involves collecting data, questioning and comparing; *Synthesis* involves developing answers and generating ideas; and *Evaluation* involves selecting and implementing final answer. But what actually happens during the design process? Do these stages follow any particular procedure? And are they constant and consistent in different types of design? Professor Lang states that "designing is regarded by many environmental designers, particularly architects, as a sequence of operations that are internalised and undifferentiated. It is recognised that the process consists of analytical, synthetical, and evaluative processes in which the designer is a "black box" turning inputs into outputs by some mysterious process" (Lang, 1987, p. 38). Is that really what occurs? Some mysterious or intuitive process which administers all human thinking processes during the design process?

Omar Faruque (1984), describes the design process as creative problem-solving. It is similar to a biological process, it is not a rigid or strictly linear process, instead, "it is a cyclical process progressing with continuos feedback and necessary adjustments as new information becomes available" (Faruque, 1984, p. 18). With such a process allowing for feedback and adjustments, the problem begins to take new shape and the solution becomes an evolutionary rather than formulaic answer. Such a cyclic process is described by Brian Lawson (1993, p. 9) in a slightly different language, he states, "the design process is a constant battle to understand the idea that is generating and holding the scheme together". Actually this battle, the Author suggests, is the interactive processes of thinking, which exists inside the designer's mind in order to go through the design process and develop a solution. This 'interactive' process has been introduced by Bryan Lawson in a similar way. In his book, *How Designers Think*, Lawson states: "You can't start with a brief and (then) design, you have to start designing and briefing simultaneously, because the two activities are completely interrelated" (Lawson, 1992, p.35). Tovey (1984) proposes that the design process certainly involves the characteristics of both sides of the brain through matching analytically processed, symbolically coded problem models with visual-spatial, holistically processed solution patterns.

It is important to realise that some creative activities occur spontaneously during the act of the design process, but the Author believes, it is even more important to understand techniques of creative thinking which help designers to become creative and develop their hidden talents. Although many design innovators do not generally use structured creativity techniques, they may, at one time or another, seek inspiration in such methods. The Author has categorised various design techniques and approaches under the two discussions of *Cognitive Styles of Thinking in Design* – after Cross and Nathenson (1981), and *Design Strategies*, which will be examined in the following sections.

8.3.1. Cognitive Styles of Thinking

Cognitive psychology and its applications in problem-solving in architecture has been a major area of research for architects and designers. It is concerned with the subject of designer's perceptions and responses to problems.

Cross and Nathenson (1981), have described how different learning styles relate to design theory. They describe four oppositional pairs of cognitive styles which have been observed in educational experiments. These are *divergent vs. convergent, impulsive vs. reflective, field dependent vs. independent,* and *serialistic vs. holistic*. These different styles align fairly well with the Author's observed thinking modes of the two halves of the brain. Although, one could not deny that the human thinking process is the result of the two hemispheres working in an interactive manner, the Author suggests that dominance of thinking could be linked with one hemisphere or another. Therefore, he proposes that characteristics of the left hemisphere will fit with cognitive styles of: convergent; reflective; field dependent and serialistic, while the characteristics of the right hemisphere will match the cognitive styles of: divergent; impulsive; field independent and holistic.

8.3.1.1. Convergent vs. Divergent

Convergent thinking is associated with logical, structured presentations, and – in the design process – with systematic search methods, ranking and weighting, and specification writing (Jones, 1970). Convergent production is the act of synthesis. It involves producing a single idea out of many parts. On the other hand, the right brain dominance in divergent thinking, is more powerful in generating alternative ideas, particularly when they are handled visually, as they often are in design. Divergent production consists of the development of many ideas from a single observation or statement; it is concerned with the generation of a variety of ideas or potential solutions or parts thereof (Moore and Gay, 1967).

8.3.1.2. Impulsive vs. Reflective

One of the characteristics of the first generation of design methods was that they imposed a quasi-scientific approach. There was an emphasis on the acquisition of data and its comprehensive analysis before solutions could be proposed. This could be described as a left brain processing of structure in full detail before a solution is identified. Lawson (1990), has shown in controlled experiments that this strategy is the one typically adopted by science students. He found that in the same experiments architectural design students, by contrast, adopted a strategy of impulsively proposing solutions based on incomplete information and then discovering more about the problem by testing the solution against it. The tentative solution would form the basis for a more complete understanding of the problem and the development of other solution proposals. This approach is very characteristic of right brain thinking which favours the production of a pattern of synthesis, tending to extrapolate impulsively from partial information and having little patience with details.

8.3.1.3. Field Dependent vs. Independent

The left brain's thinking mode is typically concerned with drawing rational conclusions within a context, and to this extent it is, in a sense, field-dependent. The right brain has a much better capacity for the perception of patterns and shapes in the physical world, and it is able to deduce and extract from a context the overall configuration or the basic gestalt of a form. (Tovey, 1984)

8.3.1.4. Serialistic vs. Holistic

In design, the serialistic mode is more apparent when a sequential logical argument is required, for instance during brief writing, project planning and scheduling, some aspects of research, and evaluation and selection. By contrast, the holistic mode is used in the certain solutions to the design problem, when a single proposal must simultaneously meet a wide network of different constraints.

8.4. Design Thinking Strategies

By design strategies, the Author means those practical approaches in design which designers could apply to reach a design solution. Design strategies, like design types, could be applied in more than one form simultaneously. They help designers throughout the design process to analyse, synthesise, and evaluate data. Different types of design strategies exist in which the common objective is to help designers to reach the most appropriate solutions. Professor Broadbent (1973) suggests the use of three techniques for enhancing creative thinking in design. They include:

1-Check-list (i.e., list of words and visual images which trigger ideas)

2-Interaction techniques (i.e., form, size, material,…)

3-Techniques based on psychoanalysis (i.e., brainstorming and synectics)

The Author has adopted some of the strategies suggested by Broadbent and others to formulate the four educational applicable strategies of: Lateral thinking ,Visual thinking, Design principles and standards, and Group discussions.

8.4.1. Lateral Thinking

Lateral thinking is a term invented by Edward de Bono (1970; 2000, URL3) and is in contrast with traditional logical thinking for which he uses "vertical thinking". Vertical thinking is used when analysing a problem or putting forward an argument (with the yes or no answers). However, lateral thinking is concerned with digging as many new holes as possible, for the solution to a problem may not be in the direction in which one is digging.

There are various lateral thinking techniques. Some of them are concerned simply to overcome the limiting effects of vertical thinking, by challenging assumptions or by suspended judgement. Others are methods of provocatively using information, creating new combinations, concept changes and idea reversals, so as to encourage actively innovative proposals.

One application of lateral thinking in education, the Author suggests, is in generating several alternative solutions for a problem or parts of a problem. For example, asking students to develop various ideas for how and where to enter a building would encourage them to examine different levels, directions, and locations for entering a building. As a result, students will provide some answers and get a chance to see what others have developed, and then they will evaluate their answers and develop an appropriate solution.

8.4.2. Visual Thinking

Since architectural design involves design of a space which is consisted of some physical as well as emotional characteristics, the Author suggests that one proper design approach could be through visual thinking. The subject of visual thinking is basically concerned with problem-solving and designing through the act of drawing and visualising the analytical as well as the synthetic steps of design. This way the designer will present the question as well as the solutions all in one medium. By medium, the Author means to draw attention to the various possible means of visually communicating (i.e., drawings on paper or on computer, collaging images, building models).

The basic tool of communication for architects is drawing. By drawing, designers can communicate their mental images about a design problem and illustrate them in 2-D or 3-D, depending on the appropriateness of the drawings for that particular stage of design[5]. Donald Schon, author of *The Reflective Practitioner* (1984), has suggested that one should think of the designer as 'having a conversation with the drawing'. This conversation, the Author states, is truly a useful tool for designers to adapt throughout the design process. It would allow them to see the physical characteristics of the problems and this way they tend to activate a spatial mode of thinking which is most appropriate to apply in architecture – a discipline which mostly deals with creating spaces. The nature, range and techniques of visual thinking are fully described by McKim (1980).

[5] Usually designers use 2-D drawings to communicate relationships and the senses of order or movement through diagrams, while 3-D drawings are used to explain the condition of the space and develop realistic representations of a space (also, see Figure 8.1.).

Today, a large number of designers use computers for drawing during the design process. Although computers have their own advantages as a tool, there are many critics who argue about the consequences of using them. One critical look at the use of computers is made by Brigit Cold (1995). She states, "The use of the computer in the design process is growing fast. The computer is more accurate, faster and combines separate information as desired. The computer as a sketching tool has been developed, but the machine, the hardware and the man-made programmes are barriers in the creative process compared with sketching on paper. The difference between sketching and visualising ideas on a computer is the involvement of the directness, the preconscious, producing and throwing away exformation during the sketching process. The main reason for encouraging hand sketching is the importance of learning and knowing how 'to catch, keep and create' environmental impressions and conceptions directly in time and on the spot" (Cold, 1995, p. 63).

Brigit Cold (1995) sees the drawing of sketches as a viable tool for architectural education with which one can simply record studying the local environment, travelling and visiting new and ancient architecture/places of everyday life and monuments. She suggests making sketches is one, and perhaps the best, way of increasing awareness and concentration, and strengthening the memory for building up this repertoire of experiences. Such a repertoire is necessary to draw on in the creative design process. The awareness of the value of sketches, she underlines, is now stronger because of the interest in creative processes, through which quality emerges. Further, Cold describes the strength of the sketch as a working method as "the openness, the unfinished, the incompleteness, the suggestions, which may give a promise of the 'divine solution'" (Cold, 1995, p. 61).

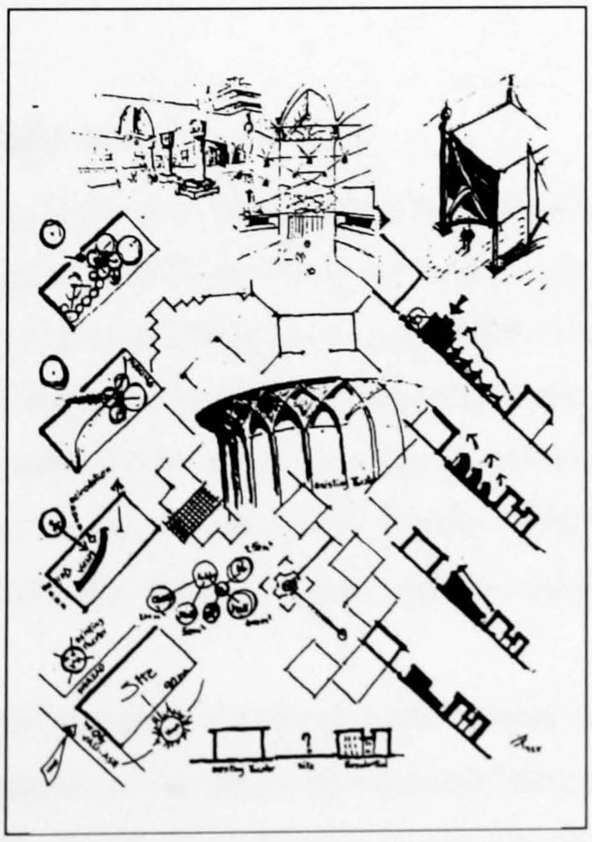
Dr. Betty Edwards (1992), introduces a new perspective on drawing to her students. In her book, *Drawing on the Right Side of the Brain*, Edwards covers a number of techniques for outwitting the left hemisphere control mechanism and allowing more direct access to the right brain for drawing. These techniques include different ways of looking at the object being represented, by looking at an upside-down object and drawing it, or concentrating on the negative spaces around an object rather than the actual positive object, and a few other approaches. These techniques are designed to inhibit the left hemisphere coding system, whereby objects are perceived in terms of abstract symbols, rather than their being appreciated directly. The Author exercises these drawing techniques with his entrant students who usually find it difficult to draw and need some encouraging techniques to start with (see Appendix A).

Paul Laseau (1989), also wrote a valuable book on *Graphic Thinking for Architects and Designers* in which he demonstrated the necessity of using drawings and visual thinking and analysis throughout the design process. The term "Graphic thinking" is coined by Laseau, to describe thinking assisted by sketching. In architecture, this type of thinking is usually associated with the conceptual design stages of a project in which thinking and sketching work closely together as stimulants for developing ideas.

Figure 8.1., illustrates one of the Author's design students attempts to design a cultural centre near an existing theatre in the centre of Tehran. In this scheme, the Third-year design student has illustrated his visual thinking approach of analysing the site, and generating ideas which relate to the existing theatre.

In this Figure, some 2-D and 3-D diagrams are presented by the student who has analysed the relation between spaces, approaches, circulation, views, and some other aspects of the site. At the same time, the student has been asked to generate spatial ideas with regards to the character of the existing theatre and surrounding residential neighbourhood. As a result, the student has become involved in analysing the site and the needs of the new cultural centre, synthesising ideas – of which some exist in the site and some were generated by the student – and evaluating those ideas simultaneously.

Figure 8.1 Visual Thinking in the Design Process (Drawn by a student of Architecture, University of Tehran, 1998).



Bryan Lawson (1990, p. 95) best summarises the whole idea of visual thinking and the use of sketches. He states, "The whole purpose of doodles, sketches or models is to act as a kind of additional memory to freeze and store spatial ideas which can then be evaluated and manipulated"[for developing design solutions].

In addition to drawings, other means of visual thinking have been effective in the education of artists and architects. In the 19th century, Friedrich Froebel, extended and popularised the work of his predecessors – the Swiss Pestalozzi – by inventing famous exercises for teaching children to express themselves through play and become educated in what he called "motor-expression". Froebel believed that tactile and visual knowledge was far more important than language. To teach what he called "plastic material representation", Froebel developed a series of didactic materials, the most widely known and influential of which were his Gifts and Occupations, consisting of a series of objects given to children at intervals from the age of two months up to six years. Through the Gifts, children would learn basic ideas about relationships among objects: similarity and contrast, tactility, lightness, and heaviness. While Froebel intended that the Gifts teach the child basic skills of "motor-expression", he also believed that each Gift had a symbolic meaning, bringing forth from the child an innate idea of the Absolute and the mathematical laws that govern the universe. "Froebel had a pervasive influence in late nineteenth- and early twentieth-century child education, and as historians point out, his method appears to have been quite successful: Many architects and artists, among them Frank Lloyd Wright, Le Corbusier, and Wassily Kandinsky, were students of his system in childhood" (Varnelis, 1998, p.214).

8.4.3. Design Principle and Standards

Professionals in all the design fields use design principles very extensively in moving from a series of problem statements to solutions. Design principles are not fundamental truths, laws, or propositions specifying a condition or a relationship. They are rules for guiding action (Broadbent, 1973). Designers use principles and standards all the time. They save the designer from having to reinvent the wheel for every problem he/she faces; they enable designers to make decisions on matters about which they know very little; they reduce design-by-habit situations that really require creative problem-solving.

The Author claims that some design principles provide general knowledge for designers within a specific subject, location, or condition. For example, there are books written about design principles in an arid climate (i.e., *Design Primer for Hot Climates*, by Konya, 1980). These type of design principles, provide some facts and some list of concerns for designers to address during their design process. The other types of design principles, the Author notes, include a variety of design handbooks, standards, regulations, and so on, which provide some general design information and are usually prescribed by some governmental organisations (i.e., Some American publications such as the *Graphic Standards* for Architects, and the *Uniform Building Code* (UBC)). In this regard DiPasquale (1990), recommends the wider use of the 16-division format of the Construction Specifications Institute (CSI) in architecture schools as a tool during the design process. He suggests the CSI format will familiarise students with materials and building-related information for the entire building process.

8.4.4. Group Discussions

The Author finds group discussion strategies to be extremely viable design strategies which enables designers to reach some design solutions through simple conversations with other designers, experts, or the general public who are involved in the project or are simply interested in the subject. There are different forms and techniques for group discussions. Many of these techniques are introduced by Henry Sanoff (1991) in his book, Visual Research Methods in Design. Some of the techniques Sanoff introduces include: *Group Processes, Squatters, Focus Group,* and *Quality Circles*. In these methods, as their titles indicate, the main objective is to reach the users and/or experts and involve them in decision making processes.

Brainstorming is another common technique in design which consists of a formalised group activity organised to encourage the flow of original ideas. Brainstorming encourages cross-stimulation, and the apparently crazy ideas of one participant will stimulate quite useable ideas from another (Jones, 1970). Usually, all ideas are recorded, either on tape or in shorthand, and afterwards the list of ideas is circulated to the members of the group, for their afterthoughts. Finally, a full list of ideas is prepared, and each idea checked for feasibility, preferably by a panel of specialists who took no part in the original brainstorming (Broadbent, 1973).

Chapter 9
An Interactive Model of Design

9.1. Introduction

The complexity of issues involved in solving a design problem requires different types of thinking throughout the design process. As indicated earlier, solving a design problem requires both problem-solving strategies (which tend to follow some sequential processes) as well as creative efforts to reach a solution. However, unlike the conventional design methodologies which tend to go through the design process in a sequential manner (usually start with analysis, followed by synthesis, and then evaluation), the proposed model of design methodology requires a model of thinking which would allow different thinking modes to participate in any stage of design activities. The University of Iowa's Education Department has developed a thinking model for art students in that state by which three types of: *analytic, content,* and *creative* thinking are at work. Since the Iowa's model of thinking matches the Author's search for an 'interactive' model of thinking, it is incorporated in the proposed model of design methodology, introduced in Chapter 6.

This chapter will introduce the Iowa's thinking model along with the characteristics of its major components. Then the 'interactive' model of thinking will be introduced for the design process. Different components of the design process will be identified in accordance with the proper thinking types involved during each stage of the process.

9.2. The Iowa's Model of Thinking

Thus far, the subjects of the design process, designers' thinking processes, and the types of design approaches have been discussed. The Author suggests that a comprehensive design methodology in architecture requires an interactive process of thinking to employ various modes of thinking and implement flexible design approaches in different stages and conditions of design in order to develop a proper solution.

In his proposal for an 'interactive' design methodology, presented in Chapter 6, the Author introduced his three-stage model of understanding, idealising, and presenting. However, in order for him to give that model a practical meaning in the sense of the design process applicable to architectural design education, the Author needs to employ a model of teaching/learning which would be appropriate to his interactive model.

Among various teaching/learning models reviewed by the Author, the majority of them did not either consider thinking or did not reflect thinking as being the most important element in their approaches. However, there is one approach, made possible by the University of Iowa's Department of Education, which makes a considerable effort to acknowledge the interaction between the student and the educator in its teaching/learning model. They have established an organisation called the New Art Basics (NAB), (URL-5, Caldwell, et al., 2000). Organisers of the NAB believe that each child is born with a natural birthright for visual and creative thinking. That birthright needs to be nurtured and brought out in each student through solid thinking skills education. The project maintains that it is not enough to simply place the child in a school art classroom and attempt to input preordained curricular content. NAB, co-ordinated from the College of Design at Iowa State University, was created in 1986 as a coalition of professional art teachers, graduate students in art education, and art education faculty and staff at Iowa State University, (ISU). The project utilises an online database with over 2000 teacher-designed and classroom-tested art strategies composing a "Living Curriculum" which is constantly evolving and improving. The NAB strategies are approved by the Visual Arts in Iowa Schools Standards (VAIS), which sets the scope and sequence guidelines for visual arts teachers in the state of Iowa.

There are four AIMS in the VAIS standards. They are action statements which describe activities of the art teacher who guides, helps, motivates and assists students.

AIM #1: Guiding students to perceive, comprehend, and evaluate the visual world

AIM #2: Helping students acquire an ability to look at and understand the visual arts

AIM #3: Motivating students to develop and communicate imaginative and inventive ideas

AIM #4: Assisting students in the making of art

Under each scope and sequence aim, one will find a number of student *GOALS*; under each student goal there are a number of student *OBJECTIVES* at three levels of increasing maturity and complexity.

Level 1: Objectives for students with little or no art background

Level 2: Objectives for students with intermediate art knowledge, skills and experience

Level 3: Objectives for high school students or those with a variety of art experiences and a depth of art concepts and knowledge

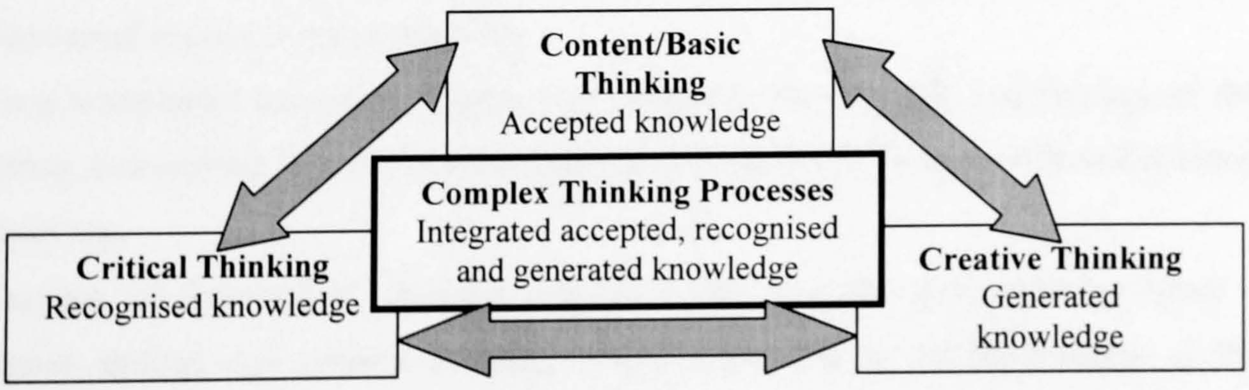
Caldwell *et.al.* (URL-6, 2000) claim that VAIS standards will be gradually replaced with National Visual Arts Standards, in the United States, in years to come.

NAB's thinking and educational principles, like those of the Author, are based on the Brain-based Visual Education. Their definition of Brain-based Visual Education states: "Brain based visual education is the critical and sustained use of knowledge from the brain sciences to design exciting instructional innovations, assess visual arts curriculum effectiveness, and promote sound artistic growth in students" (URL-7, Caldwell, et al., 2000). NAB defines Principles of Brain-based Visual Education as:

1. Metacontrol: Obeying Laws of Visual Brain
2. Fitting Artists' Methods and Brain Dominance
3. Greater Reliance on Right Mode Processes
4. Visual Cognition as an Alternative Learning System

The model of Integrated Higher Order Thinking (HOT), introduced by the Department of Education at ISU (URL-8, Caldwell, *et al.,* 2000), is extremely applicable to the Author's cerebral criteria of thinking modes and his design methodology. In the HOT model, "complex thinking processes", [which the design process in architecture enjoys that characteristic], are viewed as an interaction between three types of thinking: *Critical Thinking, Creative Thinking* and *Content/Basic Thinking* (see Figure 9.1).

Figure 9.1 Iowa Department of Education Integrated HOTS Thinking Model. (Redrawn from http://www.design.iastate.edu/ART/NAB/hots.html, Visited 5/1/2000)



The above Figure illustrates Caldwell *et. al.*'s model of complex thinking processes in which three types of thinking are interacting. These types of thinking are introduced to include various thinking modes (URL-8, Caldwell, *et al.,* 2000).

- **Content/basic thinking**

problem-solving (i.e., sensing the problem, researching the problem, formulating the problem, finding alternatives, choosing the solution, and building acceptance),
designing (imagining a goal, formulating a goal, inventing a product, assessing the product, and revising the product),
decision making (identifying the issue, generating the alternatives, assessing the consequences, making a choice, and evaluating the choices).

- **Critical thinking**

analysing (i.e., recognising patterns, classifying, identifying assumptions, identifying the main ideas, and finding sequences),
evaluating (i.e., assembling information, determining criteria, prioritising, recognising fallacies, and verifying),
connecting (i.e., comparing, logical thinking, inferring deductively, and identifying causal relationships).

- **Creative thinking**

synthesising (i.e., analogical thinking, summarising, hypothesising, and planning),
elaborating (i.e., expanding, modifying, extending, shifting categories, concretising),
imagining (i.e., fluency, predicting, speculating, visualising, and intuition).

The implication of the interactive model presented by the ISU's Education Department could be justified by the Author to be applied in his model of the design process due to the following reasons:

1- The Iowa's model is an art-education model with very similar aims and objectives to educate art students to those of the Author. This model is already adapted in the entire State of Iowa, and as claimed by NAB organisers, it will soon be extended in the art educational system of the entire USA.

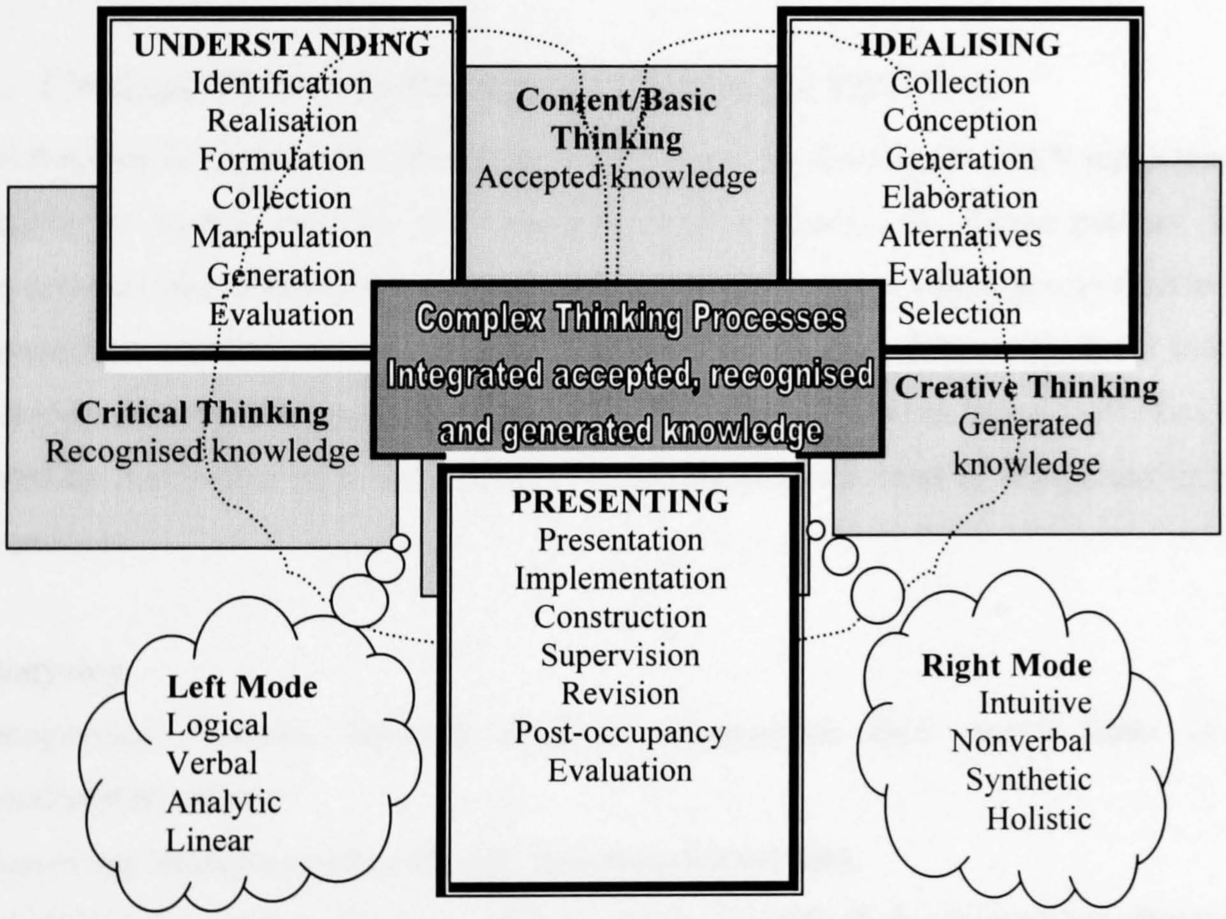
2- It is a brain-based education system, very similar to the thoughts and findings of the Author, considering left and right hemisphere dominance, to be applied in architectural education.

3- It enjoys an 'interactive' thinking process which involves three-thinking types – content, critical and creative thinking – very applicable to the three-stages of the design methodology – understanding, idealising, and presenting, proposed by the Author.

9.3. An Interactive Model of the Design Process

Unlike conventional design processes, separating *analysis, synthesis,* and *evaluation* as independent stages of the process, the Author encourages the use of an interactive design process in which the three stages of *understanding* a problem, *idealising* answers, and *presenting* a solution, all work together simultaneously. This model, concurrently, enjoys an 'interactive' model of thinking which engages designers *creative, critical,* and *content* thinking. Figure 9.2, illustrates the interaction between the three stages of the proposed design methodology with respect to their thinking behaviour.

Figure 9.2 Interactive model of the design process with respect to the interactive model of thinking (proposed by the Author)



In this model, *creative thinking* is assumed to originate in the right hemisphere where it enjoys the dominating intuitive, synthetic, and holistic characteristics of the right mode. *Critical thinking*, on the other hand, is assumed to originate in the left hemisphere where it enjoys the left mode dominating characteristics of logic, analytic, and linear processing. The two thinking types, creative and critical, however, are interacting with one another through *Content/Basic thinking* which enjoys both right mode and left mode characteristics of the brain simultaneously.

By overlaying the proposed model of the design methodology on the thinking model, the Author seeks to correspond the *understanding* realm with *critical thinking*, the *idealising* with *creative thinking*, and *presenting* with *content thinking*. This way, he emphasises the contribution of *recognising knowledge* to the *understanding* stage, *generating knowledge* to the *idealising* stage, and *accepted knowledge to presenting* stage. Each stage, as mentioned earlier in the design methodology, will interact with one another, and enjoy an interaction of analysis, synthesis, and evaluation within themselves.

The 'interactive' thinking model is responsible for various tasks in the model of the design process proposed by the Author. The following section describes the Author's model of the design process from an educational perspective which could be implemented by students and educators of architectural design.

9.3.1. Critical Thinking for Understanding a Problem

Critical thinking is suggested by the Author to be under the dominance of left hemisphere, responsible for logical, rational, and sequential thinking during the design process. The Author defines *Critical thinking* as being of recognised knowledge which is responsible for understanding a problem. It involves *Analysing, Evaluating,* and *Connecting* in his model of the design process. With regards to critical thinking, the following lists of activities are suggested by the Author to be considered by students and educators of design during the design process.

- **Analysing**

1- *Recognising Patterns.* Students need to demonstrate their verbal ideas in a visual/spatial manner.
2- *Classifying.* Students need to classify various collected data.
3- *Identifying Assumption.* Students need to clearly identify their assumptions about the problem.
4- *Identifying the Main Ideas.* Students need to identify their major objectives and ideas of solving a problem.
5- *Finding Sequences.* Students need to record all of their design ideas and develop new ideas based on the old ones.

- **Evaluating**

1- *Assessing Information.* Students need to assess their work, in addition to the educators' assessments, to develop a criteria of evaluating their work.

2- *Determining Criteria.* Students need to determine some major criteria for developing solutions.
3- *Prioritising.* Students need to prioritise their objectives.
4- *Recognising Fallacies.* Students need to look for weak points for developing solutions.
5- *Verifying.* Students need to verify the appropriateness of their solutions.

- **Connecting**

1- *Comparing/Contrasting.* Students need to compare their solutions with others.
2- *Logical Thinking.* Students need to develop reasonably logical solutions for all design problems.
3- *Inferring Deductively.* Based on Comparing (#1), and Logical thinking (#2), the students need to infer the relative success of their solution.
4- *Identifying Causal Relationships.* Students need to identify the causal reasons in their thinking process.

9. 3. 2. Creative Thinking for idealising solutions

Creative thinking is suggested by the Author to be under the dominance of right hemisphere, responsible for intuitive, visual, and simultaneous thinking during the design process. The Author defines *Creative thinking* as being of generated knowledge which is responsible for idealising a solution. It involves *Synthesising, Elaborating* and *Imagining* in his model of the design process. With regards to creative thinking, the following lists of activities are suggested by the Author to be considered by students and educators of design during the design process.

- **Synthesising**

1- *Design Types.* Students need to implement some design types which would help them generate solutions.
2- *Design Strategies.* Students need to apply some design strategies to exercise their design ideas.
3- *Planning.* Students need to prepare a plan of work to generate ideas.

- **Elaborating**

1- *Expanding.* Students need to be able to expand their initial ideas.
2- *Modifying.* Students need to be able to modify the initial as well as newly generated ideas.
3- *Extending.* Students need to extend on the ideas which are generated by others.

4- *Shifting Perspectives*. Students need to be able to shift their viewpoints and not stick with one idea.

5- *Concretising*. Students need to develop concrete ideas.

- **Imagining**

1- *Fluency*. Students need to develop fluent responses to problem.

2- *Predicting*. Students need to predict the final solution and its effects.

3- *Speculating*. Students need to speculate on their solutions.

4- *Visualising*. Students need to visualise their solutions.

5- *Intuition*. Students need to trust their intuitive judgements and decisions.

9.3.3. Content/Basic Thinking for Presenting Solution

Content thinking, the Author believes, could be considered as the most important component of thinking processes during the design process which enjoys the characteristics of both hemispheres. It acts as an archive of information and images and a major processing mechanism in the designer's mind. All types of information including: the environmental background of designers, images they have seen in the past, experiences they have had, and even those new information that they seek and collect throughout a design process, are collected and processed in this place. The Author defines Content/Basic thinking as being part accepted knowledge which is responsible for presenting a solution. It involves problem solving, designing, and decision making in his model of the design process. With regards to content thinking, the following lists of activities are suggested by the Author to be considered by students and educators of design during the design process.

- **Problem Solving**

1- *Sensing the problem*. Students need to become sensitive to the design problem and develop early ideas.

2- *Researching the Problem*. Students need to visually research a problem and visually collect information.

3- *Formulating the Problem*. Students need to formulate the problem in its wide range and find ways of responding to those problems.

4- *Finding Alternatives*. Early ideas are good but not final. Students need to explore different ideas and find alternatives.

5- *Choosing the Solution*. Students need to use their creative skills of decision making to choose a solution.

6- *Building Acceptance.* Students need to use architectural criticism skills to explain the significance of the solution they have created.

- **Designing**

1- *Imagining a Goal.* Educators need to build student's visualisation abilities.

2- *Formulating a Goal.* Students need to be taught to formulate a goal and focus in on it.

3- *Inventing a Product.* Students need to explore creative thinking approaches, i.e., visual thinking, to invent new approaches for producing solutions.

4- *Assessing the Product.* Educators need to help students develop deeper criteria for evaluating their work in-process.

5- *Revising the Product.* Students need to value the process of reworking through good assessing.

- **Decision Making**

1- *Identifying the Issue.* Students need to identify architectural design issues which most likely influence their design product.

2- *Generating the Alternatives.* Students need to generate alternative design solutions.

3- *Assessing the Consequences.* Students need to visually explore the effects of their visual decisions on the final solution.

4- *Making a Choice.* Students need to make appropriate decisions which are not solely based on personal taste.

Evaluating the Choices. Students need to use historical precedents to make quality decisions.

Chapter 10
Collecting Data

10.1. Introduction

Actually the two aims of the research described in the first chapter – developing an alternative design methodology for architectural design education, and developing an "interactive" teaching strategy for design studios – did not take their final form before a long process of enquiries, literature reviews and discussions were conducted. Therefore, throughout this research, as it is common in any Action Research described earlier, a trial-and-error approach was adopted in order to formulate the next necessary steps to be taken by the Author to reach the final research design.

Despite collecting data through literature review, reflected in the previous chapters, the Author needed to collect some additional viewpoints and specific answers to his questions about teaching design and the design process. In order to collect different viewpoints on various issues related to design strategies, the design processes, and characteristics of ideal: programmes, students, and instructors, acquisition of knowledge took form through the means of *correspondence, interviews, pilot study, initial data enquiry*, and *questionnaires*.

In this chapter and the following two, the Author will attempt to introduce the methods he used for data enquiry, as well as, for analysis. Since the quantity of collected information requires a larger space than the Author was advised to afford it, *correspondence, interviews, pilot study*, and *initial data enquiry* will be introduced in this chapter, and the *questionnaires* will be presented in the following two chapters.

10.2. Correspondence

The first step for the Author to contact others and begin collecting data was made through correspondence. This took place by means of sending electronic mail (e-mail) as well as by writing letters to some educators and professionals, mostly in the UK, and visiting several organisations and universities. In fact the first contacts that the Author made in reference to his research were in the form of formal letters. These letters were sent to some world-famous architects (i.e., Sir Norman Foster) and educators asking their general views about the design process and enquiring about possible interview appointments for further discussions with the Author (see Appendix D for the sample letters sent to professionals). Those who replied to the letters and/or set a meeting included:

- Dr. Jens Pohl, California Polytechnic State University
- Professor Geoffrey Broadbent, (formerly Head) University of Portsmouth
- Professor Bryan Lawson, University of Sheffield
- Professor Peter Smith, Hallam University in Sheffield
- Sir Norman Foster, Foster and Partners, London
- Mr. Terry Farrell, Terry Farrell & Partners, London

The initial replies indicated to the Author that his subject of choice was interesting enough to build his research question around. Later the Author made some interview appointments with those who were interested to have meetings with him and discussed the issues more specifically. Although the earlier letters were general, the later ones were more direct and specific.

One major contribution to the research was made by Dr. Jens Pohl[1], the Author's supervisor during his Master of Architecture studies at California Polytechnic State University (Cal Poly), and an expert on the application of artificial intelligence in architecture. During the 1980s when the Author was studying at Cal Poly, Dr. Pohl in his computer class, had speculated about the future of architectural practice. He had suggested that personal computers would replace most computer terminals of that time and people could be able to stay home and review their daily business without actually going to the office; or even do their shopping by ordering through computers. Of course, there was not advancements in the Internet back then, but he had very correctly predicted the future. In his recent contact with Dr. Pohl, the Author had forwarded a question to him asking about his views of how the future of the architectural profession and architectural education would develop. Dr. Pohl replied:

"You refer to our discussions about information management trends during a graduate computer class in 1985. In computer technology terms that is at least five generations ago.

[1] Dr. Jens Pohl, Executive Director of Collaborative Agent Design (CAD) Research Center at the College of Architecture and Environmental Design, at the California Polytechnic State University, San Luis Obispo, CA. For some of Dr. Pohl's books and articles see Bibliography.

Much has happened in the meantime and my predictions in 1985 were probably on the conservative side. We simply underestimated the rate of technological developments. Conversely, I believe that we are now in danger of overestimating the ability of human beings to rapidly adapt to the opportunities and almost mandatory changes in lifestyle that these technological advances bring. I will categorize my thoughts under several topic areas.

How will architects design? We will increasingly utilize intelligent computer-aided design systems that are capable of assisting architects in the design decision making process (see for example the enclosed brochure describing ICADS). This will be made possible by the representation of ***information*** rather than ***data*** in the computer (i.e., ***data*** consists mostly of words and numbers, while ***information*** includes data and the relationships that exist between data items; for example, the word 'table' means nothing by itself without the relationships that we automatically form in our mind between the set of characters (table) and our knowledge and experience with the physical object 'table'). As I discuss in the paper "The Future of Computing: Cyberspace" (see enclosure), the premises of the Cyberspace environment cannot be fulfilled without meaningful computer-based decision-support capabilities, and to achieve this level of utility computer systems must have some understanding of the information that they are processing.

As global connectivity continues to expand human users will increasingly rely on computer-based agents to serve their needs. Such services will range from rating e-mail messages in order of priority and the performance of sophisticated information search functions; to the automatic implementation of investment strategies and the identification of business opportunities.

These enabling capabilities will greatly increase the ability of individual architects to accomplish tasks that hitherto have required the resources of medium-sized firms.

What will architects design? Telecommuting will become the preferred arrangement for many companies and employees. This will require new kinds of office building facilities. We are already witnessing this trend in the hotel business. Today, virtually all hotels in urban areas offer conference rooms and small business centers (with computer facilities). In the USA many hotel guest rooms provide convenient modem hookup outlets for internet access. Apart from the changes in hotel design, there will be an increasing market for small office buildings where companies and individuals can rent well equipped single and shared office space, ranging from small rooms to single and multiple suite clusters.

Increasingly the home will also serve as an office and work space. Home owners will insist on convenience, flexibility and automation. The intelligent building will become a reality posing several challenges to architects. Firstly, architects will need to become conversant with many technical (particularly electronic) devices and facilities that will become integral components of most building types. Secondly, there will be an increasing expectation of high quality and rapid fixed-price delivery. With all of the new opportunities for human productivity, time will become very precious and customers will have very little patience.

How will architects learn to become architects? Increasingly all persons, including professionals and architects, will be judged on their performance and not on their qualifications. Apart from the normal discipline-based skills that are required to successfully perform building design and construction management services, architects also need to acquire broadly-based business skills (i.e., financial management, effective promotion and marketing, assessment of business opportunities, relationship building, etc.). In addition, architecture schools must recognize that a significant percentage of their students will either never enter the architecture profession or will make a major career change during their life. Design skills and experience, which really translate into an ability to deal with complex problem situations are becoming highly marketable skills as society increasingly tackles more and more complex problems (see the enclosed paper on Complex Adaptive Systems). Under these circumstances architecture schools, and universities in general, have an important role to play in ***continuing education*** (i.e., post-professional education)".

Dr. Pohl who joined Cal Poly teaching staff in 1982 from Sydney Australia, expressed his views about architecture schools stating: "It is unlikely that architecture degree programs that require five to six years of full-time studies (in residence) will be able to sustain themselves. Part-time programs with periodic high intensity resident workshops (e.g., weekends, and one to two weeks) are likely to become the norm. These periodic resident seminars will supplement virtual classroom activities that can be accessed at anytime from anywhere".

The Author believes that computers as a "tool" will become highly influential in the future of architecture and it is the time for those countries/schools which have not taken this issue seriously to start planning. The profession is once again ahead of the educational system in adapting to computers, but it is the responsibility of the schools to define the appropriate use and applications of computers before it is too late and students start to misuse them.

Other correspondences were followed by interviews which will be presented in the following section. Although the number of educators and professionals who replied to the Author were not very many, the Author welcomed getting small but qualitative responses from those who replied. The Author believes that knowledge is not produced, but extended. To extend the knowledge, one requires co-operation. Doing research and investigating about the "truth" of a subject can never be accomplished unless there is a share of information. Therefore, the joy of acquisition of knowledge may not be fulfilled unless there is a will to express it and share it with others.

10.3. Interviews

The Author conducted some *non-directive*[2] interviews with a total of five educators in regards to different aspects of his work throughout the research. Whenever the Author was in need for some supporting information to complete or justify his thoughts, he would make an appointment with an appropriate educator to discuss his concerns. These discussions were casual, but the Author would let the interviewees know the main subject of the discussion ahead of time. Depending on the conditions of the meeting, he would ask some further related questions. The interviewees included four architects and one psychologist. They are (in the order of interviews made):

1- Prof. Peter Smith, (Architect)............	Hallam University, Sheffield
2- Miss Melony Richardson, (Architect).....	University of Sheffield
3- Dr. Mitchel Waterman, (Psychologist)...	University of Leeds
4- Dr. Bob Felix, (Architect)..................	Leeds Metropolitan University (LMU)
5- Prof. Geoffrey Broadbent, (Architect)...	(Formerly) University of Portsmouth

The first two interviews were conducted in September 1997, with Professor Peter Smith and Miss Melony Richardson, who were recommended to the Author by one of his supervisors, Professor Peter Dale, as the appropriate educators for getting started with the research. Back then, the Author's general idea of the research was directed toward the characteristics of the human brain and developing some educational methods to maximise the use of the creative hemisphere during the design process; with those thoughts he started his first interviews.

[2] Non-directive interviews are particularly valuable techniques for getting at the deeper attitudes and perceptions of the persons being interviewed without having any preconceived notion of the exact structured questions (Cohen and Manion, 1994).

Professor Peter Smith (1992, 1984, 1987) is an educator at the Department of Construction Management at Hallam University in Sheffield and is interested in the area of applying bi-cerebral consciousness in architectural design. In reply to the Author's first question about how he defines architecture, Professor Smith stated: "Architecture is a unique discipline...it is a totality", it is not about the history of architecture, but "the history of knowledge". He later suggested the design method in architecture should act as a bridge connecting "information" to "the ability to see things". He argues that architectural education "should show students to see history first and become enthusiastic about it". He believes that architecture creates art and beauty, and "aesthetics" can be taught. Yet he adds that architecture is "the added value to utility, [which gives] extra dimension above men's necessity".

Asking him about his thoughts on the design process and the thinking processes involved, Professor Peter Smith replied: "The human brain is consisted of two hemispheres and a natural harmony exists between the two hemispheres". However, he added "it is vital to activate the right brain potentials in the design process, since most people tend to use the characteristics of their left brain in normal situations". He suggested "vertical intelligence", in charge of rational thinking, as well as "lateral intelligence", in charge of creative thinking, as "inheriting" and must work together "interactively" in the design process. For achieving this, he added, "students need to be emotionally charged in the design process". Maximum use of the different facilities that the brain can offer must be utilised in the design process which he called is "an integrating process".

Professor Smith underlined his thoughts on the design process and architectural education with what he believed to be the necessity of interaction between what he called "inherited potentials" and the "environmental stimulates". He stressed that there is inherited information for designers and that architectural education is there to bring them out, however, if nothing exists, then "intelligence" can't do anything about it. He used the terms "connections", "sparks" and "energy" in describing designer's role to make a *connection* between the information and *sparks* of ideas that would help them to give *energy* to the design process and developing solutions.

Later, he recommended that the Author to see the works of Roger Sperry and Richard Ornstein in the area of bi-cerebral consciousness and split brain theories.

This first interview was an exciting experience for the Author, since he had found an experienced educator who shared the same thoughts about the human thinking process.

The Author's ideas about using the potentials of the human brain toward improving the design process in architectural education were welcomed by Professor Smith. This meeting gave some starting points in collecting materials for his literature review and the following steps became clearer in the research.

The first experience was followed by another interview in Sheffield, this time however, with another perspective about design teaching and working with students. Miss Melony Richardson from the Department of Architecture at the University of Sheffield was interviewed by the Author on September 14, 1997. The Author asked about her general thoughts on the subject of teaching design. Miss Richardson, looking through a minority perspective, directed the discussion in the areas of: 1- student experience (i.e., where they come from and what are their backgrounds, environmental and cultural differences,...) and 2- tutor's attitude and involvement (i.e., prejudices against students' social, racial, or gender status). Although the subjects which Miss Richardson had brought up were not expected to be discussed by the Author – since in Iran a large number of students come from different regions of the country with different cultural and social/economic backgrounds – the Author welcomed the opportunity for discussing students' backgrounds.

Miss Richardson's major remarks with regards to teaching design could be summarised as:

- Provide critiques which do not clearly divide between what is "right" and "wrong".
- Clash between the past and current may destroy self confidence of the students.
- Instructors need to be open-minded especially with entrant students.
- Group criticisms intimidate many students, try to avoid group crits if possible.
- Stress on the importance of theory by involving students with History.
- Give more independence to students so they ask instructors instead of instructors telling them what to do.
- Gradually build up relations, gently teach them how to put things together.

Meeting with Miss Richardson, too, was an exciting experience for the Author since it brought up some issues, as summarised above, in relation to dealing with students in a design studio. As the Author had been cautioned by his research supervisors though, there is an enormous number of subjects and/or areas related to design education that the Author could easily fall into, and losing the initial direction of his research. Therefore, no matter how interesting most cultural issues appeared to the Author, he decided to continue on his main track of "improving the performance of design students" with an emphasis on design methodology.

After 18 months progress into his research, the Author had to present his work for the Transfer Report[3] at the University of Leeds. In the Transfer Meeting, two issues were suggested by the Internal Examiners, one was to be precise with the research design, and the other was to downplay the "brain talks" in the final research and pay a closer look at the educational aspects of the research. In fact one of the examiners, Dr. Beggs, insisted that there is no scope of application for left-brain, right-brain characteristics with respect to design as he had checked with one of his psychologist friends. These remarks made the Author realise the shortcomings of his argument and he became more determined to work harder and collect more information before changing the direction of his research.

At this stage two very helpful meetings took place, one with Dr. Felix at Leeds Metropolitan University and the other with Dr. Waterman at the University of Leeds. Each individual looked at the meeting from his own perspective, the former in an architectural and the latter in a psychological view. The Author needed to check his research design with an architectural educator, and also, he needed to find out more about the controversial subject of the human brain. The opportunity to discuss about specific research problems was provided within the area of Leeds which was an interesting experience for the Author to arrange these meetings locally and receive some valuable results[4].

Meeting with Dr. Felix was arranged by one of the Author's supervisors, Professor Peter Dale, at Leeds Metropolitan University[5]. Dr. Felix from the Department of architecture at LMU, born and educated in the United States, welcomed the occasion to discuss about design teaching methodology with the Author. In the meeting the Author explained his research design and outlined some possible alternative directions for his work (i.e., compare between two groups of students working with the Author through different methodologies, and/or compare the methodology of the Author against another educator).

Dr. Felix first explained his model of design methodology stating "an appropriate model of design methodology would look at both analytic and synthetic skills". However, he stressed that the method of teaching design has to be appropriate for the pace of the students, since students' capabilities are different, "No matter how difficult it is", he underlined, "adaptable methods should be applied in studios, for different students".

[3] Transfer Report is the report required by the University from all Ph.D. students to be approved by two 'Internal Examiners' on the progress of the candidate and his transfer from Provisional Ph.D. into a Full Ph.D. status.
[4] Usually researchers think they have to contact scholars in long distances for enquiring their questions, however, locally, in most cases, educators are perfectly capable in responding to those questions.
[5] This interview was conducted by the Author on 6/12/99 at Dr. Felix's office at LMU.

Further he explained, assessing student's work too must be dealt with individually, for example two students may receive a B+ grade from the same educator, but it doesn't follow that these students abilities in design are equal. He said, "when we give a B+ that is not equal for all students, some are encouraged and some are penalised...gifted students get B+s easy". With regards to working with students and the role of design educators, Dr. Felix explained that the amount of work that teachers put in for the education of First-Year and Second-Year students is a lot more extensive than their contribution demanded by the Forth-Year and Fifth-Year students. He called students at the end of their fifth year "independent practitioners", and throughout their educational experience, students have to learn how to reach that point.

Again on the subject of teaching methodology in design, he reminded the Author about Schon's[6] "reflective practitioner" judgement of what happens in architectural education through the design studio experience. Calling the architectural education model an 'ideal educational model using design studio', Dr. Felix called for a methodology which would bring up both intuitive and analytic potentials of students during design. Having sketches, from his own projects and those of his students, all around his office, Dr. Felix viewed sketching as a 'visual note taking' method useful to present the intuitive and creative aspects of design.

With regards to the alternative research design mentioned by the Author, Dr. Felix suggested that the Author should find an educational model, in the areas of "learning styles" or "teaching styles", and then apply his model of teaching design based on those already formulated models. Dr. Felix didn't think either of the alternative plans of the Author would be appropriate since he said "it would be difficult to isolate students from one another in those experiences". After examining the Author's educational experiences, including teaching work with 1st, 3rd, and 5th year (Thesis Project)[7] students, Dr. Felix suggested to the Author that he should present a case study of his educational works. He encouraged the Author to introduce his students' design exercises in different years and compare their works with other students who didn't work with him.

Meeting with Dr. Felix was an exciting experience for the Author since he shared many ideas with Dr. Felix (i.e., activating both intuitive and analytic potentials of students, using sketches and visual thinking or as he called it "visual note taking"). The meeting also shed a light on the research design; the Author always thought he had to "prove" something with his research, but Dr. Felix indicated that this research could end by presenting the

[6] See Design Studio in Chapter 3 for more on Schon.

results of an investigation. Therefore, the Author could present his methodology based on his hypothesis and all the appropriate knowledge which he had gained throughout his research in the form of a *case study*. Also, the Author took Dr. Felix's advice and "surfed" the Internet for information on some subjects related to his research, i.e., *learning/teaching styles* and *thinking*. The result of this "surfing" was the discovery of a number of enjoyable sites relevant to *Thinking*, in particular a site which helped the Author to develop his thinking model in the design process based on Iowa's Model of Art Education (discussed in the previous chapter).

With regards to his second concern, the appropriateness of the brain discussion in the design process, the Author contacted the Director of Teaching and Training at the Department of Psychology at the University of Leeds to introduce to him an educator who is interested in the subject of the human brain. Dr. Mitchel Waterman was referred to the Author and the meeting was arranged[8].

In the meeting, the Author explained his findings – which were mostly based on Sperry's (1974, 1985) findings in the United States – and explained the outcome of the Transfer meeting. Therefore, his question to Dr. Waterman was if this discussion has any place in Britain, and why were most articles written in the 1980s? Dr. Waterman explained first of all "brain differences are not absolute and any behaviour is likely to be bilaterally represented". There are some records of people who can choose one preferred hemisphere, but it is rare and abnormal. Sperry's work through surgery and split brain patients during the 1960s and 1970s showed the whole world that there are differences between the characteristics of the two hemispheres. However, nowadays split brain surgery has been stopped since there is evidences showing that surgery does more harm to the patient. "This is probably why you don't see more articles in the 1990s about the subject of split brains".

He added, "There are evidences from people who haven't had brain surgery but show different brain characteristics". In reaction to the question: *Can the creative characteristics of the right brain become stimulated, let's say through visual thinking and graphics during the design process?* Dr. Waterman made it clear that "you can encourage right brain processing [in design], but it can never happen by itself". He further added: "the output of thinking is not the product of left or right, we are not aware of which is active, ..." he added, "I think the intention to learn something is not controlling what we learn" and

[7] The Author has supervised over twenty Master of Architecture Thesis projects at the University of Tehran since 1997.
[8] Meeting with Dr. Waterman took place on 13/12/99, in his office at the University of Leeds.

actually "all learning is implicit". He went on further explaining "implicit" vs. "explicit" learning, and gave some implicit examples (i.e. riding a bike). However, he suggested a move away from the left-brain dominated educational system in the world, which is oriented towards the use of "language", by taking a closer look at the "dual code" theory. In this theory, he explained, "right brain becomes more active through abstract/unabstract visual representations". His reference to visual abstract representations in architectural design would mean the use of graphic forms while by unabstract representations he meant the use of verbal notes.

The Author then asked, *wouldn't implicit knowledge of architecture in students play the main role in developing their solutions?* Dr. Waterman agreed and suggested that "that is why most students from larger communities who have been exposed to more visual experiences are more likely to develop creative solutions than those who are from smaller communities" [or rural areas with reference to Iran]. With regards to the students from rural areas in Iran who have a hard time creating appropriate design solutions in the Author's teaching experience, Dr. Waterman suspected "even the meaning of a straight vertical or horizontal line may be different for them". Their point of reference is what they have seen in the country and straight lines look different in nature than in large cities.

Dr. Waterman gave a list of suggested readings with respect to the two brains and stressed that the Author should look up John Anderson's (1995) books on Cognitive Psychology (see these references in Bibliography). The Author gained some invaluable information from this meeting, particularly now that he had found some logical reasons for his long awaited question about the poor performance of his students who had come from rural areas. Paying heed to Miss Richardson and Dr. Waterman's remarks about students with different social/cultural backgrounds made the Author more determined to develop a teaching methodology which would benefit all groups and backgrounds.

The final interview which was truly an educational experience for the Author was conducted with Professor Geoffrey Broadbent (1998, 1995, 1988, 1973), the former Head of Portsmouth Department of Architecture and a pioneer in the issue of the design process and creative thinking. Although some communication had been initiated before the December meeting[9] with Professor Broadbent through emails and letters, the interview provided an opportunity for the Author to have a face to face discussions.

As in other interviews, the Author first briefly introduced his research and the steps he had taken thus far. His question to Professor Broadbent was "in your 1988 Postscript to *Design in Architecture* (1973) you had made some changes to the Four types of Design, will you please explain those? Professor Broadbent stated "The four "Types of Design" identified in 1973, [Pragmatic, Typologic, Iconic, and Canonic], were developed over the years, however, after discussions with very many people in very many places they became: Pragmatic, Typologic, Analogic and Syntactic Design". In his later correspondence with the Author Professor Broadbent specifically defined his terms as:

- "Pragmatic Design: in which materials, climate and other physical factors are used as the basis for proceeding, by trial-and-error, to see what can be made to "work" at full scale, with the actual materials, in physical mode form or, especially these days, in computer model form.
- Typological Design: in which one draws on known and established *types*. One may copy known examples directly or try to penetrate to the "essence" of the type (see my 1990). What's more I see typologies as operating at every scale from that of, say, a doorknob to a kitchen layout; from that of an apartment layout to an entire building form and from this again to the layout of spaces between buildings (see Krier 1975) and up to the scales of whole neighbourhoods, cities and regions.
- Anologic Design: in which one draws on, perhaps combines, visual or other images to trigger new ideas. I suggest in Design in Architecture (quoting Gordon, 1961) that analogies may be personal, drawn from one's own physical feelings (useful in understanding structures!), direct such as appearances drawn from nature, from paintings, even from existing building or symbolic, perhaps even allegorical or metaphorical.
- Syntactic Design: in which one works according to some rule-based system much like those which Chomsky suggests (1957) lie behind the ways we structure sentences in language. The Classical orders work somewhat in this way but these days architects are more likely to work out rule-based geometric systems and use these to generate two-dimensional patterns or even three-dimensional forms. One can also work out rule-based systems for other aspects of design, such as the application of colour".

The Author then asked where do these fit in your model of design method? Professor Broadbent described his design method is consisted of:

[9] Meeting was held at the Lobby of RIBA in London, on 12/01/2000. Despite the shameful 2hr tardiness of the Author due to missing his train, Professor Broadbent was patiently waiting.

Briefing
Analysis
Synthesis
Evaluation
Implementation

Conjecture
Refutations

Further he explained the four types of design fall under "Synthesis". He also described the concerning issues in "Evaluation" are:

-Fit the spaces and activities (function)

-Building fabric (environmental fit/appropriateness, energy, site, ...)

-Cultural symbolism (symbolic content, is it appropriate and readable?)

-Economic performance (through the life of the building)

-Environmental impact (impact of the project on the site and visaversa,..)

When the Author asked: *if different stages of design in his design model follow a "linear" process*, Professor Broadbent replied, "No, it is cyclic, after Jones and Asimow's model" (see Fig. 5.1 in Chapter 5). Then the Author explained his model of the design process which takes more a "conical" form, narrowing down on to a specific solution (see Fig. 6.2 in Chapter 6). Professor Broadbent seemed interested in the Author's proposed form and called it "fascinating".

The meeting with Professor Broadbent was an educational experience for the Author. Following his meeting with Professor Broadbent, the Author was told by his supervisor, Professor Smith, to not make any further contact with Professor Broadbent since they were going to invite him as the one specialist on the subject for his final examination.

10.4. Pilot Studies

A *Pilot study* is a preliminary study conducted to try out experimental procedures for the purpose of working out potential problems before the main study begins (Slavin, 1984; Crotty, 1998). In this research, too, the objective of giving pilot studies was to get a feeling about the objectives of the research before proceeding any further and receiving some feedback about the structure of questions which were going to be sent later to schools. The pilots were given to two groups. One to students and one to educators to examine their viewpoints on the content and format of the proposed questions related to the design process and architectural design. As it is expected from a pilot study, the results of these pilots turned out to influence not only the format of the questions but also the direction of the research which will be explained in the following sections.

10.4.1. Student's Pilot

Student pilot questions were given to a small group of fourth-year architecture students, totalling six in number, at the University of Leeds in October 1999. They were in the Architectural Engineering programme at Leeds working on the design of an airport for the Leeds-Bradford area. The questions ranged greatly in topic from asking about students' views of design and the design process, and the tools which they preferred to use in design; to querying if they were satisfied with their schools and schooling (see Appendix E1 for a sample of Student Pilot questionnaire). The Author had asked students to answer the 17-question pilot and feel free to make comments about the content or format of the questions. However, as it turned out, most students didn't make any comments on the structure or the content of the questions. The Author doesn't think this is necessarily because the questions didn't have any problems, rather he suspects, either students had not been given enough time to examine them[10], or they were too shy to express their views. The exception was a comment on Question 2, a question about how students develop design concepts; "it depends on the nature of the design". This was a good hint for the Author to make questions more specific. Also, Question 17 posed some difficulties for students to order their thoughts about governing factors in architectural design. This indicated to the Author that long questions require a more convenient method of selecting answers. Incidentally nobody answered Question 16, which was an open question asking students for general comments on architectural education. This indicated to the Author that maybe students didn't like an open question requiring them to express their views; also, it could have been the language of the question. As Cohen suggests (1994) when one takes a positive or negative side in questioning about a subject, it appears easier to answer that question – for the respondents – than when the language of the question is in a neutral sense asking general opinions about a subject.

10.4.2. Educator's Pilot

Educators' pilots were sent to six educators who were aware of research. These individuals again were selected on the basis of being conveniently accessed in case of further enquiries about their comments. The pilot questions were sent in October 1999, with a cover letter[11] stating the purpose of the research and requesting the educator's views about the content as well as the format of the questions (see Appendix E2 for a sample of the Cover Letter and Educator Pilot questionnaire). The recipients were: Dr. Clive Beggs and Mr. Krisen Moodley, the Author's Internal Examiners during the Transfer Report, and Dr. Apollo

[10] Students were given 30 minutes to complete the pilot questionnaires in the presence of the author.

Tutesigensi, all from the School of Civil Engineering at Leeds; Mr. Abbas Izadi, one of the Author's colleagues at the University of Tehran who was a Ph.D. student in Architecture at the University of Sheffield; Professor Peter Smith at Halam University in Sheffield and Professor Peter Fawcett, at the University of Nottingham. The latter two educators were recommended to the Author by one of his supervisors, Professor Peter Dale.

The results of the pilot enquiry were very helpful for the Author in directing his future attempts. Professor **Fawcett** wrote:

"... It seems to me that the 'interactive' nature of design is a well-trodden path and has been ever since the beginnings of research into design methodology in the early 1960s. There is, as I am sure you are aware, a huge literature surrounding this. This suggests to me that your research area should be much more clearly defined and more focussed than appears to be the case at present. The other well-trodden path is that of so-called architectural psychology which embraces the 'visual thinking' (whatever that is) aspect of your proposed research, as I understand it. You also need to define your terms more precisely; to suggest that 'visual thinking' involves 'spatial thinking' is sloppy and I wonder what any self-respecting psychologist would make of it!..."

One constructive issue from Professor Fawcett remarks was to warn the Author to take a closer look at the title/direction of the research, then "Interactive Design Process in Architecture, Using Visual Thinking as an Educational Approach of Dealing with Design Factors". Although it was clear that the Author wanted to suggest the use of "visual thinking"[12] as a method in the design process, it was not quite comprehensive enough to include all issues that he had in mind. Later, after making new findings about "thinking modes"[13], the Author shifted the direction of his research toward a more comprehensive approach. Instead of investigating a "method", i.e. visual thinking, he started to apply a methodology of design to which different methods could be applied[14]. Therefore, *methodology of teaching design* and the design process formed the new direction in which the Author would pursue his investigation.
Nevertheless, other replies were very positive and supportive. Professor Peter Smith gave his full support on the subject of "architectural psychology" but didn't have any comments

[11] A cover letter is suggested by Cohen and Manion (1994) to accompany a questionnaire. Also, a follow up letter was sent to those who hadn't replied after two weeks.
[12] "Visual Thinking", despite Professor Fawcett's confusion about the term, has been defined since the 1960s (Arnheim 1969) as a way of thinking in design with the assistance of visual elements i.e. drawings and images. Also see Chapter 8.
[13] Thinking modes were discussed in Chapter 7.
[14] For definitions of methodology and method see Chapter 1.

on the structure of the questionnaires. Mr. Izadi on the other hand, had spent an extended amount of time elaborating his views about the questions; incidentally, he was the first educator to reply. He had made comments on both the structure of the questions, and their contents. Mr. Izadi had suggested:

- to group the related questions together,
- to direct questions into specific design years,
- and to be more precise in the format of the questions.

He had also made a remarkable comment on Question 2, regarding design approaches in students' problem-solving process, he asked: "shouldn't you differentiate between *design process* and *problem solving*"? This was a notation which was underestimated by the Author as far as choosing the right vocabulary in the professional dialogue and keeping it consistent.

Dr. Beggs and Dr. Tutesigensi's comments were minor in regards to the structure of some questions. Mr. Moodley, however, had spent some time reviewing the questionnaire and in his response he stated, "My chief concern is what is the objective of this questionnaire? How can they be analysed and is it going to help you"? The Author met with Mr. Moodley on a few occasions and used his advice for getting the objectives straight. His constructive criticisms, helped the Author to a great extent. Mr. Moodley's major concerns were:

- To clarify the objectives of the research,
- and to develop a helpful set of questions which would lead to the aims of the research.

The initial aim of the research was to help students to become more successful in design, and the new direction of the research, i.e., investigating a methodology of teaching design, would have served in that direction. Under the light of the pilot studies and after spending approximately two months re-evaluating the shortcomings of the research and its direction, the Author had developed some new questions. When does design start? What are the strategies in teaching design? What are the issues influencing an architectural design solution? How should one design? Investigating about these questions could help the Author to succeed in his search for developing a pedagogic methodology of design.

Therefore, the Author developed a new set of enquiries directed toward educators in order to collect some views on the subject of design issues and design methodology; this short version of capturing data was called the *Initial Data Capture*.

10.5. The Initial Data Capture

Initial Data Capture (IDC) was designed to collect the views of educators on the issues of design and methodology. The enquiry was directed toward British design educators for two reasons: First, they were more accessible in terms of communication[15] and secondly, because they were influential in today's world architectural education[16]. IDCs along with cover letters were sent to 33 Heads of Architecture schools in early December 1999, asking Heads or one of their colleagues who is interested in the subject of design process to comment on them. The addresses were obtained from RIBA's booklet on Schools of Architecture (RIBA, 1996), and thanks to modern computer technology, the preparation of the initial letters as well as follow up letters[17] didn't take much time (see Appendix F for the list of universities which were contacted). Among 33 recipients of the IDCs, 8 replied within a week of the initial letters being sent out, and 3 replied after the follow up letters. Those individuals who replied included (in the order of replies received):

1- Dr. Rob Macdonald, (Reader)...........	University of Liverpool John Moores
2- Miss Wendy Potts, (Head)................	University of Portsmouth
3- Professor Philip Tabor....................	Bartlett School of Architecture
4- Mr. Nicholas Weaver (Deputy Head)...	University of East London
5- Mr. Norman Arnold (Senior Lecturer)..	Hull School of Architecture
6- Professor Jeremy Till (Head)...........	University of Sheffield
7- Professor Brain Edwards	University of Huddersfield
8- Professor John McKean..................	University of Brighton
9- Mr. J. Collier (Lecturer)..................	University of Dundee
10- Mr. Gary Brown (Senior Lecturer)....	Centre for Arch. John Moores University
11- Mr. Neil Lamb (Stage-2 Co-ordinat.)	The Scott Sutherland School, Aberdeen

Three open questions were asked in the IDC with about half a page left blank for responses (see Appendix G for a sample of the IDC cover letter and questions). The Author believes that these remarkable responses to his questions have to be read completely before making any generalisation about their views. With this intention, the Author has attempted to put the complete replies to each question from each educator as he believes it would not be fair to categorise some "pros" and "cons" on different issues. Summaries of the questions

[15] Communication in the sense of both "distance" and "English Language".

[16] There are over 33 architectural programmes at universities and institutions within the UK which are highly commended by the profession and are accredited by RIBA. Also, there are over 50 schools in 18 countries world-wide where RIBA recognises their architectural programmes (RIBA, 1996) and British architectural educational system has influences on them.

[17] In this stage, follow up letters were sent a month after the initial contact.

along with educators' responses to each question are reflected below; starting with the first question which was in regards to the design process.

1- What are your thoughts about the subject of the design process in architecture? (What model, stages,...)

Many educators provided a model introducing various stages in their definitions of the design process. For instance, **Dr. Rob Macdonald** describes his model of the design process as "An intuitive soft model". It includes:

1- "Anthropological feeling for subject,
2- Site understanding,
3- Urban master planning,
4- Architectural design solution".
5-

Professor Nicholas Weaver had sent a copy of his paper describing Atelier principles[18] along with a school Yearbook to the Author. However, his short reply was that "The design process involves analysis and synthesis, knowledge, skill and intuition. It is both a science and an art. The way the creative process can be organised is described in the Yearbook".

Mr. Norman Arnold from the Hull School of Architecture describes his model of the design process as an "Organic" one after well known architects such as Scaroon, Aalto, etc. Major components in his model include:

1- "Site analysis
2- Brief/user formulation
3- Precedent studies"

He also adds, "The design should evolve naturally (organically) from a detailed study of objective and subjective qualities of the site. It should be appropriate to its context. The design should evolve naturally from a detailed study of the needs of the building users".

With regards to a model describing different stages in the design process, **Professor Brian Edwards** outlines his model as:

- "Form follows function
- Form follows ...
- Detail to whole
- Tectonics and poetics of construction

[18] Parts of Professor Weaver's paper on *Atelier Principle in Teaching* was discussed earlier in Chapter 3, under Design Studio.

- Meaning through semiotics of form".

Mr. Collier from the University of Dundee describes his model as:
"Brief formulation – Cost / area limits
Site investigation and analysis
Conceptual framework
Spatial and organisational developments
Investigation of fabric / structure / environmental design
Integration feedback loops
Detail design."

Miss Wendy Potts (1999), Head of the school of Architecture at the University of Portsmouth, in reply to the questions had sent a paper, *"The Design Studio as a Vehicle for Change: The Portsmouth Model"*. In this paper she has explained Portsmouth's experiences in design teaching and design methodology. The Author has reflected a summary of "Portsmouth Model" under *Design Studio* in Chapter 3.
However, there were some educators who had expressed some reservations in singling out a model for the design process due to the complex nature of architectural design. For example **Professor Tabor** states: "Architectural design is an infinitely various activity using all aspects of the designer's intelligence, knowledge, intuition and sensibility. No single model corresponds with this complexity. It's sometimes assumed that the "natural" design sequences are from research to proposition, from the general to the particular. This is no more logical than the reverse which, therefore, I tend to encourage".

Professor Tabor further describes: "The "cyclical" theory of design (oscillating between "research" and "proposition" or "modification", for example), though nearer the truth than the "straight-line" theory (from the general to the particular), is a tedious model for learning because it downplays the importance of intuitive short-circuits".

Professor Till expresses his views about the design process by suggesting: "I don't refer to a specific model, but the closest would be Socratic Irony (i.e., student led learning / self critique / critical scepticism are parts of it)".
"Major stages – Research / Critique / Assimilation"

Mr. Gary Brown didn't see the answer as a straightforward outline model. He explains: "The design process is complex in order to end up with simplicity that is appropriate for the context / function and spiritual requirements. Architecture deals with 'space' which is an 'intangible' until defined, architectural students need to understand the perimeters for defining space and multiples of spaces which in most cases relate to the 'actions of people' including psychological and social needs. The model used (if it can be termed such) is to attempt to make space a tangible by 'use' explanations balancing this with what could be termed spiritual or philosophical aspirations. This involves both sketch teaching 'exercises' and lectures relating to a wide scope of subjects the core of which are technology – history and design. (design = methodologies, philosophies and precedents). The aim is to create a flexible framework ......[so that students] are educated to educate themselves for the continual changes within "design" of spatial matrixes for 'society'".

Mr. Neil Lamb from the Scott Sutherland School of Architecture explained: "We do not follow any one particular model but have adopted a strategy to provide a comprehensive training in the theory and practice of architecture. Practice and the practical in architecture remain predominant, building on foundations of the early modern ideology from the Bauhaus through the Miesian inspired architectural programs at IIT [Illinois Institute of Technology] to the current preoccupations of the Stansfield Smith Report (4- year BSc Hons Architecture. 1 year postgraduate Diploma in advanced Architectural Studies)".

One different reply had come from **Professor John McKean** from Brighton University. He stated in his reply: "To answer these questions would be to write your doctorate for you. Anyone who has time to do this today clearly is not teaching in UK school of architecture!" Although he was kind enough to further add: "Will happy to talk to you, and for you to visit our school and talk to colleagues – if you do so, do ring the Head of school, Anne Boddington first".

As stated earlier, the Author was intrigued by the responses he received and it gave him an opportunity to hear different views on his questions. On Question 1, even among those educators who didn't feel there is one single model for the design process, their responses indicated some organisation of thoughts in explaining the complexity of the issues, and the Author sees this as a "model". Very often some colleagues think by giving examples and expressing an organised train of thoughts on the subject of the design process to the students – as was demanded by seeking suggestions towards a "model" – could be misleading. On the contrary, the Author believes that many students welcome this clarity and it could be suggested that this "model" is not the best or only model, but something to start with.

The Author has collected some key issues expressed by the educators' responses with regards to the subject of the design process in Table 10.1. These key issues have assisted the Author as a checklist for reference during preparation of the Questionnaires as well as for construction of his proposed model of design methodology. For example, in Table 10.1, some key issues are related to mental activities during the design process such as: intelligence, knowledge, intuition, sensibility, analysis, synthesis, and evaluation. These issues were dealt with already in Chapters 7 and 8, and they will be applied to the proposed teaching methodology in Chapter 13. There are some issues which have to do with general approaches to conduct design activities, including: general, particular, linear, cyclic, whole, and detail. These issues were dealt with in Chapters 5 and 6. Also, there are some issues that have to do with the products of the design process, including: construction, design, form, and etc. which were discussed in Chapters 4 and 8, and they will be applied to the proposed teaching methodology in Chapter 13.

Table 10.1 List of key issues in the design process introduced by some British educators. (Compiled by the Author)

Intelligence,	Critique,	Design,
Knowledge,	Assimilation,	Integration,
Intuition,	Form,	Feedback,
Sensibility,	Function,	Spiritual,
General,	Detail,	Space,
Particular,	Whole,	Intangible,
Cyclical,	Tectonics,	Action,
Linear,	Fabric,	Psychological,
Research,	Poetic,	Social,
Proposition,	Construction,	Needs,
Skill,	Semiotics,	Philosophical,
Analysis,	Cost,	Aspirations,
Synthesis,	Area,	Exercises,
Science,	Limits,	Methodologies,
Art,	Investigation,	Technology,
Site,	Conceptual	History,
User,	Framework,	Flexible,
Studies,	Spatial,	Changes,
Subjective,	Organisation,	Theory,
Objective,	Developments,	Practice,
Context,	Environmental,	Ideology, ...

The second question which was put forward to the educators, had to do with their views about architectural design. It stated:

2- ***List design issues which influence architectural design and you feel students need to respond to them in different stages of their architectural education (specify in terms of educational year, i.e., 3rd Year).***

Educators' responses to this question – which was intended to identify, critical issues influencing design – varied extensively. **Dr. Mcdonald** had grouped them into three stages, 1-3 in one group [the study stage], 4-8 in another group [the development stage], and 9 and 10 in the final group [the implementation stage]. His reply to this question was outlined as:

1- "Conceptual studies
2- Urban modelling
3- Architectural modelling
4- Building planning
5- Sectional planning
6- 3-D representation
7- Detailing
8- Detailed study
9- Structure/construction
10- Environmental services"

On the other hand **Professor Tabor** from Bartlett had a very simple model, his response to the most influencing issues in design was: "All years: "firmness, commodity, delight". I can think of near – synonyms more appropriate to our own time, but these are the main "issues"".

Professor Weaver from the UEL replied in a similar manner, he explains: "The aim of architectural education is to develop the student's conceptual analytical imaginative and practical skills necessary for them to determine human needs and aspirations and meet or express these in space and form. As they pass through the course[,] the problems encountered and their solutions become increasingly complex".

Norman Arnold did not reply to this question, however, on a separate sheet he expressed his view of architectural design. He states: "The resulting design should feel "positive" and comfortable/appropriate for its purpose. The building should be designed with modern materials and modern technology but should be deferential to its existing environment".

Professor Till from Sheffield cautioned against generalising his response to this question and explained: "It depends entirely on the project but the following seem common:

- The politics of space
- The user
- Sustainability
- The ethics of design
- The process of design in relation to external factors"

Professor Brain Edwards expressed his views about the influencing design issues through characterising:

- "How is it built, construction legibility
- How does the design respond to environmental issues
- How does the design reflect contemporary values
- Consistency in whole and detail
- Integration of at least 3 in major project (Year-5)"

Other replies, however, had a more systematic order in regards to the student's educational level. For instance, **Mr. Collier** explained the influencing design issues in the following format:

- "Year One: Understanding of ergonomics/structural criteria,

Simple integration of planning and fabric design,

Development of spatial possibilities – 3 dimensional design.

- Year 2/3:Increasing scale of project. Continuation of integrative process. Involvement of Landscape design.
- Year 4: Specialisation - Option report

Design related to special option. Increases scale and complexity.

- Year 5: Detail small design followed by major project (including research report, specialist investigation/design".

Gary Brown introduces the influencing issues in design as:

"Context: topographic – geographic social and cultural (environmental, wind, heat, cold) Year 1-4,

History: Relevant positioning – comprehension of historic models within their context Year 1-6,

Finance: Cost and value for money of space fabric – life of building format -Year 3-10,
Aspirations: Of the client – user – designer. (Problem solving for others and/or change the world) Year 1-6,
Communication: Techniques in terms of models and drawings to visualise, verbal, written- Year 1-10,
Procurement: Have to build it, social context financial communicative technology etc. Year 2-6,
Technology: of materials – form and systems related to environment, social and geographical - Year 1-6".

Neil Lamb outlines his response as:

- "Year 1: To demonstrate a knowledge and understanding of the basic elements and techniques of architectural design.
- Year 2: To demonstrate a knowledge and understanding of the systems and methodology of architectural design.
- Year 3: To demonstrate a knowledge of the composite interdisciplinary nature of architectural design.
- Year 4: To demonstrate the realisation of architectural ideas and aesthetic intentions through integration of the full range of acquired knowledge and skills.
- Diploma: To participate in a near practice like educational environment developing a degree of specialism which can directly be applied to practice". Based on the collected replies, the Author decided to categorise different design issues with respect to the educational level of the students. Analysing the educators' replies indicated some common stands on many issues, i.e., they all seemed to want to answer to "how" questions in their models implemented during the first year - how to draw? How to build? How to put things together? Therefore, the Author – in the instance of Year-1 – has made some assumptions based on the replies to describe issues such as *techniques, basic elements, ergonomics, space, user, context, environment, composition, ...* as the major issues influencing design projects. The result of such assumptions is illustrated in Table 10.2. In this Table, the most common issues introduced by the majority of the respondents are grouped in their corresponding educational level.

Table 10.2 Most common design issues influencing architectural design, based on some British educators' responses. (Categorised by the Author)

Year-1	Techniques, basic elements, ergonomics, space, user, context, environment, composition, ...
Year-2	(All of those from previous year) + methodology, integration, history, position, ...
Year-3	(All of those from previous years) + social/cultural, detailing, values, interdisciplines, ethics, materials, ...
Year-4	(All of those from previous years) + structure, technology, aesthetics, ideology, ...
Year-5	(All of those from previous years) + specialisation, practical, finance, research, report, ...

In the final question, the Author had the intention to collect some general views in relation to the educators' methodology of teaching. It stated:

3- ***What design methodology do you suggest that would help students in their projects? (Should design instructors give a framework of design activities?)***

Two of the educators, **Dr. Macdonald** and **Professor Till** strongly disagreed with design methodology or giving a framework to students. For example, Dr. Macdonald replies: "Design instructors should not give a framework of design, but rather encourage a rational and responsive approach to each problem. Guidance and encouragement are more important than a design methodology".

Also, Professor Till in reply to the question of methodology of design and giving framework to students states: "None. I strongly disagree with any idea of design methodology. Architecture is a contingent discipline and cannot be contained within strict methodologies. In addition, any such methodology is an imposition on the development of the student's own critical position".

However, other educators in one way or another supported the idea of methodology in design and having a teaching strategy in design by introducing a framework to the students. In this regard **Professor Tabor** states: "Design methodology" always promises more than it delivers, in my experience. In the school situation, too, it can act as a design–substitute". Professor Tabor further explains: "How best to begin and continue designing depends on the project, the context, and of course the personality and aptitudes of the designer. The important thing is to make a (drawn or modelled) proposal as soon as possible, reflect on it, discover more data if necessary, then make another design move. When beginning a design project, too many facts and figures paralyse, and a blank sheet of paper scares one rigid. Make some moves, however crummy, get stuck in, and go with the flow".

Professor Weaver from the UEL states: "In this school at the present time the methodology includes rational and intuitive analysis and a propositional phase in an interactive process. The tutors offer a framework of activities to engender a … dynamic to learning how to design".

Norman Arnold's reply in relation to using design methodology and giving a framework in design to students was short: "Yes at undergraduate level".

Professor Edwards had a very specific method, he explains it as: "Design from detail to whole, not whole to detail. Let the principles of the small influence the strategy. Design grows organically (ecological references)". He further introduced his books, *The Modern Terminal, Green Architecture, Sustainable Architecture*, which were interesting for the author who browsed through them on different occasions.

Mr. Collier from Dundee explains: "We do not at present spend time teaching design method. A …. Survey of principal issues is discussed within the history/theory course and a staged development is implied in interim design stages for project work. The RIBA plan of work is an outline model referred to. It would be far to say that listing design issues is easier than integrating them into a process. We rely on studio experience in design development to promote coherent thinking".

Gary Brown in response to introducing an appropriate design methodology and whether he thinks students should be given a framework in design replies: "Frameworks are either given and/or inferred by tutors, a variety of frameworks and methodologies should be used in Years 1,2, students then choose and follow those which are appropriate for themselves, adopting appropriate methodologies, more complex methods can then be introduced in later years". He also adds: "The question infers that design can be split into "conti.. parts" this is simple until the essence of design is the bringing together of the … parts in an "appropriate format". It also, infers that one method is appropriate which is also … and infers that there are not for instance different levels to teach category, i.e., that what you teach in terms of technology in 1st year is the same as that which is taught in 6th year-, there is an … of subjects and subjects are continually revisited and dealt with in more depth". He concludes his remarks by stating: "Design education is a continual process, this is due to the rapid change of society and of universe. The environment architectural and urban, that meets their needs".

Neil Lamb from Aberdeen in relation to design methodology states: "In stage 2 of the course the student is directed to develop research skills while working closely with paradigm of best practice. Practical and theoretical issues are cultured in an environment of individual and group centred learning". With regards to the framework, he adds: "Frameworks are used within the studio program to provide a structure for study but are not seen to be prescriptive".

After reviewing the educators' responses, the Author detected a similar problem which he has been experiencing throughout his investigation. Most educators, including many of those who responded to the Author's research questions, misuse the two terms: "methodology", and "method". By "methodology" the Author means a wide but planned strategy of action which may be consisted of many "methods" to execute that strategy. On the other hand, "method" is the technique or procedure of executing a methodology. For example, using drawings or models in some specific stages of the design process are indicating its design method; however, design methodology speaks of a broader strategy in design (i.e., should analysis come before synthesis and why).

Therefore, those individuals who expressed disagreement with "design methodology" in the design process actually were expressing disagreement with using specific "design methods" in the design process. As far as other comments, with the exception of the replies from Professor Weaver and Professor Edwards who had correctly understood the question, others seemed to have the same misunderstanding - explaining "design methods" instead of "design methodology". Therefore, the Author believes the responses to this question indicate that "design methodology" as a broad strategy in teaching and design is well worth spending time on; without this "strategy", it seems wasteful to spend time dealing with different "design methods".

Chapter 11
Educators' Questionnaire

11.1. Introduction

The intention behind designing Questionnaire was to provide an opportunity for the Author to become familiar with the views of some educators and students about the specific issues related to the two major aims of the research – developing an alternative design methodology for architectural design education, and developing an "interactive" teaching strategy for design studios. This chapter examines the responses of 20 educators – 11 from Iran and 9 from other countries – who have expressed their views about specific issues in relation to architectural design education and architectural design process.

Although the overall findings of these questionnaires would illustrate the opinions of a small portion of those who are involved in the architectural education system, and could not be generalised, these results provided the Author an opportunity to develop his models of design methodology and the design process. The overall responses of the educators are presented in the bar charts following each question. Since there is only a small group of participants involved in the questionnaire, the results are presented on the basis of individual preferences, rather than percentages of the overall participants.

The most major findings which directly influenced the formulation of the model of design methodology and the design process – are noted by the symbol, ➢ – would follow the responses in each question. These major findings will be summarised as the key findings of the questionnaire at the end of this chapter.

11.2. Developing the Questionnaire

The most widely used research method in the social sciences, behavioural sciences, and education is reported to be the survey method (Maxwell, 1996). Three reasons for this much attention on surveys is described by Robert Slavin (1984, p. 185) as:

1. Survey methods are often the sole way of retrieving information about a respondent's past history,
2. Surveys provide one of the few techniques available for the study of attitudes, values, beliefs, and motives,
3. Survey methods may be adapted to collect generaliseable information from almost any known human population.

Since the primary concerns of this research are directed towards formulating a teaching design methodology and a proper approach during the design process in architectural design education, the Author uses *questionnaires* – one type of survey methods – to examine the educators'/students' views on those issues.

The *Educator* and *Student Questionnaires* were developed by the Author throughout this research, using the collected data from literature reviews and his personal teaching experience. By adapting pilot studies, the Author first tested his questions and made some necessary corrections/adjustments for the final questionnaires. This chapter reviews the *Educator Questionnaire* and the following chapter looks into the *Student Questionnaire*.

11.2.1. Developing Questions

Questions in this questionnaire reflect some major concerns of the Author in relation to some issues involving architectural design education – its teaching methodologies and strategies – and the educators' views and concerns about design. Some initial questions, which were developed by the Author in relation to his findings throughout the literature review and some were based on his personal teaching experience, were tested during the pilot studies. Many of those questions are modified and implemented in this questionnaire in a combination of *open* and *closed* questions – meaning in some cases the respondents could use their own "open" answers, and in other questions, the respondents had to select between the given "closed" answers (Sudman, and Bradburn, 1982). However, in the questionnaires, respondents were encouraged to provide some comments on any question for which they needed to explain some further thoughts (see respondents' comments on Questions 6, 7, 9, and 11).

Many issues are involved in the subjects of the design process and architectural design education, which could range from identifying: the characteristics of a good design student, good design instructor, appropriate environment to study, necessary facilities, method of teaching, content and/or curriculum of design programmes, method of assessment, techniques and strategies in designing, and many other influencing design issues. The Author has summarised these concerns into 11 main questions, in which many of them ask some further related questions, categorised in three sections: *Architectural Design Education, Design Methodology and the Design Process,* and *Design Factors influencing Architecture.*

The *Architectural Design Education* section enquires general questions in an attempt to examine educators' preference of defining architecture, characteristics of a successful architectural education system, and the characteristics of a successful student/educator in design.

The *Design Methodology and the Design Process* section examines educators' preferences in teaching methodology, design methodology and the design process, and the techniques and communication tools during the design process.

The final section under the title of: *Design Factors Influencing Architectural Design*, examines educators' views about the effectiveness of several design factors influencing architectural design. It also reviews the educators' recommendations for teaching design factors to different design levels.

11.2.2. Selecting Educators

Although in the final case study, the Author is conducting his research at the University of Tehran, he used the opportunity of this research to contact several design educators around the world to review their reactions on the subjects of design education and the design process. Using the *International Association of Universities (1998)* guidebook, the Author selected some countries which had substantial reputations in architectural education, or were in a similar educational position to the architectural education system in Iran. In his selection of countries, as a general rule, the Author considered two determining priorities: 1- The higher number of the educators and students who were involved in that school, and 2- the educational background of their architecture programmes, in terms of their history. Therefore, schools in 38 countries[1] were selected and the Questionnaires were sent to the Heads of Architecture schools of 45 universities (see Appendix H for the list of countries which the Educator Questionnaires were sent). In the covering letters, the objectives of the research were introduced and the Department Heads were asked if either themselves or one of their colleagues who was most interested on the subject of the design process would complete the Questionnaires (see Appendix I for the samples of Covering Letter and the Educator Questionnaire).

Letters and the Questionnaires were sent in late December 1999, just after the first results of the Initial Data Capture[2] had been received by the Author and the last minute changes were made on the questionnaires. From the 45 schools contacted, 21 educators from those schools replied within two months. Since it would have taken another two months to finish the data collection period, the Author decided to omit the follow up letters in that stage. The number of replies, however, exceeds the one-third expected turn-out in a survey (Cohen and Manion, 1994). Questionnaires for the Iranian educators were rewritten in Persian, although most of them are fluent in English, and distributed personally by the Author. The names, positions, and names of the universities of those educators who replied to the Questionnaires, 11 from Iran and 10 from other countries, are listed below (in the order of time when the replies were received).

[1] With the exception of the United States and Iran. For the United States, American Collegiate Schools of Architecture (URL-9, ACSA, 1999), divides US architecture schools into six regions which one university was selected from each region. And in the case of Iran, since the final case study and research are directed toward that country, two schools were selected and the Department Heads were asked to introduce five educators who were most interested on the subject of the design process from different design years.

[2] See Chapter 10 for Initial Data Capture.

1- Mr. Lannis E. Kirklan, (Associate Dean)	University of Houston, USA.
2- Dr. Nabil Abu-Dayyeh, (Assistant Prof.)	University of Jordan, Jordan.
3- Professor W. Mike Martin, (UG[3] Dean)	University of California, Berkeley, USA.
4- Professor V. Lampugnani, (Dean)	Swiss Fedearl Inst. of Tech., Switzerland.
5- Mr. Hiroyuki Suzuki, (Dean)..............	University of Tokyo, Japan.
6- Professor Richard Coyne....................	University of Edinburgh, UK.
7- Mr. Araiza Moreno, (Assoc. Director)	University of Guanajuato, Mexico.
8- Professor Geoffrey Broadbent............	University of Portsmouth, UK.
9- Professor Duarte Cabral de Mello.........	Tech. University of Lisbon, Portugal.
10- Dr. Keith L. Hilton (Assoc. Professor)	King Faisal University, Saudi Arabia.
11- Dip.Eng. Javad Hatami (Assoc. Professor)	University of Tehran, Iran.
12- Dr. Alireza Eynifar, (PG Co-ordinator)	University of Tehran, Iran.
13- Dr. Seyed G.Reza Eslami, (Ass. Prof.)	University of Tehran, Iran.
14- Dr. Darab Diba, (Assoc. Professor).....	University of Tehran, Iran.
15- Dr. Mehdi Hojjat, (Ass. Professor)......	University of Tehran, Iran.
16- Mr. Eisa Hajjat, (Senior Lecturer)......	University of Tehran, Iran.
17- Mr. Kambiz Navaii, (UG Head).........	University of Shahid Beheshti, Iran.
18- Dr. Ali Alaii, (Ass. Professor)............	University of Shahid Beheshti, Iran.
19- Dr. S. Poordeyhimi, (Assoc. Professor)	University of Shahid Beheshti, Iran.
20- Dr. Hamid Nadimi, (Ass. Professor)....	University of Shahid Beheshti, Iran.
21- Mr. Farhad Ahmadi, (Senior Lecturer).	University of Shahid Beheshti, Iran.

Among the above educators, Professor Lampugnani in his letter to the Author expressed difficulties answering the questions and stated that the questions "cannot adequately be adapted to the structure and demands of our school. You are therefore kindly asked to exempt us from handing it in". Therefore, the number of actual responses would include 11 educators from Iran and 9 educators from other countries.

[3] UG stands for Undergraduate, while PG stands for Postgraduate.

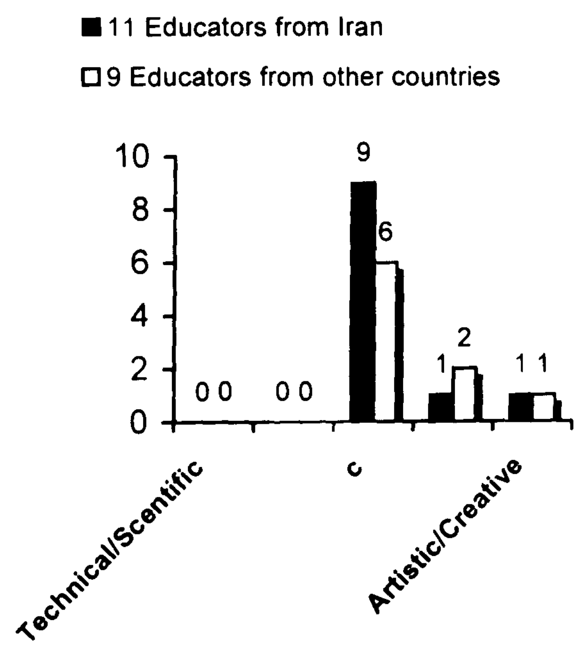
11.2.3. Analysing Responses

This section reflects educators' responses to the questions in the form of selecting between given choices or expressing their own further thoughts about each question. The Author, then, illustrates the collected responses on a bar chart – based on the total of 20 respondents – followed by his analysis of the overall findings. In this section, the Author also makes an attempt to identify those findings which directly relate to his proposed models of design methodology and the design process – emphasising by the symbol, ⋗. The three sections of the questionnaire, as introduced earlier, are presented here in which the educators' responses as well as the Author's analyses are followed after each question, ***highlighted in Italic.***

SECTION 1- Architectural Design Education

1- Where do you define architecture in the given spectrum, between the Technical/Scientific pole and the Artistic/Creative pole?

Figure 11. 1 Defining the place of Architecture between the sciences and arts.



As indicated in the Bar Chart, a majority of educators from the two groups, Iranian educators and those from other countries, defined architecture as lying in between arts and sciences. Although there are a few cases who are more lenient toward defining architecture closer to artistic/creative knowledge.

The Author's remarks about the above responses include:

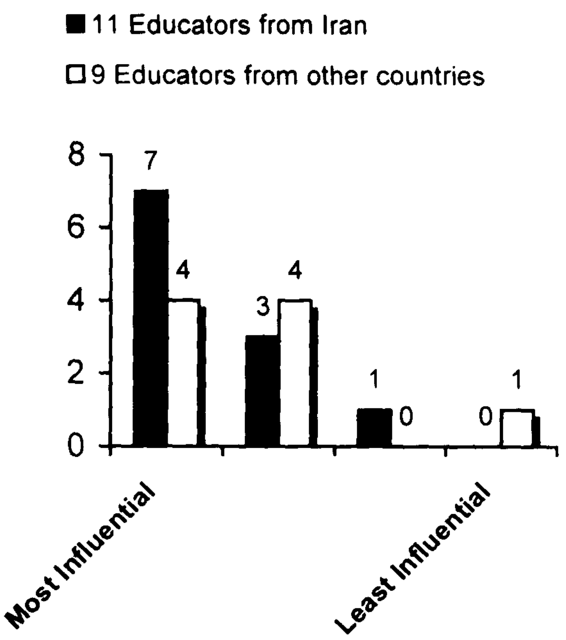
- There is no major difference between the views of the two groups of educators.

⋗It suggests that although architectural design utilises scientific knowledge as well as artistic knowledge, it tends to involve more artistic issues and as a consequence engages creative acts of thinking and working.

2- How influential do you consider the following issues in developing a "successful" architectural education system? (Rank them on a scale of 1- 4, where "1" is the most influential issue)

- *Student's characteristics (e.g. motivation, qualification, ...)*

Figure 11. 2 Influence of student characteristics in architectural education.



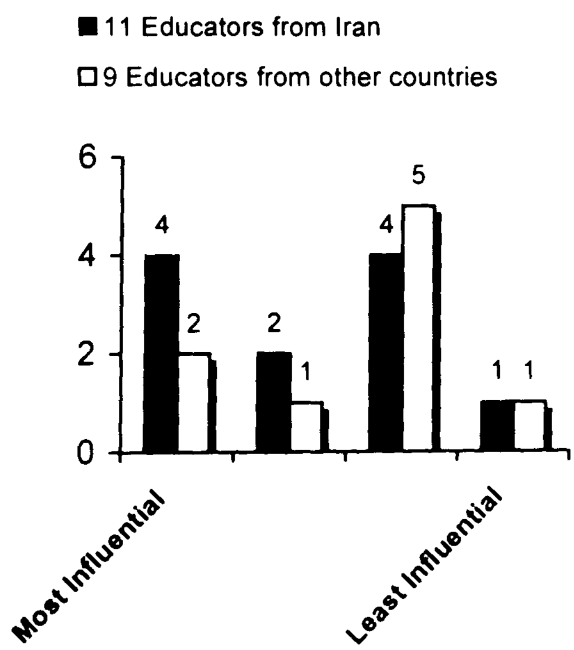
Results on the Chart indicate that a majority of Iranian educators believe that students characteristics are very influential in developing a successful education, while among educators from other countries there is a split reaction between 'most influential' and 'of some influence'. Incidentally, there is one educator who describes students characteristics as least influential in education.

The Author's remarks about the above responses include:

➢ Students' characteristics – creativity, motivation, social background, etc. – merit special consideration in the process of developing a successful architectural education system.

- *Educational programmes (e.g. curriculum, integrity, ...)*

Figure 11. 3 Influence of educational programmes in architectural education.



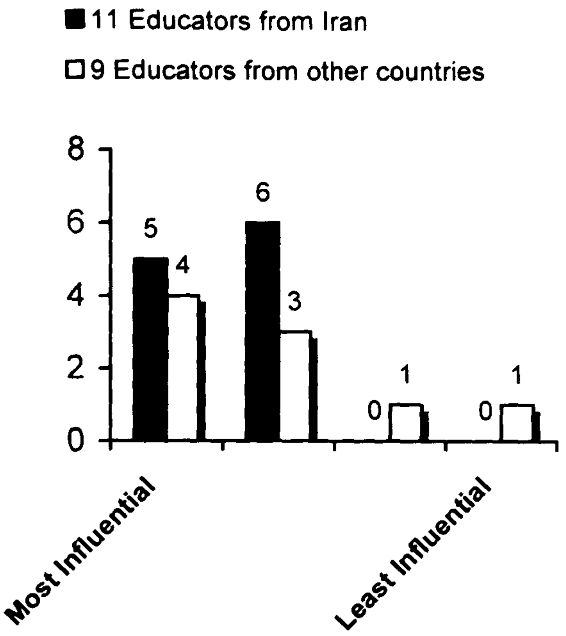
Results on the Chart indicate that many educators from other countries suggest that educational programmes are least influential in the success of an educational system, there is a split reaction between Iranian educators on this issue. Many believe it is very influential, while others believe it is less influential.

The Author's remarks about the above findings include:

➢ No matter what the educational programme may be, the influences of other components, such as students and educators, are more viable in the success of the educational system .

- *Instructors' characteristics (e.g. delivery method, availability, ...)*

Figure 11. 4 Influence of instructors' characteristics in architectural education.



Results on the Chart indicate that many educators from both groups of educators agree that instructors' characteristics are very influential in developing a successful educational system. Although there is small indication of educators from other countries who believe the characteristics of the instructors are uninfluential.

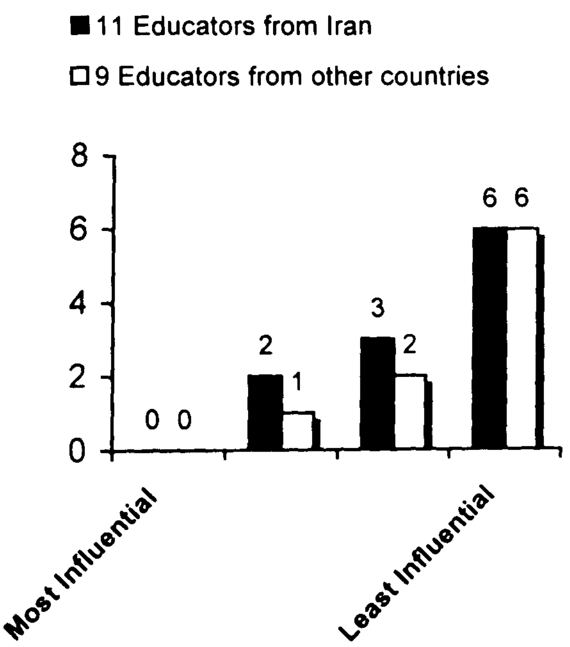
The Author's remarks about the above findings include:

➢Instructors' characteristics – which include their method of teaching, availability to answer students questions, and personal behaviour – are selected as very influential factors in the success of an educational system.

➢Instructors could make a difference in the success of an educational system.

- *School's facilities (e.g. libraries, equipment, ...)*

Figure 11. 5 Influence of school facilities in architectural education.



Results on the Chart indicate that most educators from both groups believe that school facilities play the least influential role in the success of an educational system. Although there are some educators who suggest that school facilities such as access to the libraries, and equipment could have some influences on the success of an educational system.

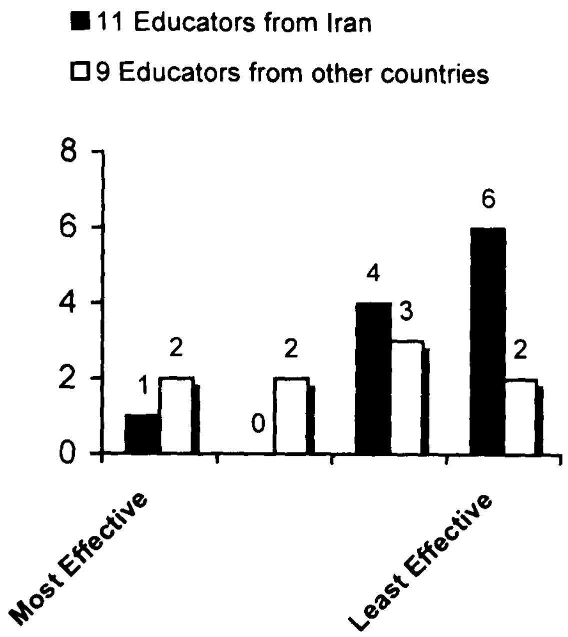
The Author's remarks about the above findings include:

➢ Those students who argue about the lack of school facilities and/or space, don't have the educators' support on such issues. This does not mean that students don't need facilities, however, the educators suggest that there are more important issues involved for improving an educational system than just the facilities.

3- How effective do you find the following issues in the progress of an architecture student in deign courses? (Rank them on a scale of 1- 4, where "1" is the most influential issue)

- *Student's ability to communicate.*

Figure 11. 6 Effectiveness of students' ability to communicate in their progress in design.



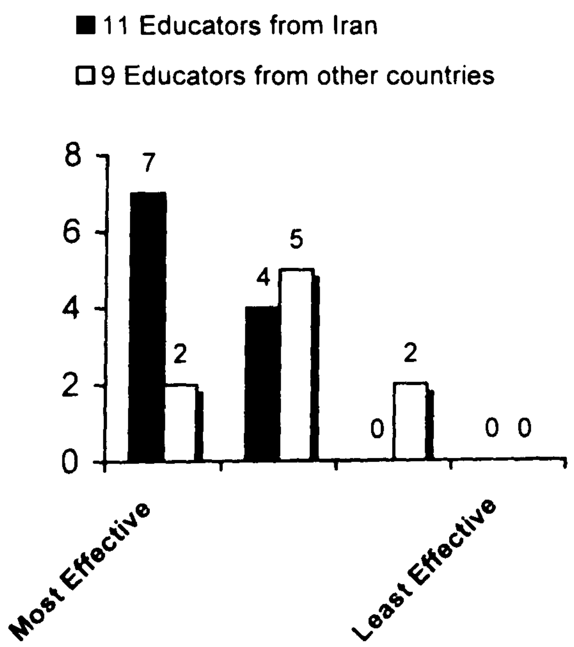
Results on the Chart indicate that most educators from Iran believe that the effectiveness of students' ability to communicate well, i.e., drawing and verbal skills, are minimal in their progress in the design courses. However, there is a mixed reaction between educators from other countries on this issue.

The Author's remarks about the above findings include:

➢ Not very many Iranian educators believe in the effectiveness of the students' communication skills, which is a worrying finding. Since during the creative thinking processes and visual thinking, students need these skills.

- *Student's level of creativity.*

Figure 11. 7 Effectiveness of students' level of creativity in their progress in design.



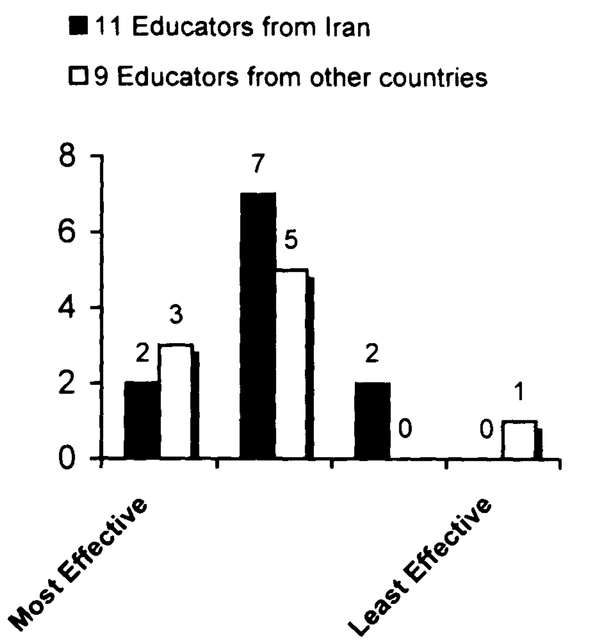
Results on the Chart indicate that a large number of the Iranian educators find students' creativity to be the most effective factor in their progress in the design courses, while the majority of educators from other countries give slightly less credit to students' creativity.

The Author's remarks about the above findings include:

➢ Educators in Iran seem to rely more on the students' level of creativity as a way to achieve progress. However, creative methods of teaching could be just as viable as students' creativity.

- *Student's willingness to work hard.*

Figure 11. 8 Effectiveness of students' willingness to work hard in their progress in design.



Results on the Chart indicate that the majority of educators from both groups suggest that students' effort and willingness to work hard would have very effective results in their progress.

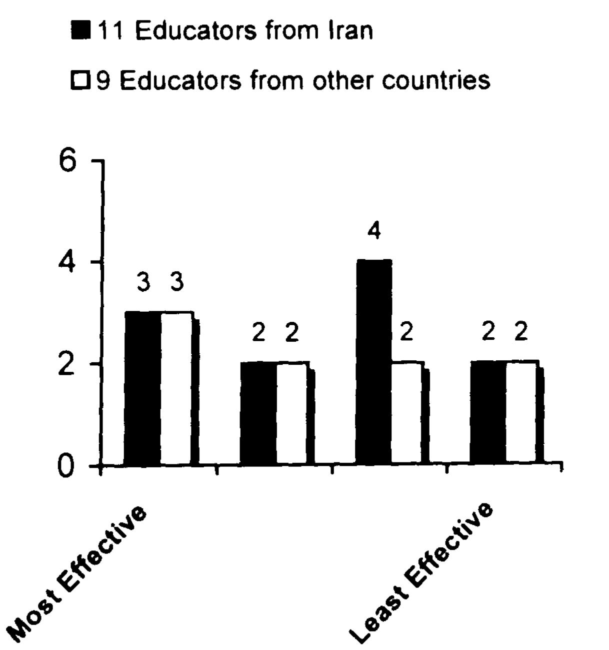
The Author's remarks about the above findings include:

➢ Working hard requires motivation and students need to understand what they are supposed to work hard after.

➢ Students need to be given design exercises to stay active both mentally and physically.

- *Student's level of intelligence.*

Figure 11. 9 Effectiveness of students' level of intelligence in their progress in design.



Results on the Chart indicate that there is a mixed reaction among all educators about the effectiveness of the level of intelligence of students in their progress.

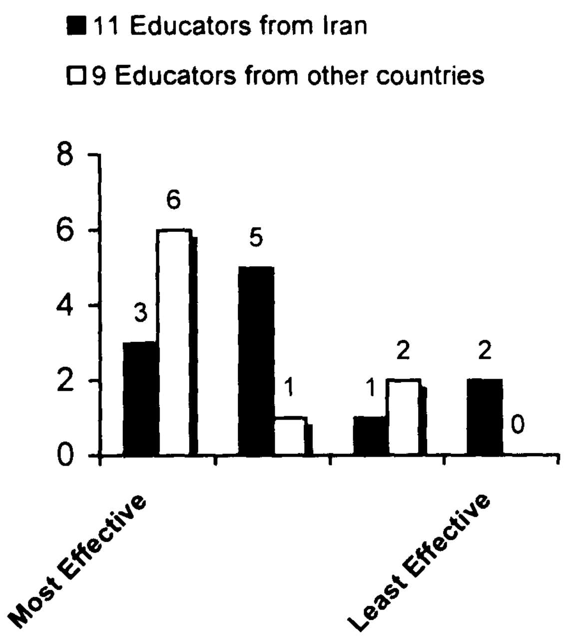
The Author's remarks about the above findings include:

➢ Although intelligence is necessary for students, it does not play the major role in the progress of an architectural student in given design projects.

4- How effective do you find the following issues in regards to the instructors of Architectural Design in the progress of the students of design? (Rank them on a scale of 1- 4, where "1" is the most influential issue)

- *Instructors who have a good rapport with students and encourage students to express new design ideas.*

Figure 11. 10 Effectiveness of instructors who have a good rapport with students.



Results on the Chart indicate that a majority of educators from both groups believe that instructors with a good rapport with students could have an effective influence on the progress of the design students.

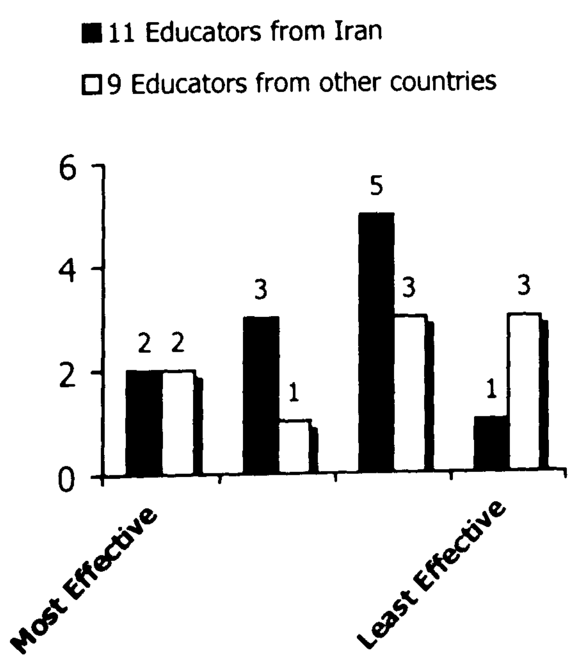
The Author's remarks about the above findings include:

➢ Good relations between students and educators could be governed by the personality of the instructor.

- The reason for difference between the responses of those Iranian educators comparing to the other educators, could be justified as a cultural effect, since in Iran most instructors like to keep the boundaries of their teaching status and not become too involved with students.

- *Instructors who have a clear design methodology and expect specific exercises to be experienced by all students.*

Figure 11. 11 Effectiveness of instructors who have a clear design methodology.



Results on the Chart indicate that most Iranian educators find some effectiveness in having a clear design methodology, comparing to those educators from other countries who have a mixed reaction about the subject.

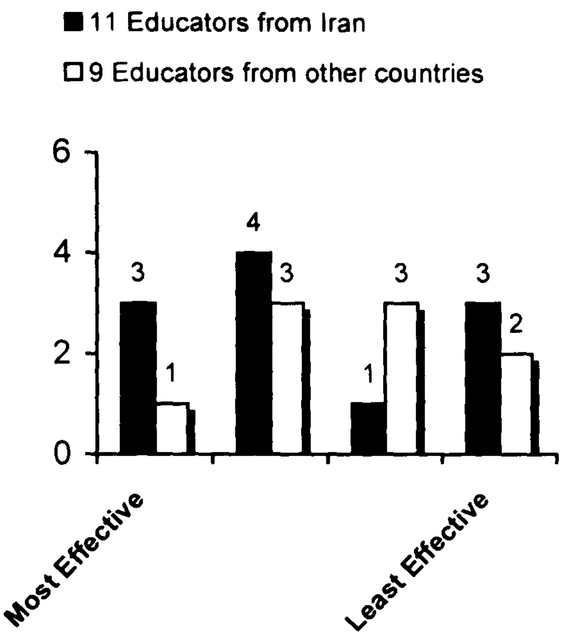
The Author's remarks about the above findings include:

➢ Instructors who have a clear methodology could be effective in guiding the progress of design students.

- In fact the Author is surprised by the low responses in favour of clear methodology. This could suggest that majority of educators are in favour of letting students struggle through the process.

- *Instructors who are not set on any particular methodology in design and deal with students independently.*

Figure 11. 12 Effectiveness of instructors who deal with students independently.



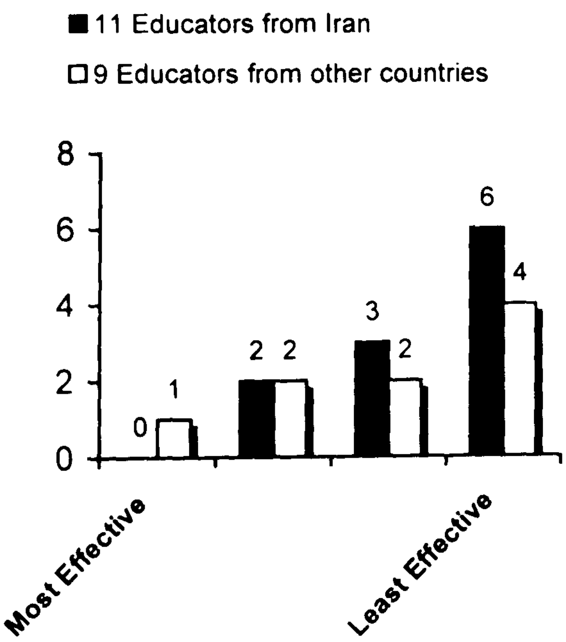
Results on the Chart indicate that both groups of educators have a mixed reaction to the effectiveness of those instructors who don't have a set methodology and deal with students independently. Although, the group of educators from Iran are more lenient toward its effectiveness.

The Author's remarks about the above findings include:

➢ Instructors with flexible approaches of dealing with different students could be effective in improving students' design.

- *Instructors who spend more time with students and expect students to spend a lot of time as well.*

Figure 11. 13 Effectiveness of instructors who spend a long time with students.



Results on the Chart indicate that a majority of the two groups of educators suggest that spending a lot of time with students is not an effective way of helping students to improve their works.

The Author's remarks about the above findings include:

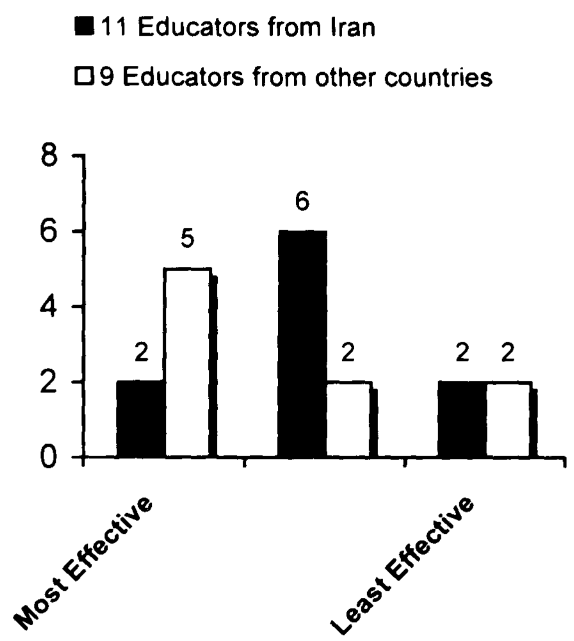
➢ Effective teaching method could be more influential in the students' progress than ineffective hard work.

SECTION 2- Design Methodology and the Design Process

5- How effective do you consider the following teaching methods in assisting design students in their design process?

- *Saying the least and letting students to find their own way through design.*

Figure 11. 14 Effectiveness of instructors who let students find their own way through.



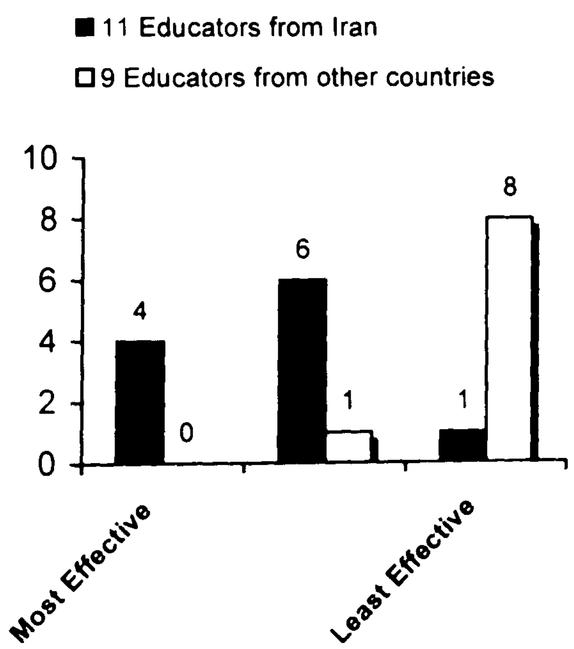
Results on the Chart indicate that the majority of the educators from other countries believe that instructors who say the least during the design process and let students find their own ways through the project are very effective. However, the responses from the educators from Iran tend to put less emphasis on the effectiveness of this approach.

The Author's remarks about the above findings include:

➢ Leaving students free to develop their own ways through some parts of the process could be very effective.

- *Giving a framework of design activities to students and directing them in their search for solution.*

Figure 11. 15 Effectiveness of instructors who give a framework of design activities.



Results on the Chart indicate that the majority of the educators from other countries believe that instructors who give a framework of design activities to students and direct them in their search for a solution use a very ineffective approach. On the contrary, the educators from Iran look at it differently and they are in favour of giving a framework for design activities.

The Author's remarks about the above findings include:

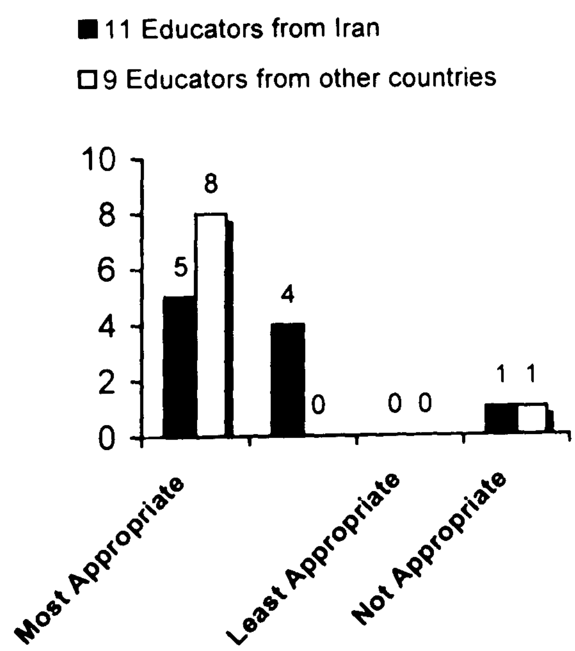
➢ With respect to the educational context of Iran, in which students would like to be told what to do next, giving a framework of design activities is more suggested by the Iranian educators.

6- *Many design students use architectural journals during their design studies, however, there is a mixed reaction from instructors about the time of referring to library for assistance. Do you refer to journals in your design exercises? And if yes, when do you feel it is more appropriate:*

Among the 20 responses to this question, two educators chose "No" – one from each group – since they didn't approve using journals during the design process. Although these two educators didn't give any reasons for their choice, there were some other educators who made some general comments. For example, **Dr. Darab Diba** states: "Obviously in all levels of education, the use of books and journals could be very helpful. However, the major question remains that whether students use these materials properly or not. In order for students to not get inappropriate cultural influences from projects in the foreign journals, they first need to develop a better understanding about the real conditions around them". The Author welcomes Dr. Diba's concern, however, he argues that reviewing journals will help students to strengthen their visual experiences which is needed during the design activities (for more, see Visual Thinking in Chapter 8). In order to identify the most appropriate time to refer to journals, the Author asked about reference use in *specific* situations:

- *When students are given a project and need to become familiar with the subject (i.e., for precedence study).*

Figure 11. 16 Appropriateness of referring to journals for precedence study.



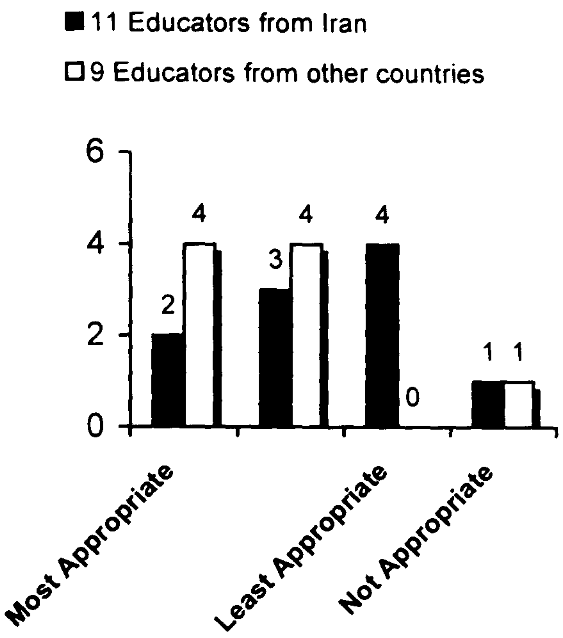
Results on the Chart indicate that most educators believed it was most appropriate to refer to journals when students want to become familiar with the project and use them for precedence studies.

The Author's remarks about the above findings include:

➢ Starting a design project with referring to journals could be very appropriate for those students who need to see examples and familiarise themselves with the subject of design.

- *When you are stuck and can not develop any ideas.*

Figure 11. 17 Appropriateness of referring to journals when students get stuck in design.



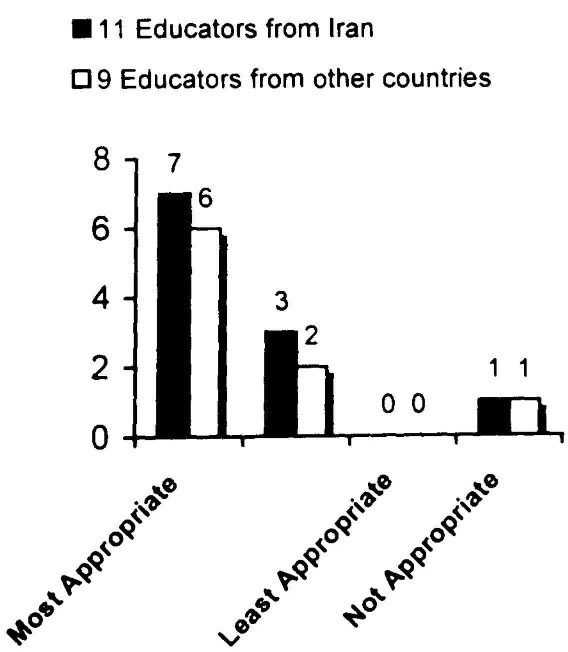
Results on the Chart indicate that there is a mixed reaction to the appropriateness of using journals when students are stuck with a problem and cannot develop ideas.

The Author's remarks about the above findings include:

➢ Students should use journals for becoming familiar with the requirements of a similar project but not to copy ideas or develop a habit of borrowing ideas from others. An "Incubation" period (discussed in Chapter 4) is normal, and students need to give themselves some time to develop ideas.

- *When students use journals for technical purposes and not necessarily for copying ideas.*

Figure 11. 18 Appropriateness of referring to journals for technical purposes.



Results on the Chart indicate that majority of educators suggested that using journals for technical purposes is very appropriate.

The Author's remarks about the above findings include:

➢ The use of journals, if it is intended for learning, is very appropriate.

➢ Students should use architectural journals to become familiar with the current events in the everyday growing world of architecture.

- *(If others, please explain)*

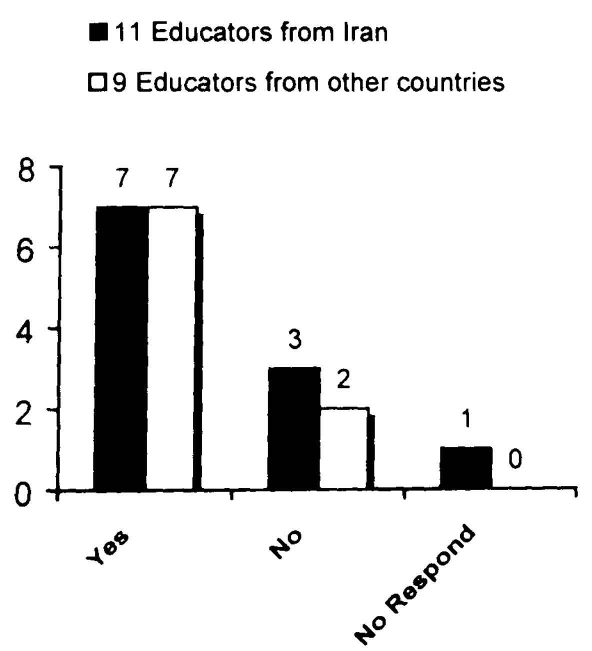
Some educators suggested other appropriate periods for using journals than what had been suggested by the Author. For example, **Eisa Hojjat** states: "It is also appropriate, when the design is finished. This way, students will learn more about what they did right and what they didn't".

Another suggestion came from **Dr. Shahram Poor-Deyhim** who stated: "It would be very helpful to refer to books and journals during the physical planning stage of the process". **Javad Hatami** suggested: "One particularly good time is when students mind is free and they are not involved in a design project".

The Author strongly suggests that using journals, in order to enrich the archive of images and reinforce the Content Thinking, could be very appropriate for architecture students throughout their design process and architectural education. The next question examines educators' views on the subject of the design process.

7- ***The term "design process", has been used in most architectural academic institutions by students and educators of architecture. Do you use methodology of design and design process? (please describe)***

Figure 11. 19 Educators who use design methodology and the design process.



Results on the Chart indicate that the majority of educators in both groups discuss the design process with their students. Although there is a smaller number of educators who do not discuss about design methodology and the design process.

The Author's remarks about the above findings include:

➢ There is a serious need for design education to discuss about the design process.

- The Author was rather surprised that some educators chose "No" for their answer. The reason, he suspects, could be the misunderstanding between "design methods" and "design methodologies".

Regarding the issue of the design process, a total of five educators out of 20, disagreed about discussing the design process with students. The Author has reviewed the views of those who explained their disagreement.

Gabriel Araiza Moreno states: "Because my courses are usually with very last semester students, I can expect that they already know how to deal with their favourite "design process".

Hiroyuki Suzuki explained his disagreement stating: The metalanguage of design process is not prevalent at Tokyo University – However, we do order the process into 1) Concept + Background research, 2) Assembly of basic form, 3) Detail design – Our system is quite a pragmatic one.

Farhad Ahmadi does not believe in discussing the design process with students since he indicates: "Design process too, as in architecture, is always changing".
Hamid Nadimi chose "No" as his answer to the question of whether he discusses design process with his students. He explains: "In order to set the context for developing a design concept, two things are needed:

1) Students' imagination should be stimulated through short design exercises and discussions,
2) Students should learn more about the site and the design problem".

Dr. Nadimi expresses disapproval of discussing a design process with students; however, the Author suggests in practice, that seems to be a design methodology itself.

Another disagreement was raised by **Dr. Diba,** who states: "There are different ways of looking at the subject of the design in architecture, however, the proper method shall be based on the capabilities of the students. Maybe it was easier to define a method during the modernism and functionalism eras. Right now, though, one should hesitate of establishing dogmatism in design. Directing students shall be conducted in a very indirect manner. In developing any physical solutions, students shall be encouraged to be flexible. Educators should not force their ideas into the students' projects and shall let them build an independent personality in design".

The Author believes that many of these disagreements, including the latter, seem to misunderstand the distinction between the design strategy, design methodology and/or the design process. This is most obvious when they speak of forcing students to follow the educators' ways. On the contrary, the design process, based on the design methodology, provides students a theoretical view. Design process is not about techniques (i.e., using drawings or models), but the broad sense of strategies involved in designing.

However, there were some educators who explained their "yes" responses to Question 7 about the design process. **Professor W. Mike Martin** defined the design process as: "The process, tools, and procedures utilised to assist in the research for an appropriate resolution to a design".

Keith L. Hilton explained the steps needed to be taken in a design process as:

1. "An understanding of all aspects of the program by means of case studies, visits, and literature search.
2. An understanding of the site through detailed analysis.
3. Site response based on site and program analysis together with organising a principle drawn from [other] principles, precedents and analogies.
4. Assessment of preliminary strategy.
5. Investigation of alternatives/modifications, technical exploration, finalise design.
6. Final presentation".

Richard Coyne explained that there is a need to cite the design process as the "Educational process". He added that educational process needs some preparation, "Generally same form of "warm up" exercise". These exercises could start "First: developing a vocabulary, metaphors, etc.".

Nabil Abu-Dayyeh underlined in the design process two options used interchangeably:

1- "Going from abstract (geometrical) understanding towards a more concretely physical product; or
2- Enjoy from concrete physicality towards more abstraction (e.g., survey)".

Dr. Poor Deyhim stressed: "There are many design issues in architecture. I usually introduce these issues through slide shows of the built projects and/or refer students to some supporting texts".

Javad Hatami explained his method of teaching by stating: "I encourage my students to work in three areas of: function, construction, and forming a space, since each of these three elements are vulnerable to the other issues. However, to start a design activity, each student shall develop ideas based on his/her preferred method of organising, locating , and forming spaces".

Dr. Ali Reza Einifar expressed: "The appropriate method in an academic sense will include: Motivating students for developing and expanding the problem questions (i.e., through precedent studies), and directing students to reach design ideas. Some differences will appear after this stage among students which involves the creative task of design educators to move with different students with their pastes".

Dr. Gholam Reza Eslami explained his design process by stating: "I have an intuitive design process in which it includes both Instrumental and symbolic types of design. This process considers two directions of whole to detail, and detail to whole".

Eisa Hojjat indicated: "I believe that directing design students in every design project requires its own strategy. This strategy involves some design exercises by which the educator can evaluate students' capabilities in design and based on those understandings, an educator could identify his strategies of dealing with students differently".

Javad Hatami stressed that: "Implementation of a design method is essential for a practising architect. However, whether we can develop a viable design methodology in an academic sense, I don't know. It requires an educator who is a practitioner and is able to transfer just the principles of design and not any specific methods to his/her students".

Dr. Mahdi Hojjat argued that in defining a design process. "One has to identify the quality of "life" within a given problem by identifying the internal and external forces influencing a design problem. Therefore, there is a need to evaluate the conditions of site and the requirements of the spaces. These studies shall be undertaken in 3-D to evaluate the quality of spaces. There is also a need for developing alternative solutions for a better understanding about the characteristics of the containing place of "life", the architecture".

The great enthusiasm with which design educators express their preferred design processes indicates to the Author that the subject of the design process is live and active. Many educators have thought about the issue of the design process, and in some forms they have applied them into their teaching methodology. This finding greatly supports the Author's proposal for applying a design methodology and teaching methodology in this research.

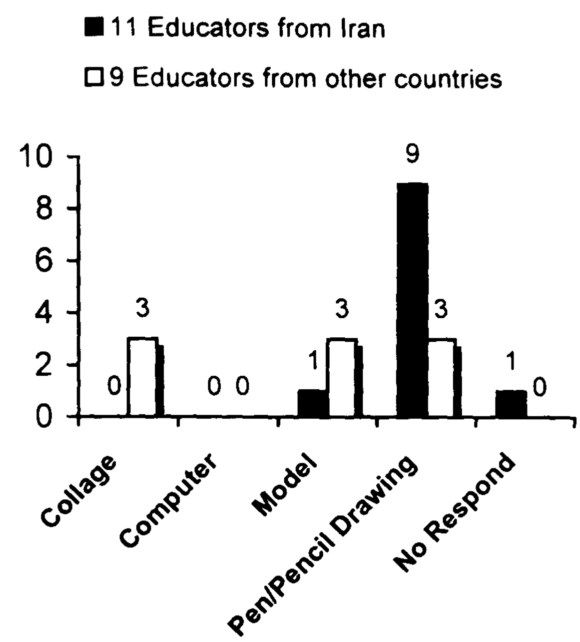
The following question is intended by the Author to examine the educators' preference for specific communication tools which they would like to see their students use during various stages of a design process. This question is also important to the Author since it would review the reaction of educators to the application of different design techniques, in particular computer techniques in architecture. Later in Chapter 12, the Author will ask a similar question from students in an attempt to compare their responses.

8- In each of the following design activities, which communication tool do you consider most effective? (please choose one best tool for each stage)

Stages included: Conceptual Design, Design Development, and Architectural Presentations. And tools included: Collage of pictures and forms, computer graphics, model making, and pen/pencil drawing.

- *During the Conceptual Design,*

Figure 11. 20 Educators' preferred communication tools during the Conceptual Design.



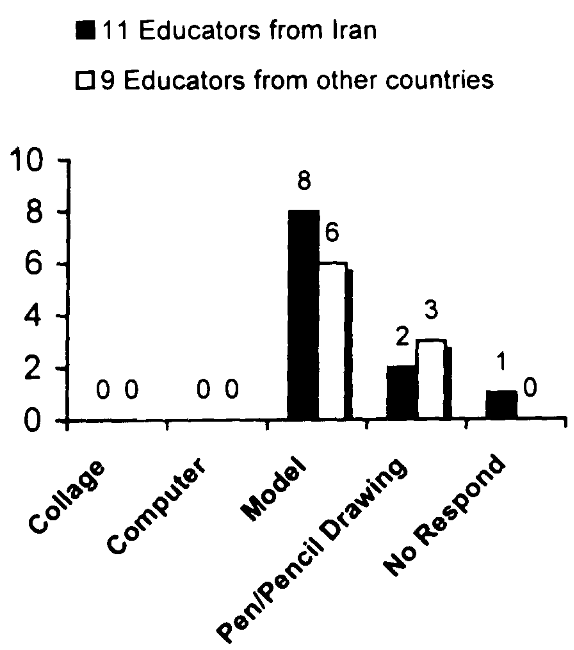
Results on the Chart indicate that the majority of the Iranian educators suggest drawings as the most effective communication tool for the conceptual design stage. However, those educators from other countries, also suggest the use of collages and models.

The Author's remarks about the above findings include:

➢ Majority of educators recommend drawing in the conceptual design stage which could mean that either they are familiar with other communication tools as well, or their experience proves that

- *During the Design Development,*

Figure 11. 21 Educators' preferred communication tools in the Design Development.



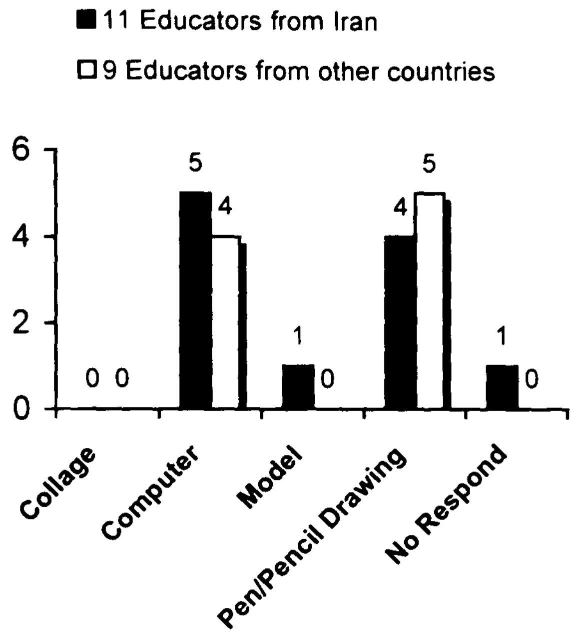
Results on the Chart indicate that almost all educators from Iran prefer model making as the most appropriate communication tool during the design development. However, among educators from other countries, a majority chose models and some chose drawing.

The Author's remarks about the above findings include:

➢ The use of 3-D studies during the design development becomes very important.

- *During the Architectural Presentation,*

Figure 11. 22 Educators' preferred communication tools during the Arch. Presentation.



Results on the Chart indicate that educators from both groups suggest the use of computers and drawings (pen/pencil) as the most appropriate communication tools during the architectural presentation stage.

The Author's remarks about the above findings include:
➢ The use of computers has gained a serious place in the architectural presentation.
➢ Many educators believe drawing is the most appropriate communication technique for architectural presentation.

The use of computer generated drawings and computer assisted design has been the subject of discussion for the past two decades. As the above chart indicates, there is a split reaction between those educators who are in favour of computer applications in education and those who are not. The Author who was probably the first generation of students who was introduced to computers back in 1985 at Cal Poly, suggests that the use of computers has its own benefits which could not be disputed (i.e., saving time in repetitive processes of drawing and design, providing exciting 3-d/real life views of design projects and etc.). However, he believes that there is a special joy of learning which could enhance students creative abilities by drawing sketches which is very important to remain in the education of architectural design students. Therefore, he suggests that although it is necessary for students to be thought to use computers, it is necessary for educational planners to determine the appropriate time and/or design exercises which students should be allowed/required to use computers.

SECTION 3- Design Factors Influencing Architecture

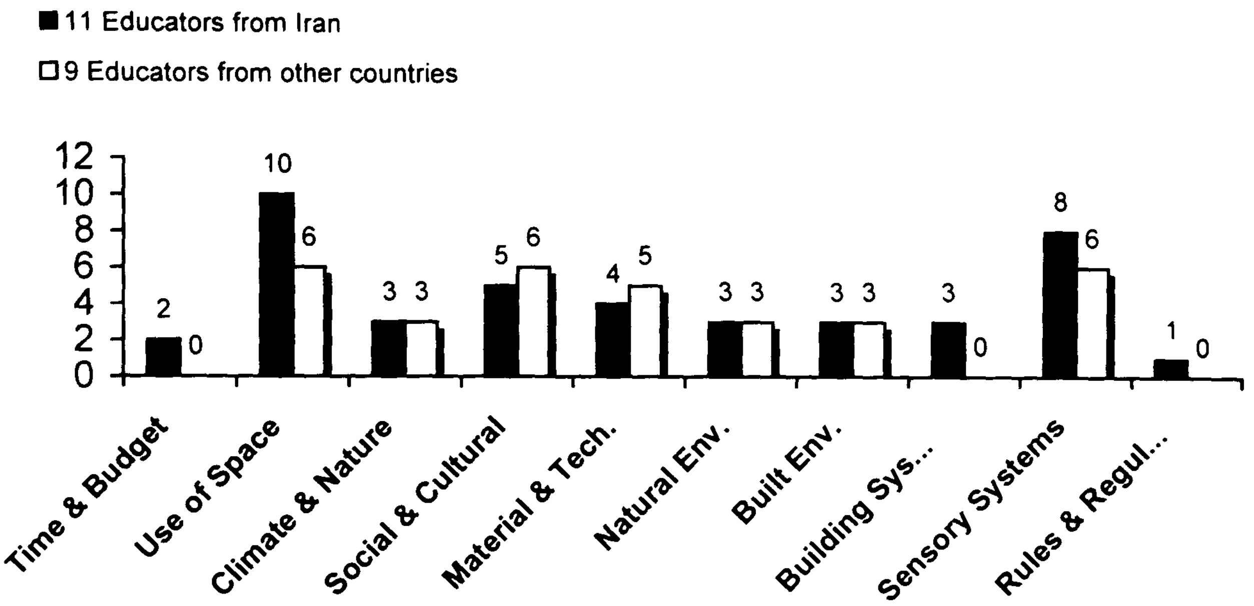
Questions in this section were prepared to collect educator's views on the subject of design issues influencing architectural design. In this section, the Author intended to examine the appropriateness of his proposed design issues by asking educators to scale their effectiveness in design education. Also, in this section, the Author attempted to collect educators' views about the most effective time during the design education to present design issues to students. The views collected on Questions 9 and 10 about design issues are presented here.

9, 10- Identify the effectiveness of the following design issues in the design exercise which you are currently involved in. And based on the following list of design factors, identify the most appropriate time/level to consider these factors in an architectural programme (please introduce any additional design factors to the following list).

- Space and User (e.g., Organisation and Circulation of Space, Client and/or User's wants and needs, User Types, ...)
- Climate and Natural Forces (e.g., Sun angles, Temperature, Precipitation, Winds, Earthquake, Tornado, Hurricane, Flood, ...)
- Social and Cultural Influences (e.g., History, Religion, Culture, Arts, Aesthetics, Thoughts, Designer Preferences/values, ...)
- Material and Construction (e.g., Availability, Durability, Reliability, Skills, Knowledge, ...)
- Natural Environment (e.g., Geography, Topography, Soil, Vegetation, ...)
- Built Environment (e.g., Neighbourhood, Architectural characteristics, Roads and access, Utilities and Infrastructures, ...)
- Building Systems (e.g., Structural, Mechanical, Electrical, ...)
- Sensory Systems (e.g., Views, Noise, Feelings, ...)
- Rules and Regulations (e.g., Country/State/City/Building regulations, ...)
- Time and Budget (e.g. Investments, Interest rates, Development opportunities, Seasons, Work hours, ...)

- *Year-1 most influential design factors,*

Figure 11. 23 Educators' views on Year-1 most influential Design Factors.

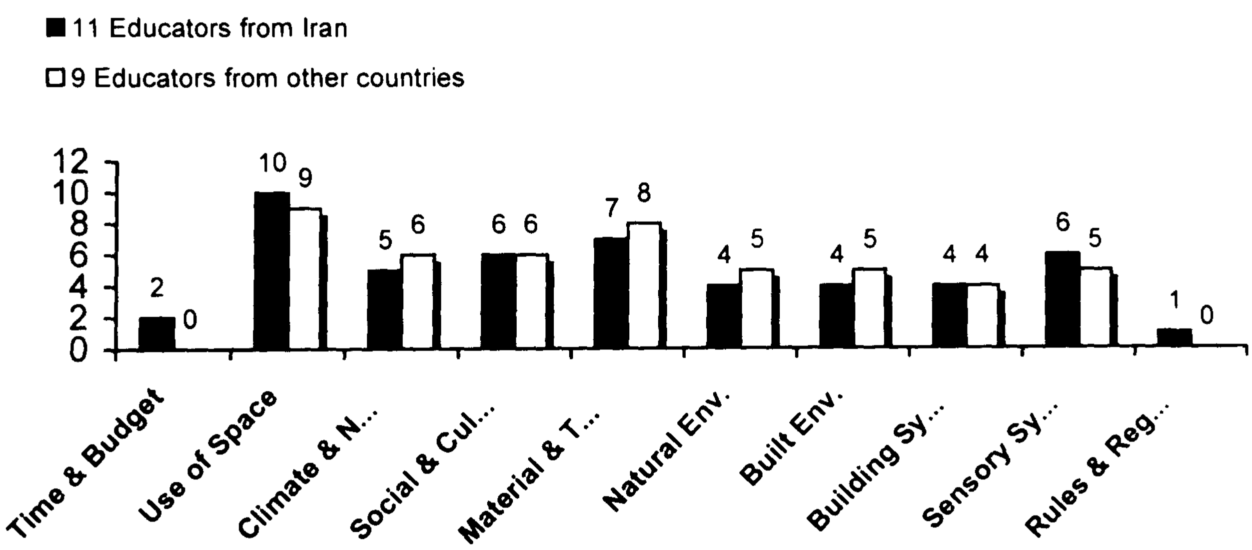


Results on the Chart indicate that many educators from both groups suggest that some design factors such as the Use of Space, Sensory Systems, and Social/Cultural topics should be discussed with Year-1 architecture students. Although in Year-1, other important design factors include: Material and Technology, Climate and Nature, Natural Environment, and the Built Environment concerns.

The Author's remarks about the above findings include:
➢Some design factors such as Space, User, Senses, Culture, Material, Climate, and Environment shall be on the top of the list for Year-1 educational programmes. This indicates that suitable Theory courses should reinforce these issues outside studios.

- *Year-2 most influential design factors,*

Figure 11. 24 Educators' views on Year-2 most influential Design Factors.

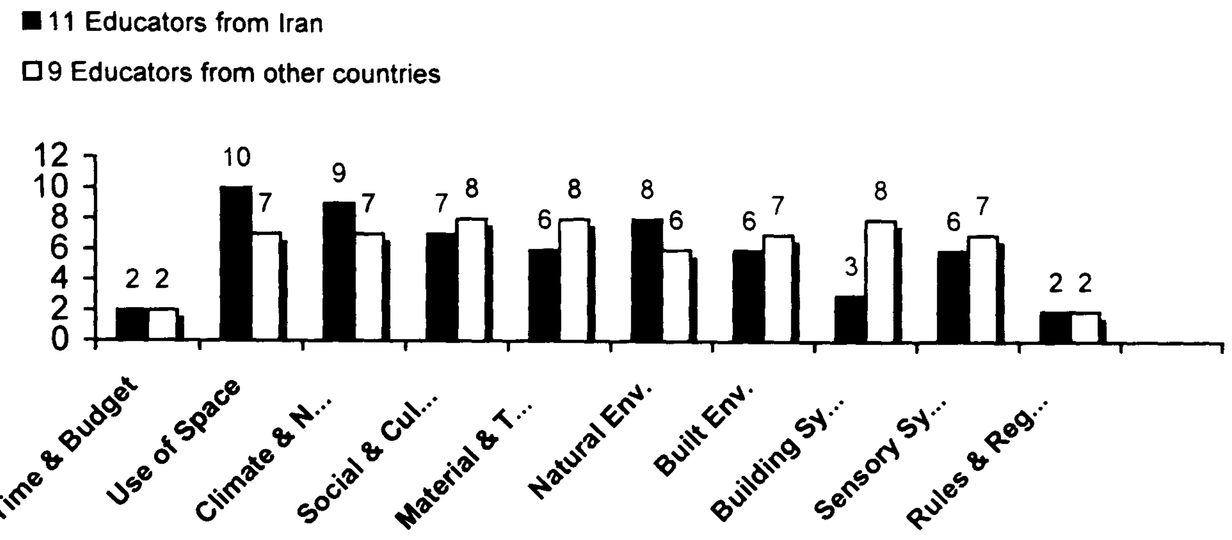


Results on the Chart indicate that many educators from both groups suggest that some design factors such as the Use of Space, Material & Technology, and Social/Cultural topics should be discussed with Year-2 architecture students. Although other important design factors include: Sensory systems, Climate and Nature, Natural Environment, and the Built Environment concerns.

The Author's remarks about the above findings include:
➢ Some design factors such as Space, User, Senses, Culture, Material, Climate, and Environment shall be on the top of the list for Year-2 educational programmes.

- *Year-3 most influential design factors,*

Figure 11. 25 Educators' views on Year-3 most influential Design Factors.

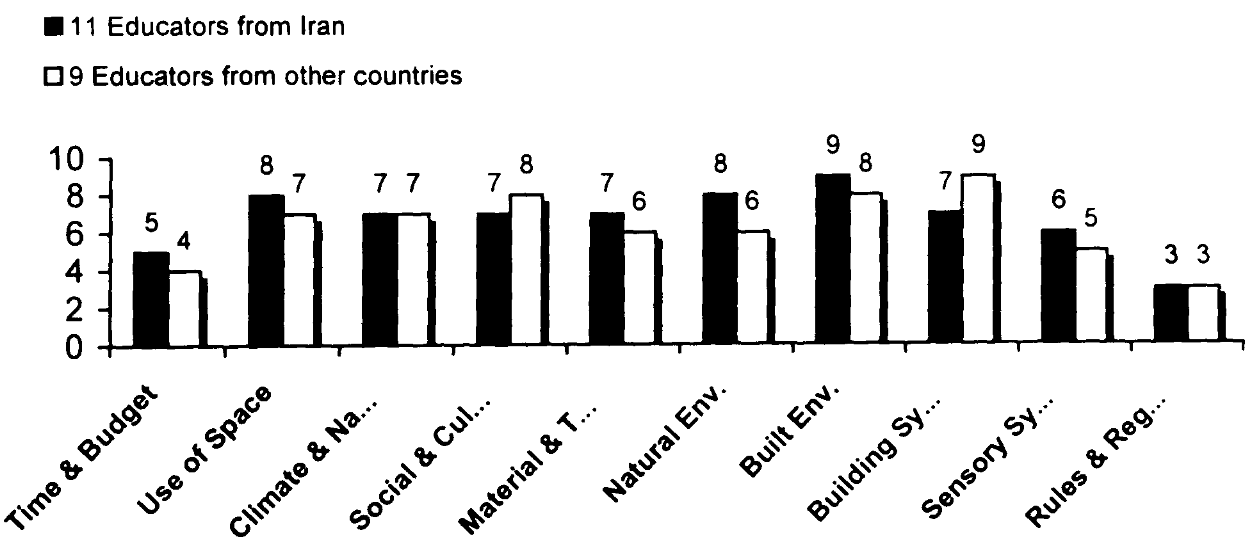


Results on the Chart indicate that many educators from both groups consider all design factors, with the exception of Time & Budget and Rules & Regulations to be important in discussions with 3rd year students.

The Author's remarks about the above findings include:
➢ Most design factors become important in Year-3, except for Time & Budget and Rules & Regulations. The most notable ones include: Use of Space and User, Climatic, and Social /Cultural topics.

- *Year-4 most influential design factors,*

Figure 11. 26 Educators' views on Year-4 most influential Design Factors.

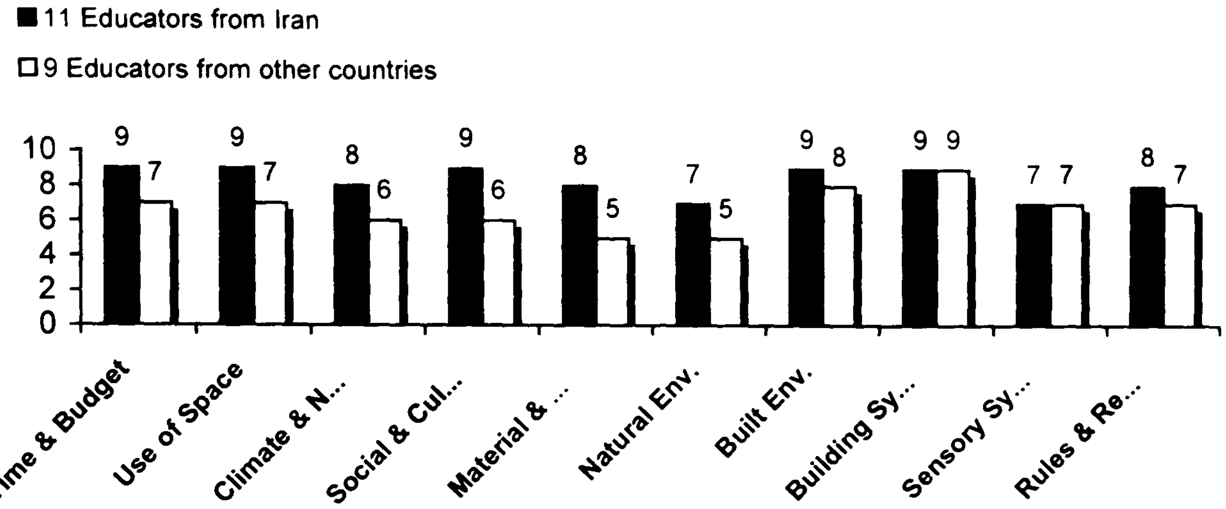


Results on the Chart indicate that many educators from both groups suggest that the influences of all design factors become very obvious and balanced. Even some factors such as Time & Budget and Rules & Regulations which didn't get much consideration before, tend to become important factors in design.

The Author's remarks about the above findings include:
➢ Most design factors become equally important in design during the Year-4. The most important ones were suggested to be issues related to: the Built Environment, Building Systems, and the Use of Space.

- *Year-5 most influential design factors*

Figure 11. 27 Educators' views on Year-5 most influential Design Factors.



Results on the Chart indicate that many educators from both groups suggest that the influences of all design factors become apparent. In Year-5, the three factors of Building Systems, Built Environment, and Time & Budget become very important factors, if not more important than the rest.

The Author's remarks about the above findings include:

➢ As predicted by the Author, some practical issues such as Time, Budget, Rules, and Regulations become viable design factors influencing a design solution in Year-5.

The results of the above comments assisted the Author in developing his design methodology in two ways. First they helped him to review the appropriateness of his proposed Ten Design Factors in architectural education, and second, they gave him an indication that in what order they should be organised during the design process (see Chapters 6 and 13).

In addition to the design factors introduced by the Author, some educators suggested a few other design factors applicable in design education. **Dr. Hamid Nadimi** added, students' understanding about the "meaning" of the design problem. He gave an example that students need to understand that "forms" have "meanings".

Nabil Abu-Dayyeh stressed on the need for "Rules of composition" for Year-1, 2, and 3. **Lannis E. Kirkland** suggested also, "Composition" for Year-1 and 2, and "Exploration" for Year-5.

Dr. Shahram Poor Deyhim suggested, "Physical planning of the open and enclosed spaces".

The Author has indirectly included many of the topics which are suggested by other educators in his model of design factors. For example, he has included the discussion of "meaning" or semiotics in the Social/ Cultural Factor, which examines the influence of issues such as history, religion, culture, arts, aesthetics, thoughts, designer preferences/values, etc.). "Composition" and "Exploration" are two issues included in the Author's model of the design factors, the former is in Space and User Factor, and the latter is in Sensory Systems. As far as "physical planning", it is an issue which will be looked into it in Space and User Factor.

In ***Question 11,*** the Author has asked the educators to express any additional thoughts on the subjects of "design process", "design methodology", and/or "design factors" in architectural design. Some responses from the educators are summarised here.

Professor Mike Martin explained, "Design methodology is what we teach. It is the carry-over learning that the student takes to his/her next level of exploration".
Richard Coyne argued that the design process and design methodology are out of date and the Author should have discussed current issues. He stated, "these are old-fashioned terms in many design courses now. ...Displaced by concepts such as "making", "disjunction", etc.".

Hiroyuki Suzuki expressed his views about the design process by stating: "There should be no dogma attached to design process. Wide research followed by thoughtful distillation of issues. An awareness that the boundaries of architecture must remain blurred. Students should be encouraged to be inclusive as opposed to exclusive in their approach".

Nabil Abu-Dayyeh expressed his views about architectural education underlining: "Design education should be inclusive of a variety of methods, not an exclusive one. Students should be exposed, I believe, to different educational experiences and methods ranging from the most rigorous to the most interactively flexible and open-ended".

Hamid Nadimi with respect to the issue of the design process, referred to his articles in *Soffeh* and Bam Architectural Conference. About the design issues, he explained, of course all design issues are important in design and designers shall respond to them. He stated, "Albeit at the time of developing a concept, designers tend to stress on some design issues more than the others, however, during the stage of design development they will engage a critical thinking in an attempt to respond sufficiently to all issues".

Dr. Poor Deyhim explained the design process by describing different stages involved in it. He suggests, "I see the design process consisting of:

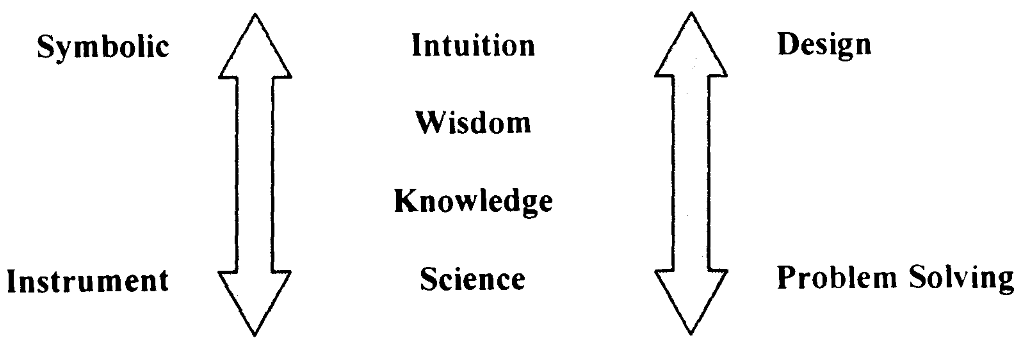
1) Implementing different design methods and influencing issues in forming a space,
2) Precedent studies and their analysing,
3) Developing different design theories for different projects,
4) Involving 2-D and 3-D studies in a simultaneous manner for developing a space".

Dr. Ali Reza Einifar described the design process stating: "Obviously in creating design and in design education there is a serious need for planning and considering processes. Although most educators may believe in some type of the design process, however, this process should not be based on linear-sequential activities. As far as the design issues are concerned, there are many design issues involved in the design process which students need to respond to in their design solutions. It takes a lot of expertise on the part of educators to direct students to see those design issues in their works in accordance to students' capabilities".

Dr. Darab Diba described his views on the design process, stating: "There are so many views about the subject of the design process. My own experience suggests that architecture should be studied in 3-D (in a spatial manner). It should consider many fundamental functions, site, social-economic, and technological issues to develop a better design decision".

Eisa Hojjat looked more at the subject from an educational perspective and stated: "One very essential element in teaching design is "creativity". I believe that an educator who adopts a specific design process in his/her teaching practice, regardless of time, location, mental, and social backgrounds of a student, is doomed to failure. Often educators speak of creativity for their students, however, many of them need to look into their own creative approaches in teaching as well. It takes a creative educator to develop creative methods of teaching design with respect to various capabilities of students". He also, argued about the design factors presented by the Author stating: "I should admit that all of those issues influence design solution in different design levels. However, the 'way they influence', and the 'scope of influence' is different in each project. For example, material or technology each effect design projects in Design 1 and Design 4, however, the issues concerned with in each of those design courses will be dealt with in it's own scope. One could suggest that in earlier design courses they concern conceptual realisation, while in later design courses, they require a practical/scientific knowledge".

Dr. Gholam Reza Eslami explained: "I believe that a viable design process should reflect the process of life. It would be a good idea to compare different design teaching methods in order to develop an ideal design process. Both scientific and intuitive methods have much to offer design education. Learning about many issues such as philosophy, laws, politics, cultural, and environmental (in both natural and built form), will extremely help students during design. My definition of architectural design process could be best represented by the following diagram":



Dr. Mahdi Hojjat described the design process, explaining: "Unfortunately today most designers evaluate the design process between the two spectrums of painting and sculpture, on one pole, and construction, on the other pole, as I noticed it was the case in this questionnaire as well. However, I believe in the design process what should be noted the most, is the need to create a condition for a better understanding about the "quality of life" which will take place in that architecture. The better understanding a student develops about the quality of life, the more capable he/she will become to develop a final solution. Therefore, an architecture student does not need to have all the skills and sensitivities of an artist, or the knowledge and expertise of a structural engineer to produce a good architectural solution. An architect should attempt to create the most appropriate container for "life" to take form in it. And this will not happen unless there is an analytic-perceptual understanding in the design process".

11.3. Key Findings

After reviewing the findings of this chapter, the Author has developed the following outline of key findings related to the two issues of his concerns – teaching design methodology, and appropriate approach in the design process. These key findings are representing educators' responses in the order of which questions were asked in the questionnaire.

➢ Majority of educators define architecture as being influenced almost equally by both sciences and arts, more leaning toward the art issues.

➢ Majority of educators consider the following issues most influential in developing a "successful" architectural education, they rank from:

1) Student's characteristics (i.e., motivation, qualification, ...).
2) Instructor's characteristics (i.e., delivery method, availability, ...).
3) Educational programmes (i.e., curriculum, continuity between courses, ...).
4) School facilities (i.e., libraries, equipment, space, ...)

➢ Majority of educators believe the progress of an architecture student in design courses is most effected by:

1) Student's level of creativity,
2) Student's willingness to work hard,
3) Student's level of intelligence,

4) Student's ability to communicate.

➢ Majority of educators define the following characteristics of a design instructor most effective in the progress of an architecture student in design:

1) Instructors who have a good rapport with students and encourage them to express new design ideas,
2) Instructors who are not set on any particular methodology in design and deal with students independently,
3) Instructors who have a clear design methodology and expect specific exercises to be experienced by all students,
4) Instructors who spend more time with students and expect them to spend a lot of time in return.

➢ Majority of educators consider those instructors who say the least and let students find their own ways through the design process are more effective than those who provide students with a framework of activities.

➢ Majority of educators describe the most effective time for architectural design students to use journals is:

1) When students use journals for technical purposes and not necessarily for copying ideas,
2) When students are given a project and they need to become familiar with the subject (eg., precedence studies)
3) When students are stuck and can not develop any ideas.

➢ Majority of educators expressed that they use design methodology and they discuss about some type of design processes with their students.

➢ Majority of educators will recommend the following communication tools to their students at specific stages of the design process:

At Conceptual Design, they recommend drawings (pen/pencil),

At Design Development, they recommend models,

And during the Architectural Presentation they favour drawings and computers.

➢ Majority of the educators find the following three design factors, among many others, as the most influential factors in design education to be addressed in different levels:

Year-1: Use of Space, Sensory Systems,

Year-2: Use of Space, Material and Technology, and Climatic factors.

Year-3: Use of Space, Climatic, Social/Cultural factors,

Year-4: The Built Environment, Building Systems, and Use of Space factors.

Year-5: Building Systems, the Built Environment, and the Time and Budget factors.

Chapter 12
Students' Questionnaire

12.1. Introduction

Similar to the Educator Questionnaire, the *Student Questionnaire* was developed to collect students views about the specific issues related to the two major aims of the research, methodology of teaching design and student's plan of work in the design process. This chapter examines the responses from 151 students from two universities in Iran. The Author has visited different design studios at these schools and collected students' responses to his questions. These responses, as well as the analyses of students' discussions, will be presented in this chapter.

The responses collected from students, in addition to the ones by the educators, will influence the Author's search for developing an alternative model of the design methodology and the design process. Similar to the previous chapter, those key findings which directly influence the formulation of the model of the design methodology and the design process, are noted by the symbol, ➢, and are summarised by the Author at the end of this chapter.

12.2. Developing the Questionnaire

The use of questionnaire was the most appropriate way for the Author to reach to a large group of students and enquire their views and concerns about design education. *Student Questionnaire* was actually developed by the Author throughout his research, using the collected data from literature reviews and his personal teaching experience. By adapting pilot studies, the Author first tested his questions and made some necessary corrections/adjustments for the final questionnaires. This chapter reviews the *Student Questionnaire* in which several related issues to design methodology and the design process are enquired from a group of 151 Iranian students at two schools of architecture in Tehran, Iran.

12.2.1. Developing Questions

Many issues concern students in the subjects of the design process and architectural design education, which could range from identifying: the characteristics of a good design student, good design instructor, appropriate environment to study, necessary facilities, method of teaching, content and/or curriculum of design programmes, method of assessment, techniques and strategies in designing, and many other influencing design issues. The Author has summarised these concerns into 17 main questions, in which many of them ask some further related questions, categorised in three sections: *Introduction*, *Architectural Design Education*, and *Influencing Issues in Architectural Design.* A combination of open and closed questions has been used in this questionnaire. Questions 3, 4, 5, 10, 11, 12, 16, and 17 are open questions in which many students have made some comments. These comments as well as the analyses on the overall responses from the students will be presented along with a review by the Author on each question.

The *Introduction* Section is concerned with issues which would encourage the student to open up and discuss his/her concerns about school and architecture. Some issues involved in this section include: students' self-image about his/her performance, students' ability and interest in drawing and designing, students' responses to assessment, and their overall judgement about their educational systems. The following, is a review of the questions along with the students' responses.

The *Architectural Design* section is designed to examine students' views on how students can improve their work, how design instructors can help them, and what strategies or methods would help them during their design processes. This section will also examine their preferred communication tools during the design process.

Influencing Issues in Architectural Design is the third section of the questionnaire. It will examine the effectiveness of various design factors in different design levels.

It is intended to help the Author to formulate the list of design factors necessary in design education which he will recommend later in Chapter 14.

12.2.2. Selecting Students

During the design of his research, the Author had selected to collect the student questionnaire and conduct his case study in Iran, where he is employed at the University of Tehran. However, he extended the scope of his student questionnaire – in order to verify the validity of responses – to include students' views from two Architecture schools in Iran. Therefore, in addition to the University of Tehran, questionnaires were distributed to another most prestigious architecture school in Iran, The University of Shahid Beheshti[1] (USB). The University of Tehran's Architectural Design Courses are offered periodically, i.e., Designs-1, 3, 5, and 7, in Fall Semester and Designs-2, 4, and 6, in Spring Semester. Therefore, during the second semester of the school year 1999-2000, the questions were distributed to design students at both schools only to Designs-3, 5, and 7[2]. Design-1 students were neglected in these questionnaires since the questions were designed only for those students who had prior Design experiences The previous design experiences greatly helped students to express their views on different design issues.

Except for Design-7 studios at both universities, in which the Author had made prior appointments with their instructors and the students knew he was attending on a certain day, the other studios were visited and questionnaires were collected without any prior notice. This could be why the number of participants in the questionnaires are far fewer than the number of students who had formally registered in those Design courses (see Table 12.1. for the number of students who participated in questionnaire). Consequently, Table 12.1. could indicate – the Author argues – that there is a lack of enthusiasm among architecture students to attend design studios regularly during the full period of 2-6 PM, two days a week.

[1] Shahid Beheshti was one of the great scholars of Islam who was involved in preparing the Constitution of the Islamic Republic of Iran in 1978. After his assassination in 1980, the National University of Iran (*Melli*) was named after him.

[2] In Design-3 the main objective of the course is to introduce some interior design criteria to students, (i.e., furnishing, spatial planning, mechanical and structural integration with architectural design). In Design-5, students are introduced to design of residential communities, and in Design-7, students are introduced to Urban planning and city scale projects in historic context.

Table 12.1 Students who participated in the questionnaire, School year 1999-2000 (data collected by the Author).

	Registered Students	Participated in the questionnaire
Design-3	64 students at UT, 36 students at USB	35 students (17 M, 18 F) at UT, 24 students (15 M, 9 F) at USB
Design-5	56 students at UT, 39 students at USB	35 students (26 M, 9 F) at UT, 18 students (13 M, 5 F) at USB
Design-7	49 students at UT, 47 students at USB	20 students (18 M, 2 F) at UT, 19 students (12 M, 7 F) at USB

The responses to the questionnaires among the participating students, a total of 90 from the UT and 61 from the USB, were statistically insignificant[3] (Smith, H., 1981) for both **M**ale and **F**emale students, therefore, the Author has not separated the results with respect to the genders.

Students were given 30 minutes to complete the questionnaire, however, there were a few students who had asked for more time and were given an additional 10 minutes. The Author was present throughout the time of students' supplying replies to the questionnaires, although only in a very few cases students needed more clarification about questions.

12.2.3. Analysing Responses

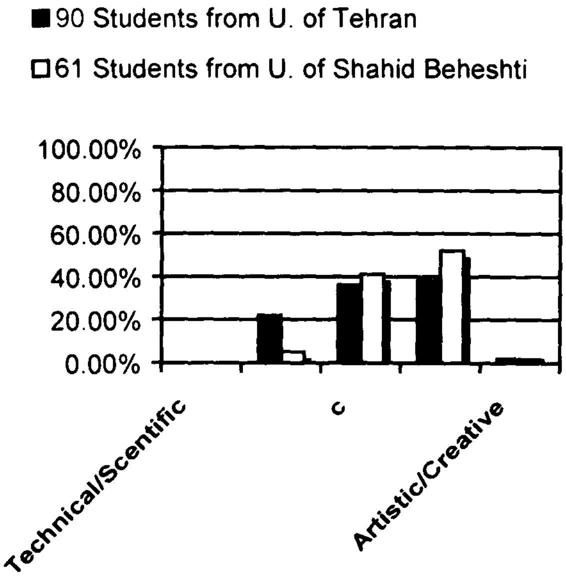
Students' responses to the questions are presented in the forms of statistically analysed bar charts and students' comments. The Author illustrates the collected responses on a bar chart based on percentages of students who expressed their views – considering the total of 90 respondents from the UT and 61 respondents from the USB – followed by his analysis of the overall findings. In this section, the Author also makes an attempt to identify those findings which directly relate to his proposed models of design methodology and the design process – emphasising by the symbol, ➢. The three sections of the questionnaire, as introduced earlier, are presented here in which the students' responses as well as the Author's analyses are followed after each question, ***highlighted in Italic***. Consequently, in order to overcome the shortcomings of the existing educational problems, the Author will present his discussions later by introducing his methodology of teaching in the following chapter.

[3] Less than 5% difference, suggested minimal (Smith, H.W., 1981, pp. 8-10)

SECTION 1- Introduction (Student's self-image, assessment, etc.)

1- Where do you define architecture in the given spectrum, between the Technical/Scientific pole and the Artistic/Creative pole?

Figure 12. 1 Defining the place of Architecture between the sciences and arts.



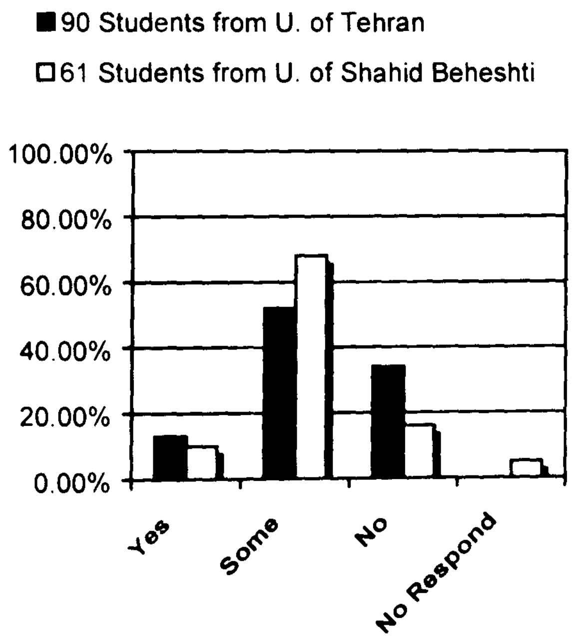
Results on the Chart indicate that over 20% of students at the UT believe that architecture is more associated with technical/scientific issues, while the rest of them suggest that it belong somewhere between arts and sciences, leaning toward arts. However, students from the USB tend to describe architecture more toward its artistic characteristics. over 50% of students at the USB define architecture closer to arts.

The Author's remarks about the above findings include:

➢ Students at the UT see architecture more as a balance between the arts and sciences which could mean that the methodology of teaching and/or the educator's preferences could have influenced them.

2- Do you consider your work "successful" in Design Courses?

Figure 12. 2 Percentage of students who consider their work successful in design.



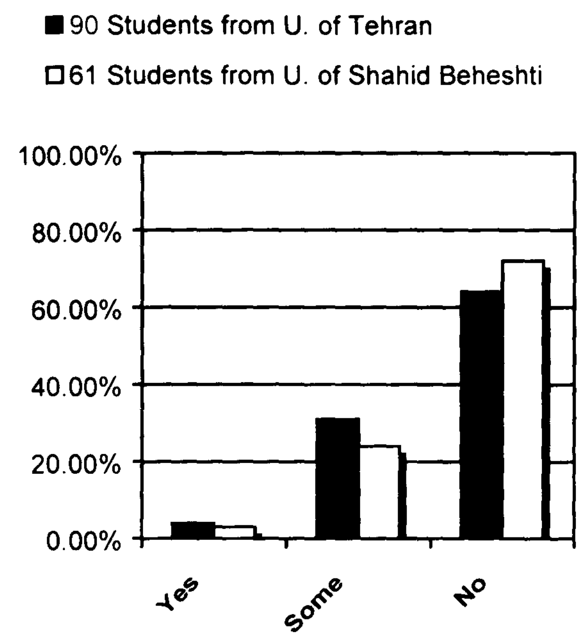
Results on the Chart indicate that the majority of students at both schools believe that they have an average standing in Design. However, there is a tendency among students at UT to consider themselves less successful.

The Author's remarks about the above findings include:

➢ The self-image of a designer should be positive and they should have confidence, which doesn't seem to be the case at these schools. Therefore the Author suggests that a teaching methodology is needed to reinforce that good image and give self confidence to students about their works.

3- Do you consider the final grade as the main indication of "success" in Design Courses?

Figure 12. 3 Percentage of students who consider grade as a main indication of success.



Results on the Chart indicate that a majority of students at both schools believe that final grades are not the main indication of their success in design. However, some students believe that grades are important in their success.

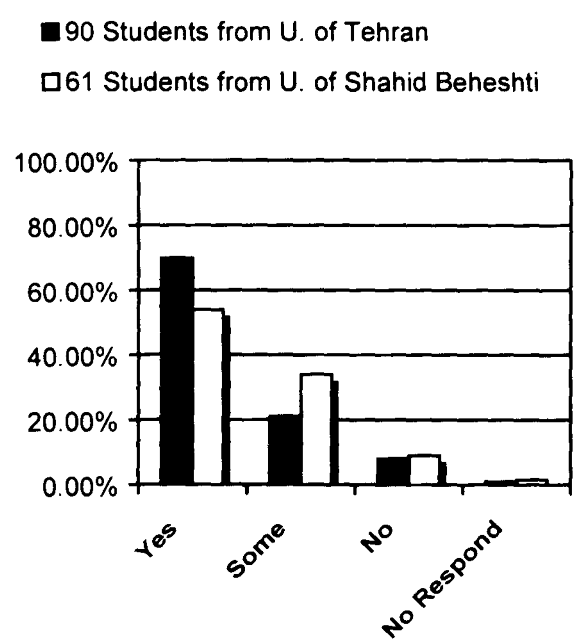
The Author's remarks about the above findings include:
- The majority of students are aware that final grades don't actually reflect their success in design.
- This also indicates that assessment methodology has weaknesses and ought to be reconsidered.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Majority of students at both universities were unhappy with their final grades in design courses arguing that educators main concerns are the final presentation instead of students' performance throughout the semester. A student at the UT expressed: "My final grade last semester was not very good and the reason for that was that I was ill and I couldn't present the project the way they had expected me to do. ...I had worked fine throughout the semester and my instructor liked the idea very much, but I guess that wasn't important at the end." Another student at the same university writes: "My final grade was not what I had expected. I guess I should have had somebody else to render my drawings for me."

Many remarks such as these mentioned above, indicates to the Author that a clear (unbiased) method of grading is needed to be spelled out to students so they know for sure how their design performances are graded. The Author has witnessed in his teaching career that the mistrust of many students on the grading system which they accuse their instructors of grading them based on the number of "pretty drawings" which they have produced, is based on some grounds in many situations which he has been involved with at the UT.

4- *Do you feel a lack of design methodology in your design exercises? (Please describe)*

Figure 12. 4 Percentage of students who report a lack of design methodology in their design exercises.



Results on the Chart indicate that the majority of students at both schools believe that there ought to be some type of design methodology in their design courses.

The Author's remarks about the above findings include:

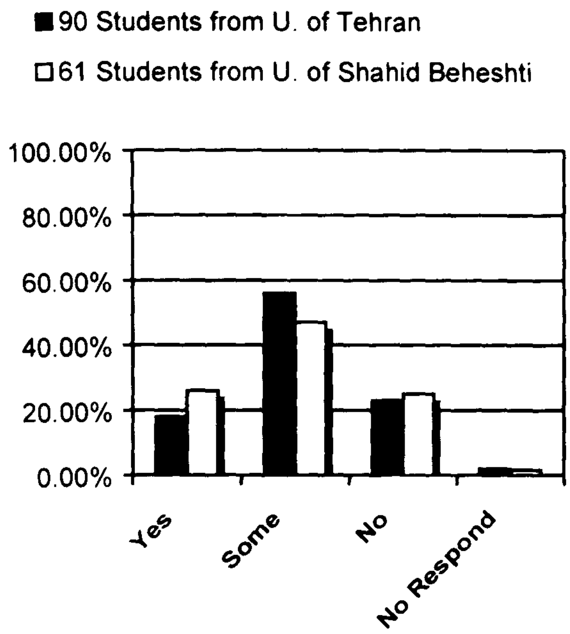
- Students welcome the idea of having a design methodology to implement in their design works.
- This also indicates that although most educators claim to have design methodologies, students are not fully aware of them. It could be helpful if design educators spell out their design methodology at the beginning of each semester.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Most students at both universities expressed dissatisfaction with their design educators' lack of design methodology. One student at the UT put it this way: "My design instructor looks at my project and tells me "it is not there yet". It is a mystery for me that when it is going to get 'there'." Many students were unhappy with their design experiences arguing that some instructors are so unorganised, busy with their own businesses outside the university, and that they spend a little time with students. "How should one expect a design methodology from such instructors?" an angry student stated.

More students from the UT were unhappy with the lack of design methodology than those from the USB, arguing that they don't know how to get started on their projects and what issues they need to consider during the process. One student in Design-7 at UT explained: "Except for that semester that we worked with you [in Design-3], using the scenario writing exercises, in other studios there was no clue of when or how to start our design project." He further explained that "we wished that we could have had another chance to work with you". This indicates to the Author that it could be necessary to work with students on at least two consecutive semesters on a design methodology to be able to fully explain it.

5- *Have you ever been introduced to any design method or design process by your previous instructors? (Please describe)*

Figure 12. 5 Percentage of students who have been introduced to design process.



Results on the Chart indicate that many students claim that they have been introduced to some type of the design process, while over 20% of students at both schools believe that they have never been introduced to any design processes.

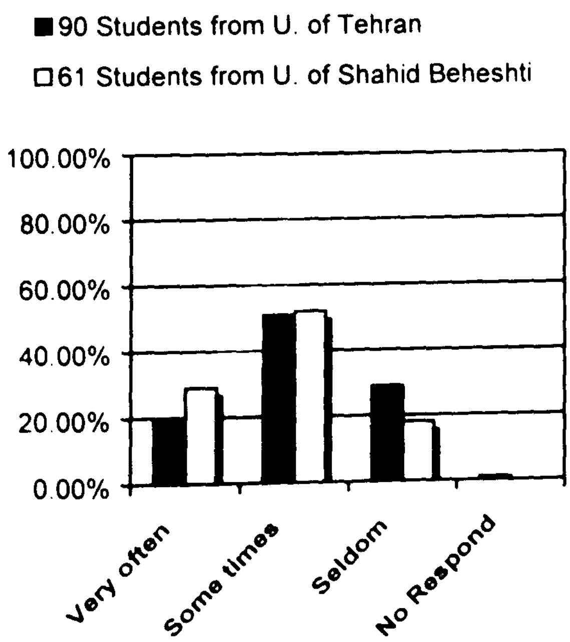
The Author's remarks about the above findings include:

- Comparing the results of this question to those in Question 4, indicates that although students have been introduced to some types of the design processes, many of them are still unsatisfied and are looking for a methodology.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Many students at USB expressed that the only semester in which they were introduced to a methodology was during their Architectural Design I course. They liked that experience and wished they could have been introduced to other methods in other years. Students at the University of Tehran supported their Basic Design courses, "there was some kind of methodology there", one student stated.

6- *How often do you use drawings and graphic analyses during your design exercises?*

Figure 12. 6 Percentage of students who use drawings during their design exercises.



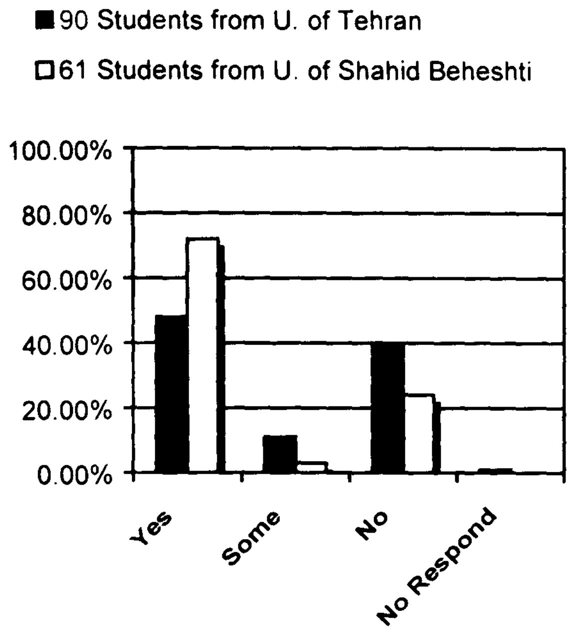
Results on the Chart indicate that about half of the students at both schools use drawings and graphic techniques during their design exercises. Over 20% of them use drawings very often, but about the same percentage use drawings very little.

The Author's remarks about the above findings include:

- Over 70% of students use drawings in their design exercises and they enjoy those exercises.

7- In general, do you enjoy drawing?

Figure 12. 7 Percentage of students who enjoy drawing.



Results on the Chart indicate that there is almost a split between the students of the UT who like drawing and those who dislike it. However, students at USB tend to like drawing in the majority.

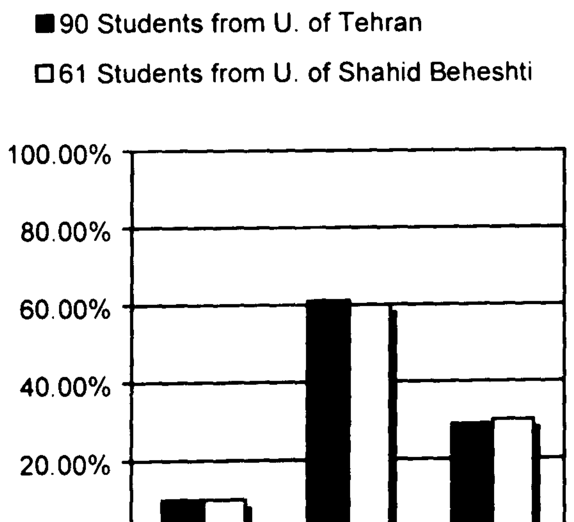
The Author's remarks about the above findings include:

➢ Visual thinking exercises which don't necessarily involve drawing skills (i.e., collecting images from journals) could be a viable substitution for these students in order to stimulate creative thinking in them.

In order to find out the reason for disliking drawing, based on Questions 6 and 7, the Author has attempted to put the question into different formats in the following two questions.

8- How "successful" do you consider yourself in drawing conceptual ideas?

Figure 12. 8 How successful do students consider themselves in conceptual drawings?



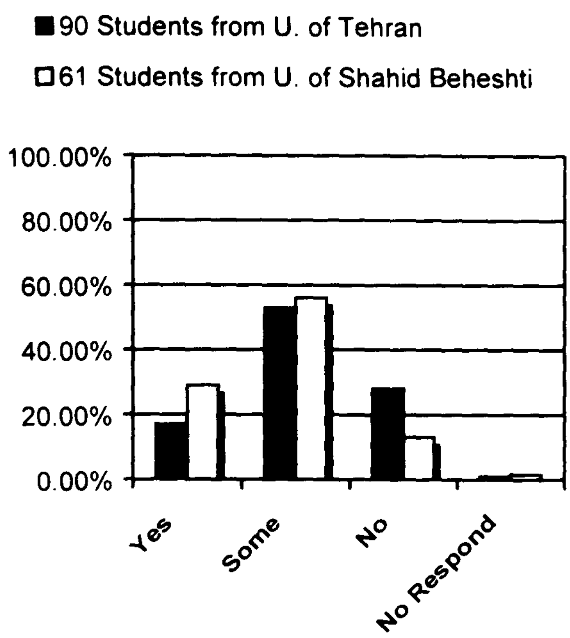
Results on the Chart indicate that 60% of students at both schools consider themselves to have some success in drawing conceptual ideas. However, about 30% of students at both schools don't consider themselves successful in drawing conceptual ideas.

The Author's remarks about the above findings include:

➢ A great number of students do not consider themselves successful in drawing. Therefore other visual thinking exercises should be adapted to stimulate them during their design processes to reflect their thoughts.

9- Do you consider yourself "creative" in design?

Figure 12. 9 Percentage of students who consider themselves creative in design.



Results on the Chart indicate that over 50% Of students consider themselves creative in some extent. However, about 30% of students at the UT don't consider themselves creative at all.

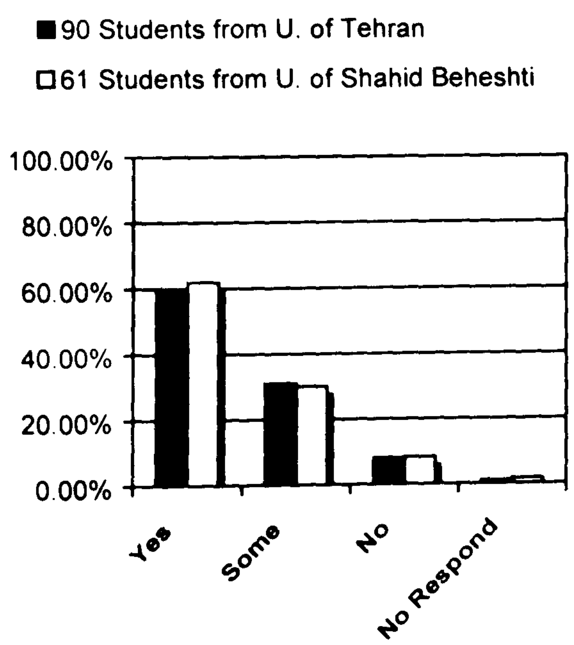
The Author's remarks about the above findings include:

➢ There could be a relation between those students who don't use drawings, don't like drawing, feel weak in drawing, and don't consider themselves creative in design, Questions 6-9. This negative self-image could be overcome by the use of creative methods of teaching design.

Based on the responses to Questions 6-9, the Author claims that there is a direct relation between the percentage of students who don't use drawing, don't like drawing, feel weak in drawing, and those who don't consider themselves creative in design. This indicates to the Author that drawing exercises could stimulate creative thinking in design students.

10- Do you think it is possible to increase the amount of creativity in people?

Figure 12. 10 Percentage of students who think it is possible to increase creativity.



Results on the Chart indicate that over 60% of students at both schools believe that the level of creativity could be increased in people.

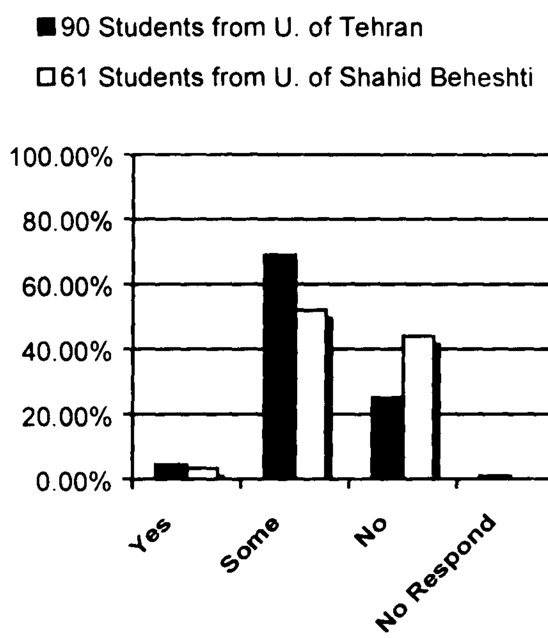
The Author's remarks about the above findings include:

➢ Students confidence about the possibility of increasing creativity is a very promising sign for the educators to invest in ways to improve creative thinking methods at schools.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Majority of students at both universities expressed that they were optimistic in improving the levels of creativity in students. A Design-5 student at the USB explained: "I have a good rapport with my instructor this semester and we get along well with my design ideas,...that has brought some new energy in my work and I feel much more productive this semester". Another student from the UT explained, "Creativity is not something we are born with, we can all learn to become more creative people in life. However, it needs to be developed in a right environment."

11- Are you satisfied with the method of assessment in your Design Courses?

Figure 12. 11. Percentage of students who are satisfied with their assessing methods.



Results on the Chart indicate that a majority of students at both schools tend to have some satisfaction with their assessments, however, many of them are not satisfied with their assessment method at all. It is note worthy that more students from the USB tend to be unsatisfied with their assessment than those of the UT.

The Author's remarks about the above findings include:

- Dissatisfaction with assessment methods could discourage students from design activities and educational achievements.
- Educators at both schools ought to reconsider their assessment methods.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Majority of students at both universities expressed that they would like to be introduced to the way which their works are going to be assessed in every semester. One student from the USB stated: "I don't know what the criteria of grading was on my project, last semester. I worked very hard throughout the semester and at the end I didn't receive the grade I was expecting." Many students were dissatisfied with the way their instructors had critted them. They raised this point that pretty pictures of the final presentations influence most design instructors. "Particularly now that computer graphics help students", stated a student from the UT who was unhappy with his grade, "it is worthless to spend time during the semester on the design process. Maybe we should draw up something pretty at the end and forget about the whole thing".

Many students at the UT, were unhappy with their design instructors grading system since they grade them in private and students don't get a chance to defend their works. One student stated: "The whole thing took them half an hour. They went into the exhibition halls and graded over 60 of our projects." She further added, "... you can tell how much they cared about our projects." Another student from the same university stated: "It is not fair for instructors to assess our works in private, we need to be there and explain what we have done. Besides, it will be an educational learning process if we get to hear the views of our educators and even our friends about our projects in an open meeting."

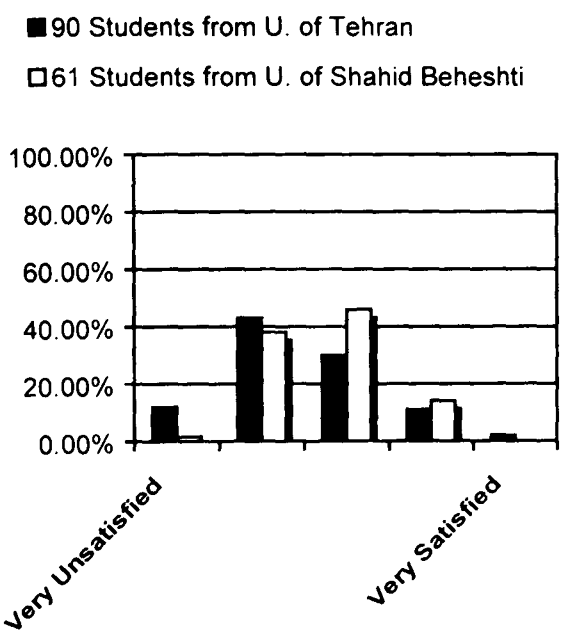
Another issue with regards to assessment was raised by the students at both universities arguing that a viable assessment method should take the progress of a student into consideration throughout a semester. One student at the UT states: "I usually have a slow start in my projects, that ticks off many of my instructors and they think I don't have it in me... I think they judge me based on those slow starts throughout the semester". Another student at the same university explained: "I don't think my instructors really get to know my projects, I don't get a chance to explain my work for them very often."

Many students at the UT were unhappy that other instructors grades should effect their final grades. A Design-5 student explained: "In my Design-3 studio, my instructor had given me a higher grade than the other three educators, since he was aware of the hard work I had put into the project, however, my final grade was decreased by two points since the other educators were grading the final product of my work." Although it is important to be aware of the other educators' views about a project, later in Chapter 14, the Author will present a solution to this problem when he faces a similar problem with his students' final grades in a case study.

SECTION 2- Architectural Education & the Design Process

12- In the given spectrum, mark the level of your satisfaction with your previous Design experiences.

Figure 12. 12 Percentage of students who are satisfied with their previous Design courses.



Results on the Chart indicate that majority of students at both schools tend feel some satisfaction with their previous design courses. This ranges at the UT from 12% very unsatisfied to 45% with a little satisfaction, and 30% with some satisfaction. There is about 13% of students at the UT who are satisfied or very satisfied with their previous design courses.

The Author's remarks about the above findings include:

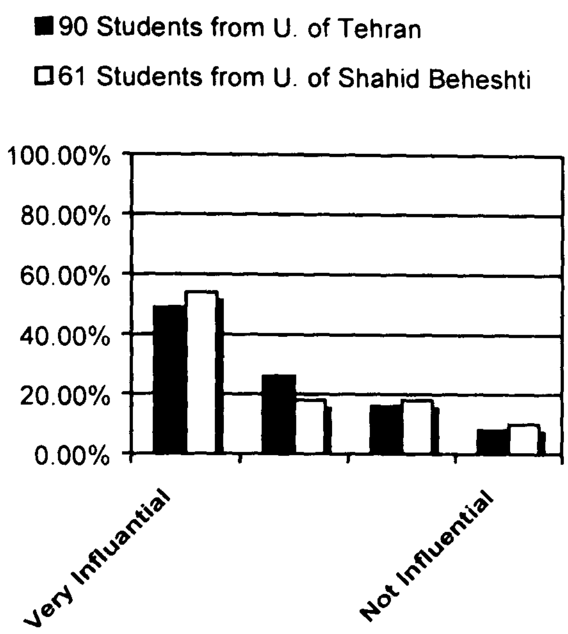
- Dissatisfaction of students from previous design experiences could mean that they didn't achieve the acquisition of knowledge which they were supposed to, and that is some issue which deserves a serious investigation by educational planners.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. In a moderate response, students from both universities expressed some satisfaction with their previous design experiences. Some students from USB expressed that they feel like they are improving and that must be because they have learned something from their past design studios. At the UT, a slightly better comments were provided. A student in Design-7 writes: "Now that I am about to finish school, I realise that we needed to go through all of those experiences. It was tough, however, we learned different things from different people." Another student at the same university writes: "I was more satisfied with the first few years of my studios. I learned more. In the later years, I don't think the educators had very much to offer us and we could have learned more."

13- How influential do you consider the following issues in developing a "successful" architectural education system? (Rank them on a scale of 1- 4, where "1" is the most influential issue)

- *Student's characteristics (e.g. motivation, qualification, ...)*

Figure 12. 13 Percentage of students who consider students' characteristics are most important in their progress in architectural design education.



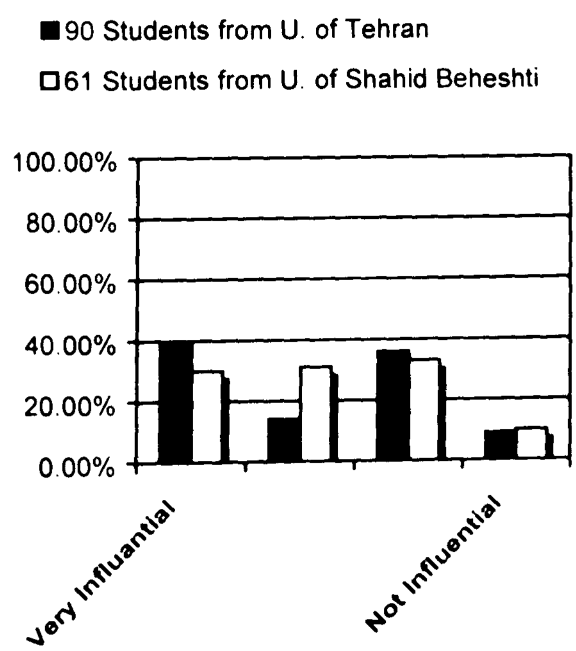
Results on the Chart indicate that the majority of students at both schools tend to believe that students' characteristics are very influential in their progress. However, some 10% of the students from both schools don't consider students' characteristics influential in their progress.

The Author's remarks about the above findings include:

➢ It is a good sign to see students consider themselves as a very influential part of a successful education. This could indicate that almost 50% of their success and progress depends on them and the other 50% on other factors. Therefore, students should be asked to rely on themselves in educational activities.

- *Educational programmes (e.g. curriculum, integrity, ...)*

Figure 12. 14 Percentage of students who consider educational programmes are most important in their progress in architectural design education.



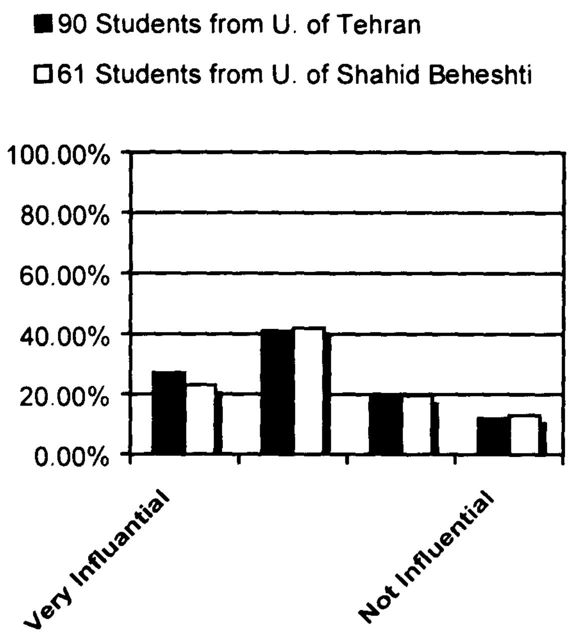
Results on the Chart indicate that for as many students who find educational programmes very influential in their progress, there are just as many who don't feel that way. In fact, some 10% of students at both schools even don't believe educational programmes would have any thing to do with their progress.

The Author's remarks about the above findings include:

➢ Although school programmes and educational organisations could play an important role in the educational success of students, it is not the most influential factor.

- *Instructors' characteristics (e.g. delivery method, availability, ...)*

Figure 12. 15 Percentage of students who consider instructors' characteristics are most important in their progress in architectural design education.



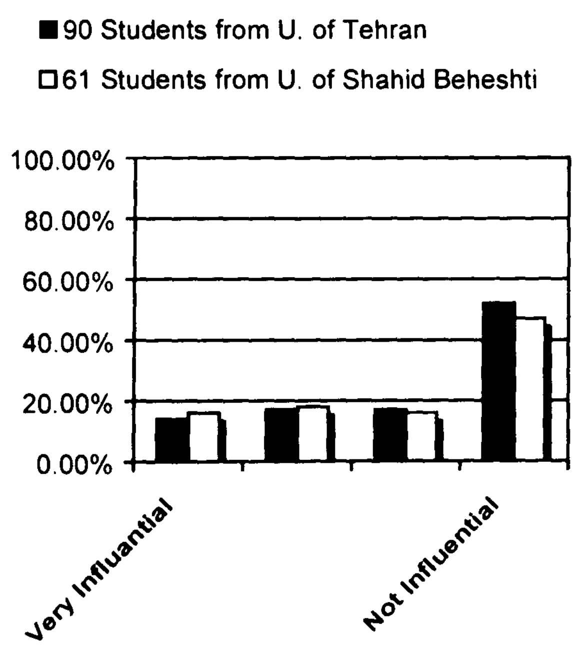
Results on the Chart indicate that over 50% of students at both schools suggest that instructors' characteristics could have serious influences on the progress of students. Although less than 50% of students don't believe that instructors characteristics are influential in their progress.

The Author's remarks about the above findings include:

➢ Instructors' characteristics in teaching and in personal conduct has some influences on the progress of the students of design.

- *School's facilities (e.g. libraries, equipment, ...)*

Figure 12. 16 Percentage of students who consider school's facilities are most important issue in their progress in architectural design education.



Results on the Chart indicate that about 50% of the students at both schools don't believe that school's facilities would have anything to do with their progress in architectural design education.

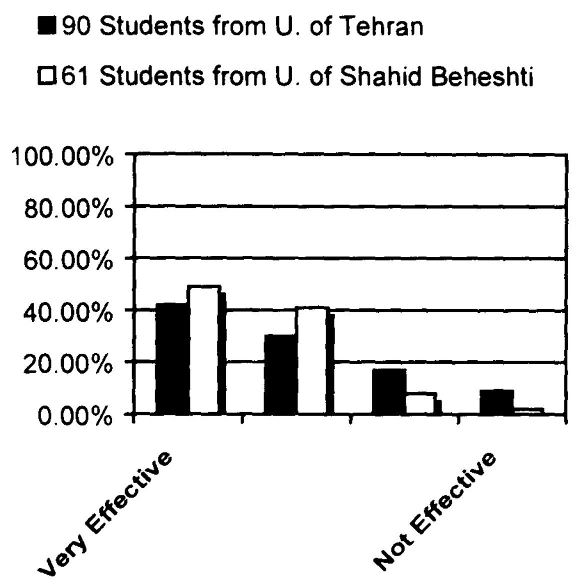
The Author's remarks about the above findings include:

- The Author expected to find a greater influence of school facilities (since most students would complain about the lack of access to good books or journals, or even they complained about the space of their studios,...). He wonders if the results would have been similar if this question was asked from students in a smaller university in a remote city.

14- How effective do you find the following issues in regards to the instructors of Architectural Design in the progress of the students of design? (Rank them on a scale of 1- 4, where "1" is the most influential issue)

- *Instructors who have a good rapport with students and encourage them to express new design ideas.*

Figure 12. 17 Percentage of students who consider instructors who have a good rapport with students are effective in their progress in architectural design education.



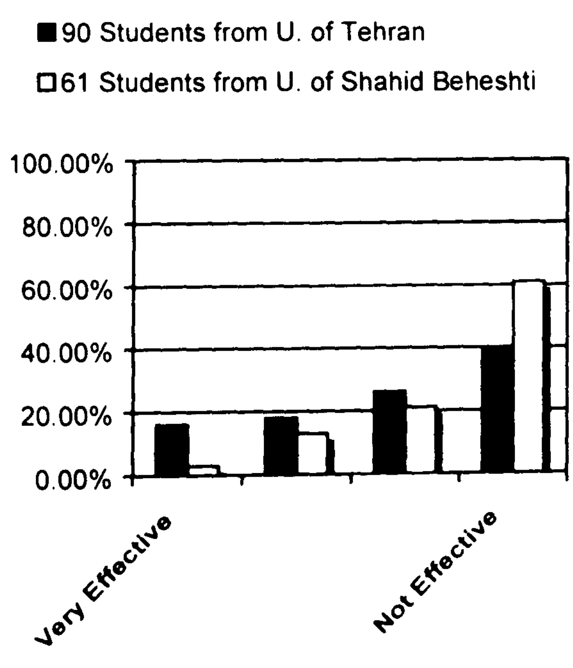
Results on the Chart indicate that over 40% of students prefer those design educators who have good rapport with them and let them express new design ideas.

The Author's remarks about the above findings include:

↓ This suggests that students are interested that their design educators to listen to their design ideas and develop a friendly dialogue with them.

- *Instructors who have a clear design methodology and expect specific exercises to be experienced by all students.*

Figure 12. 18 Percentage of students who consider instructors who have clear design methodology are effective in their progress in architectural design education.



Results on the Chart indicate that a majority of students at both schools don't find instructors who have a specific methodology and ask students to follow their exact methodology very helpful in their progress.

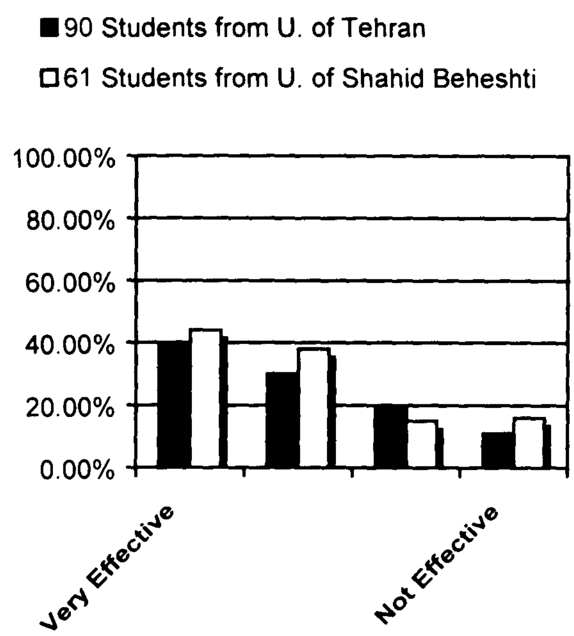
The Author's remarks about the above findings include:

↓ Students don't like to be told all the time what to do in design.

↓ Students in the earlier questions showed some interests in having a design methodology, but they don't like to be restricted in the strategies which they deal with in a design problem and they like their freedom in design.

- *Instructors who are not set on any particular methodology in design and deal with students independently.*

Figure 12. 19 Percentage of students who consider instructors who are not set on any particular methodology are effective in their progress in architectural design education.



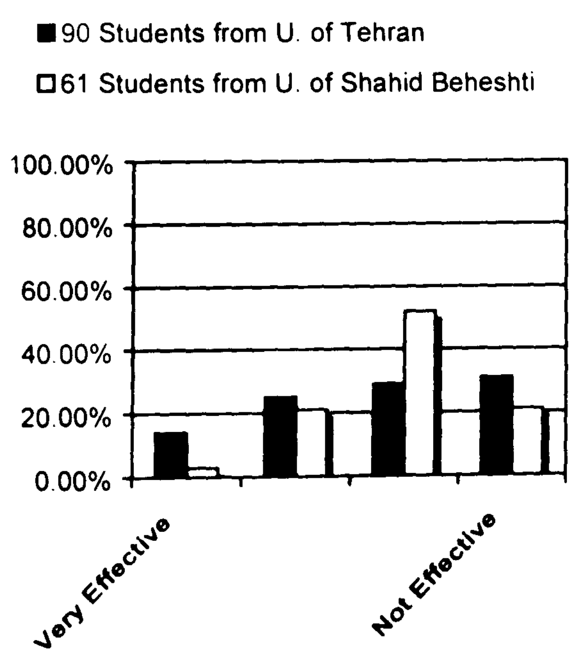
Results on the Chart indicate that about 40% of students from both schools believe that instructors who don't have a set mind in teaching by asking specific exercises to be followed by students are very effective in their progress. In general, most students are in favour of these instructors.

The Author's remarks about the above findings include:

↓ Students prefer to have instructors who do not dictate what they want from students in design exercises.

- *Instructors who spend more time with students and expect students to spend a lot of time as well.*

Figure 12. 20 Percentage of students who consider instructors who spend more time with students are effective in their progress in architectural design education.



Results on the Chart indicate that the majority of students at USB believe the instructors who spend more time with students and expect more work in return are very ineffective. However, those students from the UT have a mixed reaction, 17% believe it is very effective, about 50% believe it has some effects, and 30% believe it is very ineffective to have instructors who spend more time with them.

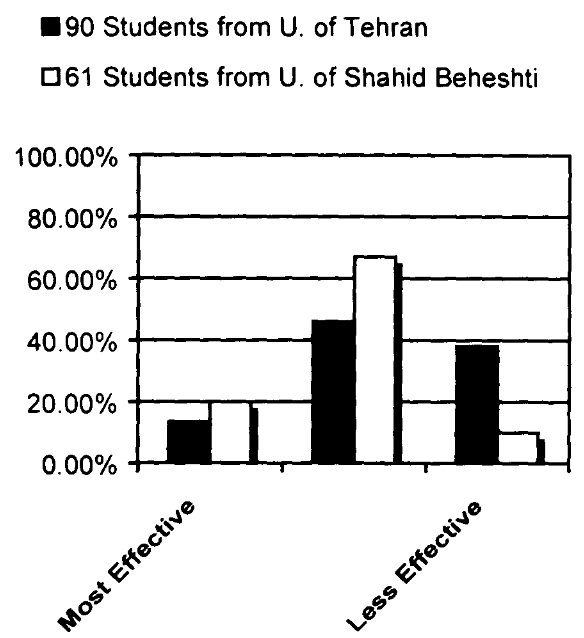
The Author's remarks about the above findings include:

↓ It is not very effective for instructors to be a hard worker instead of using other effective teaching methods.

15- How effective do you consider the following teaching methods in assisting design students in their design process?

- *Saying the least and letting students to find their own way through design.*

Figure 12. 21 Percentage of students who consider instructors who say the least and let students find their ways are effective in their assistance during the design process.



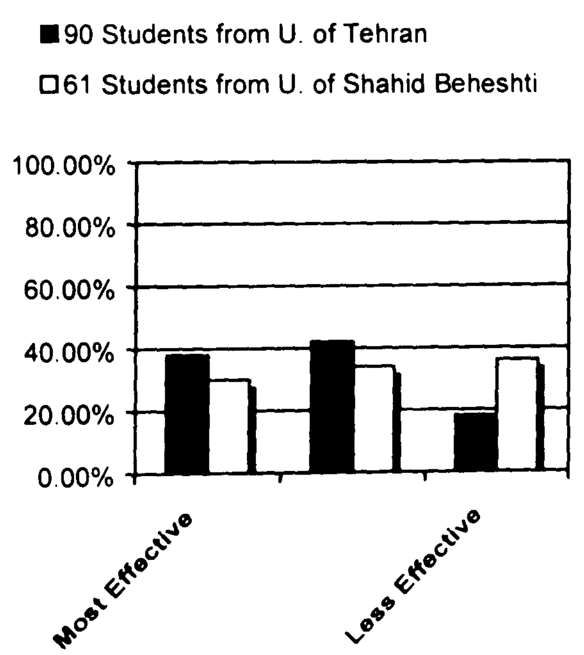
Results on the Chart indicate that a majority of students from both schools suggest that instructors who say the least and let students find their way through the process have some effects on their assistance in the design process. Although, about 40% of students at the UT believe it is not very effective.

The Author's remarks about the above findings include:

➢ Students at the UT are split in their decisions as to whether they like their instructors to help them through the process or not.

- *Giving a framework of design activities to students and directing them in their search for solution.*

Figure 12. 22 Percentage of students who consider instructors who give a framework of design activities are effective in their assistance during the design process.



Results on the Chart indicate that there is a split decision among students of the USB on the effectiveness of instructors who give a framework for design activities. However, the majority of students at the UT tend to suggest that they would rather work with an instructor who gives a framework of design activities during the design process.

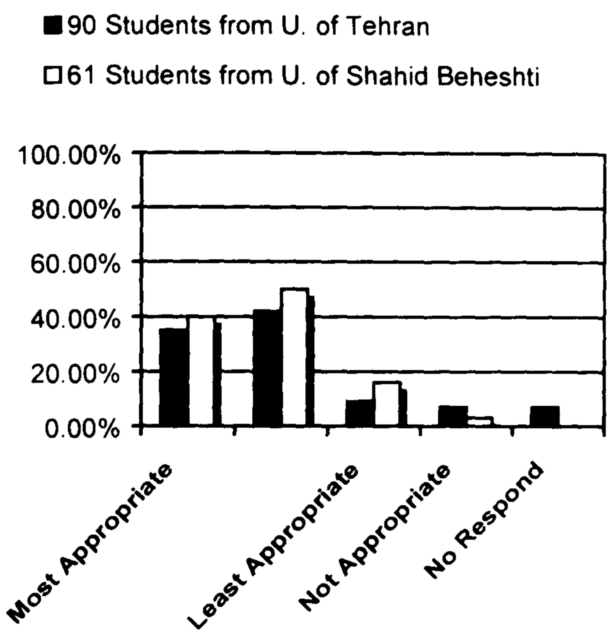
The Author's remarks about the above findings include:

➢ Students at the UT would rather have an instructor in design who gives them a framework of design activities.

16- Many design students use architectural journals during their design studies, however, there is a mixed reaction from instructors about the time of referring to library for assistance. Do you refer to journals in your design exercises? And if yes, when do you feel it is more appropriate:

- *When you are given a project and you need to become familiar with the subject (i.e., for precedence study).*

Figure 12. 23 Percentage of students who consider using journals at the start of a project.

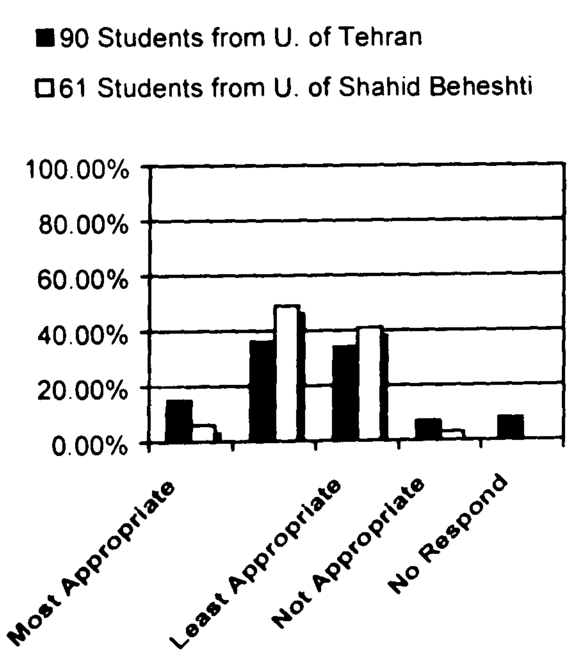


Results on the Chart indicate that the majority of students from both schools believe the use of journals to be very appropriate when they are given a project and need to become familiar with the subject.

The Author's remarks about the above findings include:
➢ Students use of architectural journals at the start of any design project, as a tool to enhance their understandings about a subject, should be recommended.

- *When you are stuck and can not develop any ideas.*

Figure 12. 24 Percentage of students who consider using journals when have problems.

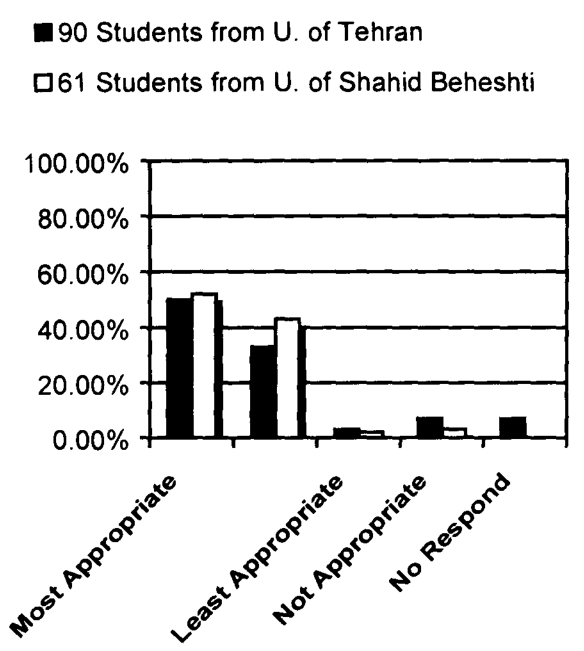


Results on the Chart indicate that about 40% of students in both schools believe it is appropriate to use journals when they are stuck, while another 40% believe it is not appropriate. Some 15% of students at the UT believe it is very appropriate to use journals when they run into problems and get stuck.

The Author's remarks about the above findings include:
➢ Using journals could be helpful during the design process, when students are stuck and cannot generate any ideas.

- *When you use journals for technical purposes and not necessarily for copying ideas.*

Figure 12. 25 Percentage of students who consider using journals for technical learning.



Results on the Chart indicate that the majority of students from both schools believe that the use of journals is very appropriate for learning purposes and not copying ideas.

The Author's remarks about the above findings include:

↓ Students should use journals when they need to learn more about a subject and acquire knowledge.

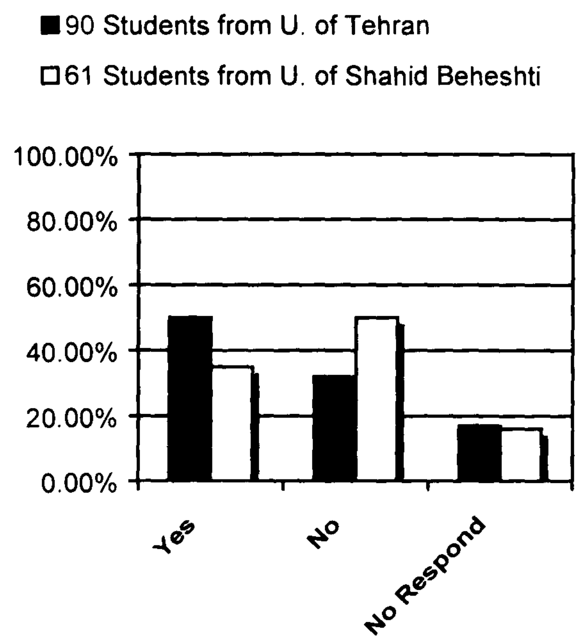
- *(If others, please explain)*

In addition to marking the questionnaire, students were asked to provide some further comments about the most appropriate time to use images from journals. Although most students indicated that they are not usually encouraged by their educators to use images from journals, they expressed their personal interest to develop this habit. A student at USB states: "The first few weeks when we are given a new project, I try to go to the library and collect as many different images related to my new project as possible. ...They are very helpful. It is not that I try to copy from them, just they give me a better perspective during the design process." Another student at the same university writes: "I think using journals is very good, too bad most samples are from other countries." On a different view, a student at the UT writes: "Foreign Journals are great, we get tired of seeing the same old stuff over and over. They let us know what other architects are doing around the world".

There were a few students who expressed their dislike of using journals. A student from the UT writes: "I feel that is cheating, we need to create ideas on our own. ...How could you see journals and not be influenced by them?"

17- The term "design process", has been used in most architectural academic institutions by students and educators of architecture. Do you use methodology of design and the design process? (please describe)

Figure 12. 26 Percentage of students who use some type of the design process.



Results on the Chart indicate that students are split at both schools, between those who have and use the design process, and those who don't. However, the chart also indicates, that students from the UT tend to have or use the design process more than their colleagues at the USB. A noticeable number of students, about 18%, did not reply to this question.

The Author's remarks about the above findings include:

➢ A majority of students at the UT apply some type of the design process in their design projects.

In addition to marking the questionnaire, students were asked to provide some further comments about the above question. Some mixed responses were collected from students at both universities. The ones who were pro the use of design methodology expressed their need for a procedure which would show them what to do next in the design process. A Design-5 student at the UT writes: "I have developed my own design methodology. I start by thinking about the project as if it was built and I was moving through it....". Another student from the same university explained a more procedural process, she explained: "I start by collecting as much information as I could about the project. Then I start to analyse them and develop some ideas for my studies. And then I choose the best alternatives and start presenting my ideas."

Some students who did not use design methodology, the Author discovered were mislead by the term. One student at the USB writes: "I don't have a fixed design methodology. Sometimes I start with drawing about my subject, sometimes with drawing diagrams, and sometimes with building models." In this case, as many others made similar mistakes, she is talking about design techniques and not design methodologies. However, there were some students who explained their different approaches in different design problems. A student at the UT writes: "I usually start my design project by a concept. They could be in the form of a model or a drawing. However, in some cases when I don't have any idea about a given project, I start analysing the problem and learning more about it while I am thinking about developing a concept for it".

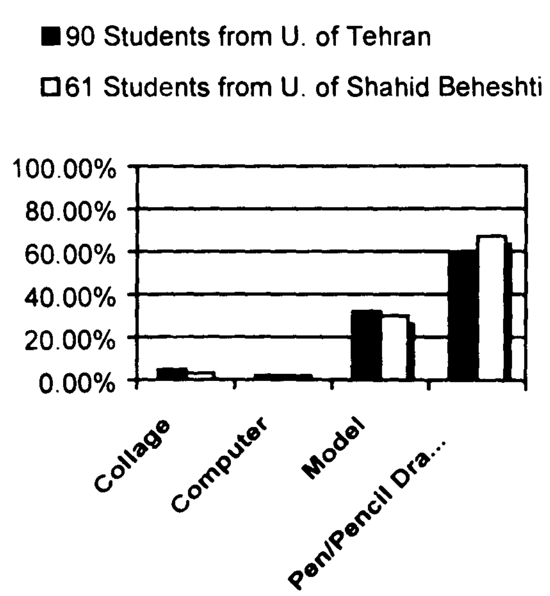
The Author appreciates both views about the design process, for some people it could be a fixed process and for others it needs to be flexible. However, his intention for suggesting an 'interactive' design methodology covers both views. It allows students with any taste to benefit from a pedagogic process in which there is some flexibility for all talents to find their design solutions.

In an attempt to review the preferred tools of communication during the design process in order to draw some concluding remarks with regards to appropriate tools to stimulate creative thinking, the Author presented the following question.

18- In each of the following design activities, which communication tool do you consider most effective? (please choose one best tool for each stage)Stages included: Conceptual Design, Design Development, and Architectural Presentations. And tools included: Collage of pictures and forms, computer graphics, model making, and pen/pencil drawing.

- *During the Conceptual Design stage,*

Figure 12. 27 Students' Most preferred communication tool during Conceptual Design.



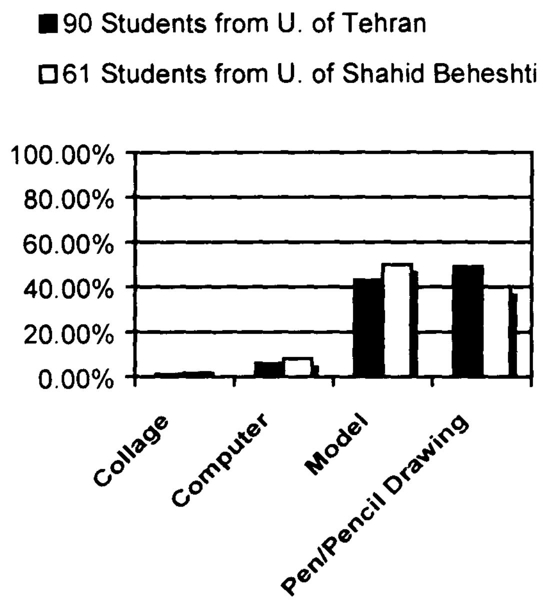
Results on the Chart indicate that the majority of students at both schools prefer using drawing. However, about 30% of the students at both schools have expressed some interests in using models during the conceptual design stage of the design process.

The Author's remarks about the above findings include:

↓ Since students prefer to use drawings and models, they ought to be well prepared with these skills during their first year of design education.

- *During the Design Development stage,*

Figure 12. 28 Students' Most preferred communication tool during Design Development.



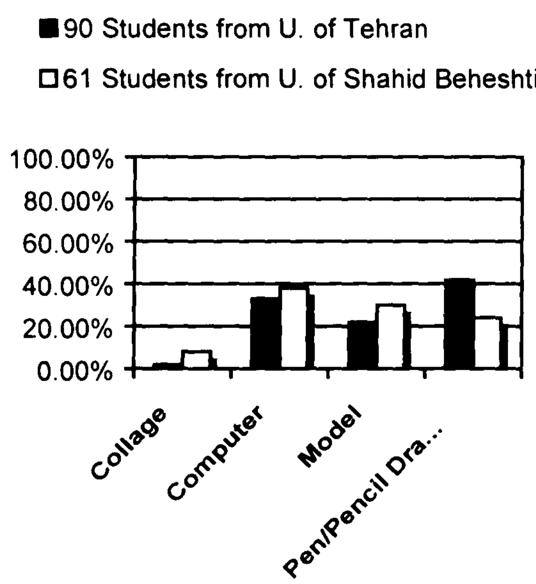
Results on the Chart indicate that there is a split between the use of drawings and models during the design development stage of the design process.

The Author's remarks about the above findings include:

➢ Students suggest that the two most appropriate communication tools for the design development stage are: drawing and models.

- *During the Architectural Presentation stage,*

Figure 12. 29 Students' Most preferred communication tool during Presentation.



Results on the Chart indicate that students at the UT tend to use drawings, computers, and models, while those students from the USB prefer computers, models, and then drawings.

The Author's remarks about the above findings include:

➢ Students at the UT rely heavily on hand drawings as their preferred communication tools.

➢ There is a growing number of students who prefer to use computers during their final presentations.

These findings with regards to the preferred tools of communication during different stages of the design process indicate to the Author that design students act very much in the manner as their design educators expect them to do (see educator's similar responses to the expected tools during the design process discussed in the previous chapter). Therefore, the Author suggests that critics of architectural education should not fear that drawing skills are becoming weaker at schools or the use of computers are becoming more widely spread (as suggested in Chapter 3 and 8). On the contrary, he believes that design educators have the power to direct students in any direction which they foresee for them. Therefore, instead of worrying about students' future thought processes, critics should worry about what directions design educators and educational planners are going to lead them to.

SECTION 3- Design Factors Influencing Architectural Design

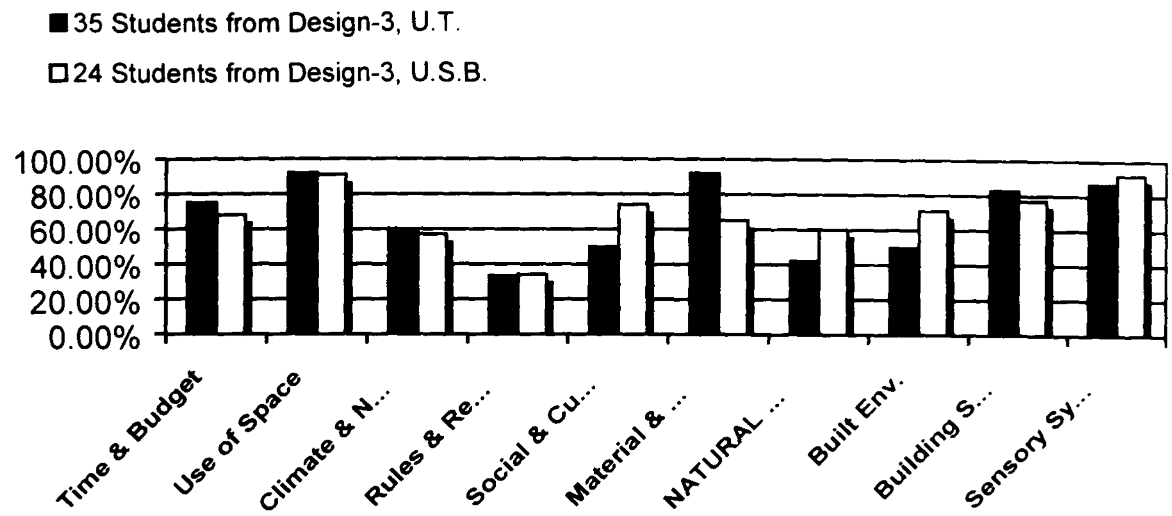
This final section is designed to collect students' views about the influencing factors for developing a design solution. This information was needed for developing Contextual Factors in Chapter 6, and it will be used later in the following chapter for developing a teaching strategy.

19- Identify the effectiveness of the following design issues in the design exercise which you are currently involved in. (Also, please introduce any additional issues to the following list)

- Time and Budget (e.g. Investments, Interest rates, Development opportunities, Seasons, Work hours, ...)
- Use of Space (e.g., Organisation and Circulation of Space, Client and/or User's wants and needs, User Types, ...)
- Climate and Natural Forces (e.g., Sun angles, Temperature, Precipitation, Winds, Earthquake, Tornado, Hurricane, Flood, ...)
- Rules and Regulations (e.g., Country/State/City/Building regulations, ...)
- Social and Cultural Influences (e.g., History, Religion, Culture, Arts, Aesthetics, Thoughts, Designer Preferences/values, ...)
- Material and Construction (e.g., Availability, Durability, Reliability, Skills, Knowledge, ...)
- Natural Environment (e.g., Geography, Topography, Soil, Vegetation, ...)
- Built Environment (e.g., Neighbourhood, Architectural characteristics, Roads and access, Utilities and Infrastructures, ...)
- Building Systems (e.g., Structural, Mechanical, Electrical, ...)
- Sensory Systems (e.g., Views, Noise, Feelings, ...)

- *Design-3 students' selection of the most influential Design Factors,*

Figure 12. 30 Most influential design factors for students in Design-3, Year-3.



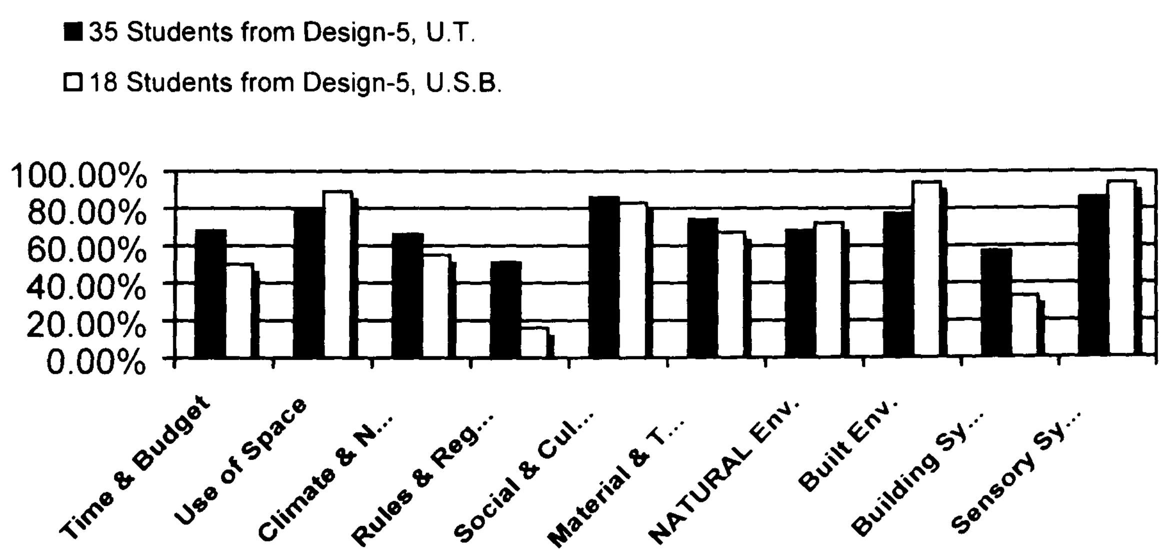
Results on the Chart indicate that students at both schools suggest factors such as: Use of Space, Sensory systems, and Building systems are the most important design factors influencing Design-3. However, students at the UT have expressed a special interest on the factor of Material and Technology in that course.

The Author's remarks about the above findings include:

➢ Since the subject of the Design-3 studio is concerned with interior spaces, these preferred factors appear as appropriate concerns of the students.

- *Design-5 students' selection of the most influential Design Factors,*

Figure 12. 31 Most influential design factors for students in Design-5, Year-4.



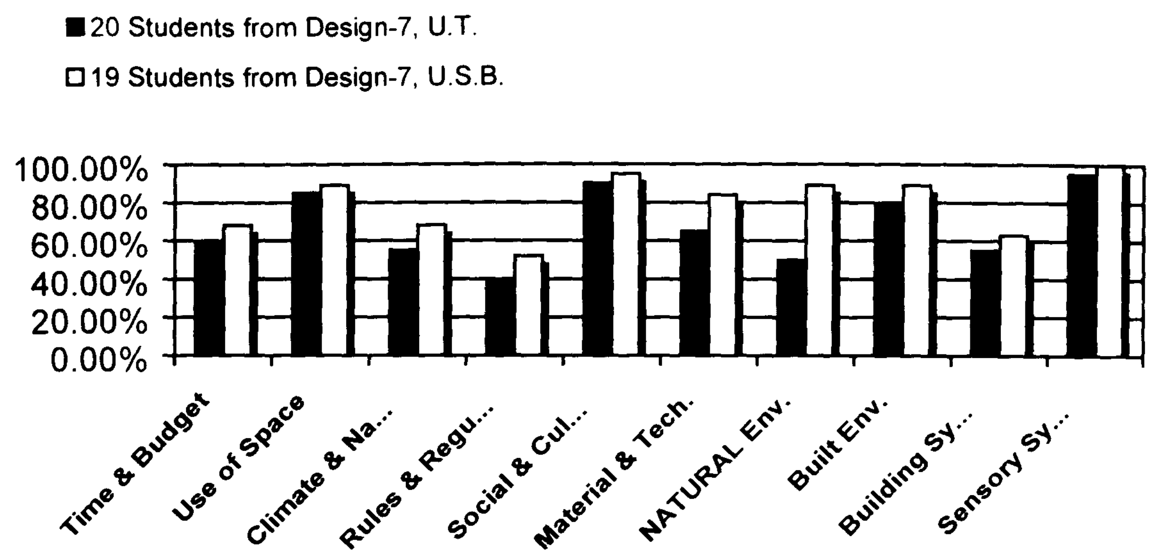
Results on the Chart indicate that students at both schools suggest factors such as: Use of Space, The Built Environment, Social and Cultural, and Sensory Systems as the most important factors influencing Design-5.

The Author's remarks about the above findings include:

➢ Since the subject of the Design-5 studio concerns residential community design, these preferred factors appear as appropriate concerns of the students.

- *Design-7 students' selection of the most influential Design Factors.*

Figure 12. 32 Most influential design factors for students in Design-7, Year-5.



Results on the Chart indicate that students at both schools suggest factors such as: Sensory Systems, Social and Cultural, and Use of Space are the most important factors influencing Design-7. A large number of students at USB express special interest on the factor of Natural Environmental during that course.

The Author's remarks about the above findings include:
↓ Since the subject of the Design-7 studio concerns urban scale projects with respect to an existing context of the city, these preferred factors appear as appropriate concerns of the students.

12.3. Key Findings

By analysing the findings of this chapter, the Author has developed the following outline of key findings related to the two issues of his concerns – teaching design methodology, and appropriate approach in the design process. These key findings are representing students' responses in the order of which questions were asked in this questionnaire.

↓ Majority of students describe architecture closer to artistic characteristics than scientific ones.

↓ Many students define themselves successful in design and have a good image about their work.

↓ Many students believe that their final grade does not reflect their abilities in design, therefore, they don't approve the assessment approaches.

↓ Many students express interest in using or the need to use design methodology in their projects.

↓ Many students have been introduced to some type of the design process during their design education.

↓ Many students express that they sometimes use drawings in their design exercises.

↓ Majority of students enjoy drawing.

↓ Many students find themselves with some success in drawing their conceptual ideas.

↓ Many students believe that they have some creative potentials.

↓ Many students believe that creativity could be increased in people.

↓ Many students have expressed their satisfaction with their assessment as some or none.

↓ Many students have expressed only some satisfaction with their previous design courses.

↓ Majority of students find the following issues most effective on their success in architectural education:

1) Students' characteristics,
2) Educational programme,
3) Instructor's characteristics,
4) School facilities.

↓ Majority of students find the following instructors most influential in their design progress:

1) Instructors who have a good rapport with students and let them express their new design ideas.
2) Instructors who are not set on any particular methodology in design and deal with students independently,
3) Instructors who spend more time with students and expect them to spend a lot of time in return,
4) Instructors who have a clear design methodology and expect specific exercises to be experienced by all students.

↓ Majority of students find those instructors who show them a framework of design more effective in helping them through the design process than those who tend to say the least and let students find their own ways.

↓ Majority of students refer to architecture journals during their design projects:

1) When they need some technical information and to increase their knowledge,
2) When they are given a project and need to familiarise themselves with the subject,
3) When they are stuck in design and cannot generate any ideas.

↓ There is a split response between students who use or do not use any design processes in their projects.

↓ Majority of students prefer to use the following communication tools during their design projects:

For Conceptual Design: drawing and model,

For Design Development: Split between drawing and model,

For Architectural Presentation: Split between drawing and computer.

↓ Students in different design levels described the three most influential design factors in their design projects as:

Design-3 (Year-3): Use of Space, Sensory Systems, and Building Systems, Design-5 (Year-4): Use of Space, Sensory Systems, Social/Cultural factors, and the Built Environment factors,

Design-7 (Year-5): Sensory Systems, Social/Cultural factors, and Use of Space.

PAGE NUMBERING AS IN THE ORIGINAL THESIS

Chapter 13
Teaching Strategy in Design

13.1. Introduction

The Author's experience in teaching design suggests that architectural design could not be taught directly, and students must be introduced to the principles of design in order to develop their own design personality throughout the years. Among many educators, at least one great architect, Frank Lloyd Wright (1936) thought in the same manner when he suggested: "Do not try to teach design. Teach principles". However, in order for design students to be introduced to the design principles, the Author suggests that they ought to be introduced to a design methodology and be directed in a manner by which the educator and students could develop a common design dialogue. This dialogue, however, does not mean that they ought to reach a complete agreement on all design issues; it is only expected that the two parties listen to one another and build an interactive learning environment[1]. As suggested by design educators in previous chapters, it is necessary for a design educator to benefit from a design methodology and establish a working design strategy based on his design principles (see Chapters 10 and 11).

In an attempt to develop a teaching strategy in design based on his interactive design methodology – *Understanding*, *Idealising*, and *Presenting* (discussed in Chapter 6) – and utilising an interactive process of thinking (discussed in Chapter 9), the Author proposes a teaching strategy by which both students and educators of Design could benefit. This chapter will first review the shortcomings of the conventional teaching strategies in design studios, discussed in Chapter 3 and expressed by some students in Chapter 12. Then it will propose a teaching strategy to overcome those shortcomings and by which many students and educators of design could benefit. The proposed teaching strategy will include various considerations in the design process – (i.e., how to get students start work, how to keep

[1] The interactive dialogue is suggested to eliminate the one-sided teaching process by the educators which usually ends up in telling students what and how to design.

students mind active throughout the process, how to stimulate students' minds to generate design ideas and analyse them, and how to develop a close relationship between educators and students in order to develop more understanding between them and increase the chances for a fair final assessment).

13.2. Shortcomings with Conventional Design-Teaching

Most architecture schools in the world run their Design courses in "design studios"[2]. Despite many advantages of the teaching and learning process in the design studio – as introduced in Chapter 3 – many educators and students of architecture argue about some shortcomings of this pedagogic environment which are more related to the teaching strategies than the physical environment of the studios. After reviewing some educators comments in Chapters 3, 10,and 11, as well as some responses from two groups of students in Chapter 12, the Author made an attempt to outline these shortcomings in the following categories.

- **Confusion about the process of design.** Many students argue about the lack of procedure/methodology in their design exercises. They are confused in the process of design and they need to learn about the appropriate steps to take for solving a design problem and developing a design solution. Students claim that some educators encourage their design students to start with precedent studies and programming, while some others encourage their students to start design activities with developing conceptual ideas. They argue that such linear design processes are subject to produce design solutions which are dominated to their starting approaches – "programming" approach usually ends up with logical solutions which are weaker on aesthetics, and "conceptual" approach could ignore many hard facts about a design problem. Many students and educators, also, argue that students are not trained with an in-depth procedure to study about design issues and most students' solutions are not practical. They argue that a design methodology could give students a plan of work to consider and exercise with.

- **Dissatisfaction with the quality of teaching.** Some students were dissatisfied with their educators' attitude towards their design solutions arguing that most design educators are single-minded and want students to design their ways. Also, many students argue that educators criticisms are not well supported by up-to-date lectures and they tend to rely on their past experiences. Many students express their willingness

[2] All those universities contacted by the Author in this research described their design-teaching environment within design studios.

to receive formal lectures on different issues related to their design projects and they argue that most educators tend to discuss only about design concepts and not other technical aspects of their design.

- **Dissatisfaction with grading system.** Majority of students were dissatisfied with their educators' assessment system arguing that they tend to give higher grades to those who draw pretty drawings and prepare beautiful final presentations. Students are in favour of fair judgement, giving more credit to the process of design and considering students' improvement throughout the term. Some students argue that their educators do not spend enough time with them explaining their weaknesses and students don't know what they are doing wrong in the process. Ultimately, most students expect their educators to give them a chance to defend their finals presentations and not to issue them their final grades in private.

13.3. Proposing an Interactive Teaching Strategy

Because of the nature of the architectural design course which involves developing design solutions within long hours of an academic period of a semester, and due to the need for an interactive working environment – involving students and educators – suitable for criticising and preparing architectural drawings and presentations, the Author finds the 'design studio' environment as the most appropriate teaching/learning environment for architectural design students. However, in order to overcome the shortcomings of the conventional design teaching in that environment, the Author suggests that some serious measures should be undertaken to improve the quality of teaching and learning in Design courses.

Throughout the past five years, the Author has been developing his design methodology with the help of this research and his teaching experience with different groups of Design students. In fact, the great opportunity to test the theoretical findings of his research in design studios throughout these years, has been an extraordinary experience for the Author to enhance his *action research*[3]. During this period, over six design studios were conducted by the Author – in three he has worked with other colleagues[4] – in which the results have been complementary and outstanding in formulating the final teaching methodology and strategy in design. The final two semesters – one experience with students at Tabriz University with the help of a colleague[5], and one experience with students at the University

[3] See Chapter 1 for more on 'action research'.
[4] See Chapter 14 for some feedback from these colleagues.

of Tehran (which will be presented as a *case study* in the following chapter) – involved the finalised teaching strategy using the proposed interactive design methodology.

The proposed interactive teaching strategy involves the principle elements of the design methodology discussed in Chapter 6 – understanding, generating ideas, and presenting – within an interactive mode of thinking as introduced in Chapter 9 – the interaction between the content/basic, analytical, and creative thinking. The combination of these models set the context by which a design educator as well as a student of architectural design could take initiatives in a pedagogic environment dealing with the design process. Although the strategies selected by the educators and/or students of design could differ in various design projects – to best suit the nature of specific requirements in those projects – the Author believes that the principles of the proposed "interactive" methodology of designing could remain constant in all design projects.

Chapters 10, 11, and 12 helped the Author to better establish his strategy of teaching Design – by reviewing educators' and students' views about many issues in design such as the design methodology, the design process, and assessment of students' design works. These chapters helped the Author to understand the shortcomings of the conventional teaching strategies and produced some ideas for dealing with those problems. For example, in Chapter 12, students not only express their dissatisfaction with their previous experiences with assessment system in Design courses, but also they make some constructive suggestions by proposing the need for a systematic assessing procedure to value their design activities throughout the design process.

In general, the proposed teaching methodology – with the help of the findings of this research – is intended to bring an interaction between students and their educators within a framework influenced by the proposed design methodology by providing interaction between understanding a problem, generating ideas about that problem, and producing design solutions in an interactive manner. Therefore, students are trained to stimulate their interactive thinking modes in all stages of the process and the design process is described to them as a cyclic/conical process[6], and not a linear one – meaning that a design process dose not have to start with "programming" nor "design concepts", but the combination of the two approaches.

---

[5] Also see Chapter 14 and Appendix J for further results demonstrating external validation of the research conducted by a colleague, Mr. Roohi at the Islamic Art University of Tabriz, exercising the Author's teaching strategy with a group of architecture students.

[6] See Chapter 6 for more on the proposed cyclic/conical "interactive" process.

In the proposed "interactive" teaching methodology,

- All design activities are considered to be interrelated and students are expected to use their interactive thinking modes throughout the process (see Chapter 9).
- All students are assumed creative – with different potentials – and need to be stimulated through design exercises to express themselves. (see Chapter 7).
- All design ideas should be honoured by educators and instead of rejecting students' weak concepts, they ought to be shown on how to improve those ideas (see Chapters 8 and 12).
- Educators should have an organised teaching plan which could be adaptable to the needs of different students with different potentials (see Chapters 3, 4, 5, 6 and 12).
- Design factors which influence a design solution ought to be reviewed by educators and students need to investigate about those influences analytically (see Chapters 6, 10, 11, and 12).
- Creative thinking should be stimulated in students by the use of Visual Thinking strategies(see Chapter 8).
- Students' work ought to be assessed throughout the process and the final assessment should take students' progress during the design process into consideration (see Chapters 7 and 12).

With regards to the shortcomings of the conventional teaching strategies, and the proposed teaching methodology, the following sections review some principle educational concerns along with their practical teaching strategies which could be addressed in any architectural design context, particularly those architecture schools in Iran. The major design-teaching concerns found in this research along with their 6-step *teaching strategies* include:

1. Getting started in a design project by *Writing Scenarios*;
2. Giving design exercises and a plan of work to keep students active throughout the term by *Issuing Daily Exercises*;
3. Addressing in-depth design studies by *Examining Design Factors*;
4. Stimulating creative thinking by *Using Visual References*;
5. Developing design ideas by *Issuing One-day Esquisses*;
6. Assessing students' work through a fair procedure by *Structuring Meetings and Periodical Assessments.*

13.3.1. Writing Scenarios

Writing scenarios could be an excellent way to encourage students to start work. It is a great 'ice-breaker' technique between students and their own thoughts, their fellow classmates, and their educators. A scenario takes the form of a narrative that could tell the story about a portion of the clients' or users' lives. It could start by a simple writing, whether imaginative or realistic. However, the Author encourages his students to place emphasis on the spatial characteristics of the spaces which they are going to design.

With regards to scenarios, Donna Duerk (1993, p. 41) states: "The most useful ones detail 'a day in the life of ...' or describe a particular event in great detail. The job of a scenario is to reveal the behaviours that need a design response and to raise issues that might not otherwise surface at this early stage of the design process".

Writing scenarios during the design process, particularly at the beginning of the process, could stimulate an interactive process of thinking which involves *content, analytic*, and *creative thinking*. This interaction takes form by describing the behaviour of the users, characteristics of the spaces, and proposing viable design solutions. Written scenarios also help students to better *understand* a project – by encouraging them to think and investigate about a problem – and *generate ideas* for overcoming those design problems. Writing scenarios could include sketches drawn by the students or photo-copied from books or articles to assist them in *presenting* their thoughts. Therefore, analytic thinking as well as creative thinking become engaged in a process in which the designer is in a full charge of investigating, problem solving, and designing. Besides improving writing and graphic communication skills, the process of writing scenarios could provide a valuable experience for design students in giving oral presentations in front of the class – a skill which is very much in demand for architects to present their design ideas in front of the juries/clients.

In general, the advantages of writing scenarios could be outlined as:

- Motivating students to start work,
- Bringing their imaginative thoughts into reality by the use of literature and graphics,
- Developing students' communication skills (verbal, graphic, and oral),
- Understanding the user and the expected spaces for design,
- Investigating and developing detailed solutions to suit their scenarios,
- Generating design ideas based on scenarios,
- Idealising, evaluating, and presenting design decisions with reference to their scenarios.

13.3.2. Issuing Daily Exercises

One of the problems discussed in Chapter 3, with relation to Design Studio, was the educators' over emphasis for developing pretty drawings for the final presentations. To overcome this problem and to give more credit to the process of design – not just the final product of design – the Author proposes daily design exercises in his model of teaching design. Daily exercises are a series of design related exercises (i.e., studying about appropriate building materials) which let students learn more about specific design questions. These exercises give an opportunity to the educators to control and evaluate students' progress throughout the project. Daily exercises, also, strengthen the educational value[7] of every design session by keeping students and educators active in bringing some new material for discussion on each day of the class. Daily exercises do not have to be always in the form of student's research work or conventional design exercises, (i.e. studying building forms, plans and elevations), they could also be in the form of technical exercises. These exercises are usually selected by the Author in his design studios with relation to the nature of the given design project. For example in Design-III – due to its relation to the subject of Interior Design – the Author gives some lectures about selecting materials, illuminating spaces, and even on some drawing/rendering techniques. The intention of these lectures, followed by studio exercises, is to encourage students to consider various aspects of design. Many of these issues are never required by other educators and many students usually do not get a chance to ask these questions from their design educators. In his design studios, the Author formats a class calendar by which he introduces different design activities throughout the term. These class calendars are intended to give an indirect instruction of time management and work organisation to students. Therefore, students would learn how to give priorities to design activities and what to do about time management in their future exercises. Also, class calendars introduce specific design tasks with which students should prepare and exercise for each class period.

In summary, daily exercises could provide:

- More attention on the process of design; in reaction to overemphasis on the final design product,
- Better understanding between the educator and the student on every design issue and/or requirement,
- More productive activities in the studio,

[7] Many students, in Chapter 12, argued that design studios are becoming a one-sided interaction in which only students present their works but educators don't have any educational input in the form of lectures.

- Better opportunity for educators to elaborate on the issues which need to be addressed by students,
- Better understanding for students about where they are standing in the process through daily critiques and/or assessments,
- More emphasis on time management and organising design tasks.

13.3.3. Examining Design Factors

One of the major dissatisfactory issues raised by students in Chapter 12 was the lack of in-depth studies on important design issues which influence a design solution. These design issues were identified by the Author through an attempt discussed in chapters 6, 11, and 12 under the issue of "design factors" – *Space and user, Climate and natural forces, Social and cultural influences, Material and construction, Natural environment, the Built environment, Building systems, Sensory systems, Rules and regulations,* and the influences of *Time and budget*. Design factors, in this teaching model, are suggested to be discussed with students from Week-1. The reason for such an early introduction to design factors is justified by the Author with respect to his description of an interactive process of thinking involved in his design methodology. He believes any of the above factors could influence designers in their production of a design solution. It follows that, the earlier designers understand the impact of various design issues, the earlier they can generate design solutions. The interactive thinking process involved in examining design factors is encouraged through visual thinking techniques discussed in Chapter 8. Therefore, when students examine the influences of design factors on their design projects, they are asked to illustrate these problems and their solutions graphically. The use of graphics at the beginning, and models in later design activities, as suggested in chapters 11 and 12, give students a chance to communicate in a 3-dimensional mode – which is very consistent with the nature of an architectural space.

Examining design factors during the first few weeks of a project could help students to develop a better understanding, generate ideas, and present their thoughts describing:

- The space and user's needs and characteristics influencing their projects,
- Climate and natural forces influencing their sites,
- Social and cultural influences effecting their projects,
- Material and construction techniques appropriate for their projects,
- Natural environment and its influence on their projects,
- The built environment and its characteristics influencing their projects,
- Building systems (i.e., structural, mechanical, and equipment requirements),

- Sensory systems (i.e., the influences of views, noise, and the meaning of spaces – semantics),
- Rules and regulations and their influences effecting their projects,
- Time and budget limitations and/or concerns effecting their projects.

13.3.4. Using Visual References

One big issue in design education has always been the power of drawing and communication skills. Some educators believe that students who cannot draw, they cannot design. On the contrary, the Author believes that even those students who cannot draw could become successful designers if their educators give them an opportunity to express their thoughts in a slightly different manner than those conventional sketches. Although the Author agrees that designers need to be skilled in communication techniques, he does not justify the early judgement of some educators about the lack of creativity in those students who cannot draw. Drawing skills can be developed and improved throughout the years and students need to invest some time and effort to achieve that. Students need to be trained to search for appropriate answers within their living environment and they need to train their eyes to look for architectural information. These information, however, could be captured by the means of sketches, photographs, and/or models.

Since students' archives of design ideas and images are limited – as discussed earlier in Chapter 9 – the Author strongly supports the use of visual references by his students throughout the design process. By visual references, however, he includes not only library materials such as books and journals, but also, encourages students to take photographs and draw sketches when they visit buildings and/or travel. As the results of the questionnaires in Chapters 11 and 12 indicate, educators and students, too, are in favour of the use of journals for collecting technical information and developing ideas about a new project. In the proposed teaching strategy, the use of graphics and visual references are encouraged throughout the design process and students are asked to provide graphic analysis even during the earlier stages of the process – during the writing of scenarios, preparing daily exercises, and examining design factors. These graphics, however, do not all have to be generated for the first time and students could photocopy some images from references which best represent their thoughts.

Furthermore, the Author encourages the use of visual references and borrowed images during the design process, since he believes that all students should have the chance to present their design ideas in high quality presentations. He supports his argument by claiming that all students have design ideas, but some of them cannot draw and they usually receive lower grades. Borrowed images and ideas from references, when properly acknowledged, could be helpful for those students who have difficulties expressing their design ideas graphically[8]. Although the Author permits the use of references, he encourages students to modify those images to best suit their project setting/requirements. In an attempt to educate students' "visual literacy"[9], the Author conducts some slide presentations to introduce appropriate local solutions for different design problems. He realises that one danger of using foreign journals could result in students' fascination with foreign/inappropriate solutions in their design projects, however, he finds the benefit of using references greater than limiting students' visual experiences to those of local ones.

Some advantages of using visual references for students of design could be summarised as:

- Understanding about new forms, materials, techniques, and possibilities in design,
- Generating ideas based on what students have seen and learned from those references,
- Improving presentation skills by presenting high quality images,
- Analysing design possibilities in a 3-dimensional mode.

13.3.5. Issuing One-day Esquisses

Development of major design ideas takes place in the form of formal presentations (i.e., one-day esquisses) after some minor design ideas have been generated by students and they have evaluated the implications of their ideas. Using the opportunities available during the design process, most students generate some design ideas which need to be evaluated and selected for the final solution. Evaluation of design ideas is a critical process which could include problem-solving, decision-making, and designing. Development of design ideas could use any form of architectural presentations – i.e., drawings, models, and/or computer graphics. However, presenting design ideas with the help of one-day esquisses could help students to prepare some design solutions under the pressure of time as a visual report of their thought progress on the formation of design solution. Different themes could be assigned to different one-day esquisses to provide design ideas. These esquisses should be aimed to look at design ideas in a holistic manner to provide general ideas – i.e., esquisses about landscaping, master planning, and generating general views about the building character, etc. Such holistic views about the project allow students to develop a broader view about their projects and gives them an opportunity to develop an

[8] Usually those students who come from different visual/environmental backgrounds – i.e., those from rural areas in Iran – have difficulties designing spaces with which they have never been in contact before (also see Dr. Waterman's comments in Chapter 10).

overall solution – also see gestalt thinking views in Chapter 7. However, the Author also encourages micro/detailed esquisses by issuing one-day esquisses to develop some ideas on various aspects of different spaces – i.e., selecting building materials, furnishing spaces, and developing spatial details. Some contribution of one-day esquisses for developing design ideas could include:

- Investigating the overall requirements of different spaces (i.e., functions, dimensions, relationships, ...etc.),
- Investigating the appropriateness of design solutions with respect to their contextual setting (i.e., adjacent neighbourhood, traffic, environmental characters, ...,etc.),
- Investigating the appropriateness of detailed solutions (i.e., building materials and their appropriateness to local environment, social-cultural characteristics , costs and expenses, ...etc.),
- Integrating between design elements (e.g., integrating through circulation, choice of materials, ...etc.),
- Pressuring students to make decisions and developing answers.

13.3.6. Structuring Meetings and Periodical Assessments

As indicated in the Student Questionnaire, in Chapter 12, most design students were somewhat dissatisfied with the method of assessment at their schools. Many reasons were stated by students in their responses for such dissatisfaction; the major issues raised by students included:

1. Lack of understanding between students and their educators; in many cases, educators assess students' works privately and they do not allow students to defend their design ideas.
2. Most educators tend to give all credits to the final product of design and they do not consider students' progress throughout the design process.

In addition to the arguments raised by students, some other shortcomings were detected by the Author throughout his teaching experiences in design studios which needed close consideration. Two of these considerations could be outlined as:

- The need for a formal periodical assessment to let students know about their educational progress,
- and the need for structured, systematic meetings with students to stay in touch with students and control their design exercises throughout the semester.

---

[9] Visual literacy is the term proposed by the Author by which students should be trained

Systematic meetings with students and periodical assessments of their works are suggested by the Author as a major tool for educators to control the progress of their students and inform them of their weaknesses. The characteristics of such provisions could be outlined as the following:

- Controlling Works through Meetings. Although all exercises do not receive a grade everyday, the Author suggests that recording some private notes on the progress of each student could be helpful for the final assessment. In addition to informal/daily crits[10], all students are required to have a more formal/private meeting with their educators during each week to discuss their achievements and/or problems. These meetings could be based on prior appointments and they are intended to help students to have a weekly discussion with their educator in order to develop a better understanding about their performance.
- Periodical Assessments. The Author has developed some periodical assessment forms by which he lets students know about their state of progress at a few specific stages during the design process. In completing these forms, the Author emphasises on the weaknesses as well as strengths of the student's activities throughout the given period of the course. These forms are completed, graded, and distributed after completion of major design activities[11].
- Assigning Different Scales for Design Activities. Various design activities – i.e., daily exercises, student's enthusiasm and activities during the course, periodical presentations, and their comprehensive final solution – should be scaled and assigned a percentage of the final grade. This strategy could increase students' activities in design studio, and students could anticipate their final grades through the quality of the work and based on assessing criteria set in assessment forms.

Defending the Final work. The Author suggests that students should be allowed to defend their design projects in front of their educators and fellow students in order to explain their works and receive a fair evaluation. The final presentation defence could be a great tool to compare students' final achievements against one another and students could learn more about design from the strengths and/or weaknesses of the other projects. This could be also a great exercise for architecture students to become

---

for visual search by investigating, understanding, and appreciating their environment.

[10] The term "crits" is short for critiques, widely used in American design studios.

[11] A total of three assessments are suggested to be distributed during a 15-week design studio – one after the studies of influencing design factors (in Week-4) to confirm the directions taken by students, the other after the one-day *esquisse* (in week-7) to give directions for the rest of the semester, and one at the end of the semester before the Final Presentation (in week-15) to make the final recommendations in order to improve students' design projects.

Chapter 14
Case Study

14.1. Introduction

This chapter introduces the results of the proposed teaching strategy in the form of a *case study* conducted by the Author with a group of his Design-III students at the University of Tehran. Case studies are in-depth investigations of a few examples of the topics under consideration. They are used to take a deep, detailed look at a minimal number of situations rather than trying to find a statistical mean predicting the outcome of a design by looking at a great number of situations or circumstances. Case studies answer the "how" and "why" questions in field situations (Duerk, 1993). One advocate of case studies is Robert K. Yin (1984, 1994). He defines a case study as: "an empirical inquiry that: investigates a contemporary phenomena with a real-life context; when the boundaries between phenomena and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984, p.23).

In an *exploratory*[1] case study, unlike the *explanatory* case study – which investigates the relationship between event 'x' and event 'y' which result in event 'z' – the intention of the investigator is to search for answers to *what* and *how* questions. This chapter introduces an *exploratory* case study introducing *what* could be an effective design strategy and *how* students and educators of architecture could achieve that. In this study, a design project was given to a group of Third-year students and the model of teaching design – as introduced in the

[1] The term "exploratory" is coined by Robert Yin (1994) as one of the three types of case study – *exploratory, descriptive,* and *explanatory* – in which observation is focused on understanding the general issues of a situation and for raising questions that can be answered by other methods.

previous chapter – was applied to investigate the practicality of this research. This chapter will first introduce the volunteer group of students who went through the study and the design project selected for this case study. After that, the design process by which the Author has supervised his volunteer students will be introduced, using a student's samples of work.

14.2. The Volunteer Students

During the second semester of the school year 1999-2000 (1378-1379 Iranian calendar), a total of 60 Third-year Design students at the University of Tehran registered in four groups to work under the supervision of four design educators. 10 of these students, one male and nine female, registered to take their Design-III under the supervision of the Author whose experimental approach in the design process was introduced by the Course co-ordinator, Dr. Darab Diba[2]. These volunteer students, as the Author later learned through his private conversation with their Design II educator – Dr. Einifar, who was also the Head of the Architecture Department at the time – were considered the most enthused and hard working students among the entire group of 60. The volunteer students expressed their willingness to work with the Author since they had heard from their friends in previous years about the systematic approach of his teaching. In the very first meeting with the Author, they expressed that they were anxious to work with an educator who had gained a good reputation for being well-organised and was known for his design-teaching strategies.

These students final grades, in Design-II, Design-III, and Design-IV will be introduced later in this chapter to provide a comparative knowledge about their performances before and after Design-III experience. However, in the interest of protecting students' privacy, the names of the ten volunteer students will be kept confidential in this research and their works and/or comments will be introduced under their assigned numbers from 1-10 (see Table 14.2).

[2] The Author suspects that if he would have been given the chance to explain his design methodology to students by himself, more enthusiasm would have been generated to attract a greater number of students to register in his group.

14.3. The Design Project

According to the architectural programme prepared by the High Council of Art Education (HCAE) – at the Ministry of Sciences, Technology and Research – the designated role of Architectural Design-III is to "... introduce the design issues of an interior space,... and the study of interior elements (i.e., floors, walls, ceilings) as well as the finishing materials and equipment". The HCAE has proposed some design subjects for Design-III, as the design of a department store, a library, a museum, or a cultural centre.

The assigned subject for Design-III in this case study, however, was selected by the four design educators and the Course co-ordinator to include the design of an architectural school in Northern Tehran. Although the Author had initially suggested the design of a smaller project (i.e., design of an art library to allow students to address interior issues within a 16-week period), he decided to accept the view of the other colleagues in order to give a common project to all four groups of students. The Author insisted on giving a common project to all students since he needed to hold conditions reasonably constant across the different groups (apart from teaching style), for his case study to be evaluated by his volunteer students and other educators at the end of the semester (see the following chapter for students' and educators' feedback on the Author's teaching strategy). Although the intention of this case study was not to compare students'/educators' works against one another – due to some practical difficulties of keeping the volunteer students isolated from the rest of the students within a common design studio – the Author was in favour of assigning a common project which would allow his volunteer students to understand and compare his proposed methodology of teaching design with other groups. Also, issuing a common project would have provided a better opportunity for the other educators to differentiate the achievements of the "controlled" group – the ten volunteer students – in their evaluations at the end of the semester.

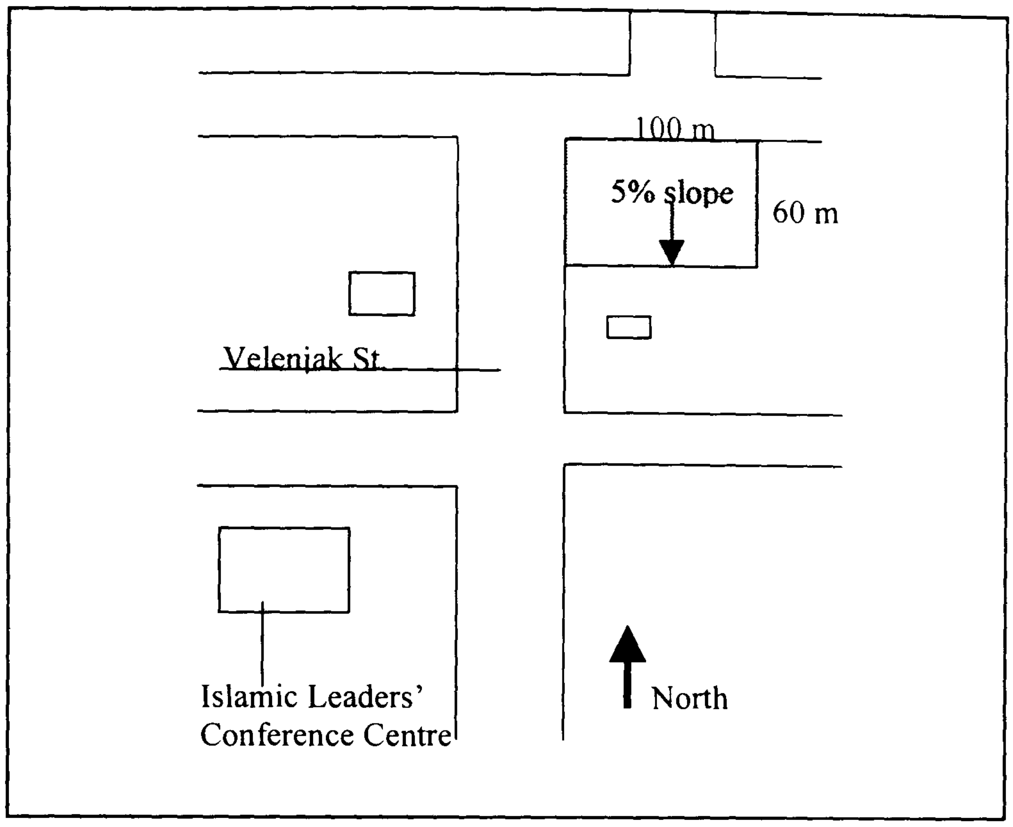
The proposed project, a School of Architecture, was supposed to be located in a site – 60x100 meters – to facilitate 30 entrant students every year. The Four-year under-graduate school was required to accommodate the following educational spaces:

- Architecture Studios; these studios were required to have suitable spaces for freehand-drawing, design studios, model-making, adjacent faculty offices and conference areas.
- Photography Studio; suitable for 8 students.
- Computer Cluster; suitable for 15 students.
- Four Classrooms; each suitable for 40 students (with facilities to show films and slides).
- Faculty Offices; suitable for 8-12 faculties.
- Administration Building; facilitating four offices.
- Library; suitable for 10,000 books, journals, study areas, and offices.
- Exhibition Hall; suitable for exhibitions and presentations.
- Auditorium; with 200 seats (suitable for multimedia presentations).

The four groups of students worked with their own educators in a large design studio with a capacity of 60 students. The site was introduced by the Course co-ordinator, on the first day of the general meeting between students and educators in Design-III. It was explained to the students that the major aim of the design project was to encourage students to become sensitive to the issues related to the interior design of a space and students should make an integration between the interior spaces and different building systems, (i.e., structural, mechanical).

The given site is introduced in Figure 14.1. It is located in the North of Tehran within 5 kilometres from the northern mountains where in summer, the temperature is between 30-40 degrees Celsius, and in winter it drops down to 10-0 degrees with some snow. The proposed site is located within 200 metres from the recently built The Islamic Leader's Conference Centre. The immediate neighbouring buildings surrounding the site include: residential buildings to the north, and Agriculture Research Centre surrounding the other three sides of the site – with lots of trees and a few office buildings.

Figure 14.1 The given site for the proposed Architecture School.



14.4 The Interactive Design Process

After the first general meeting for introducing the project, each educator – with their own preferred teaching strategy – asked their students to start on design activities by conducting a site analysis. The Author, however, took the time to explain to students about architectural theories in design, explaining the "positive" design approach in architecture (see Chapter 4). He introduced his interactive design methodology – influenced by "positive" theories in design – and explained to students that they ought to be sensitive to all issues related in design of an architectural space (i.e., the users, their environment, their needs and etc.), by conducting a thorough research. After explaining the interaction between different activities in an architectural design process – understanding a design problem, generating ideas for solving a problem, and producing the most suitable design solution for a problem (explained in Chapter 6) – the Author encouraged his students to think of a design process as an "interactive" procedure in which a design solution should be produced by a simultaneous involvement of analytic, creative, and basic thinking modes (see Chapter 9).

For example, in order to issue the first site-analysis exercise, he asked students to prepare some information on some specific features of the site – i.e., in the sense of accessibility and context – along with some creative design ideas which they could generate with regards to their visits from the site. In other stages of the process, too, the Author made an attempt to stimulate students' interactive thinking modes by requiring them to investigate and analyse about a design problem with the help of *analytic* thinking, generate ideas with the help of *creative* thinking, and use their brain archived information to make decisions and design with the help of *content* thinking.

Such an "interactive" approach in the design process was exercised throughout the semester with the help of the 6-step teaching strategy discussed in the previous chapter. The following sections of this chapter illustrate the 6-step design strategy including: *Writing Scenarios, Issuing Daily Exercises, Examining Design Factors, Using Visual References, Issuing One-day Esquisses,* and *Structuring Meetings and Periodical Assessment*, with the help of design exercises mostly prepared by Student #8[3].

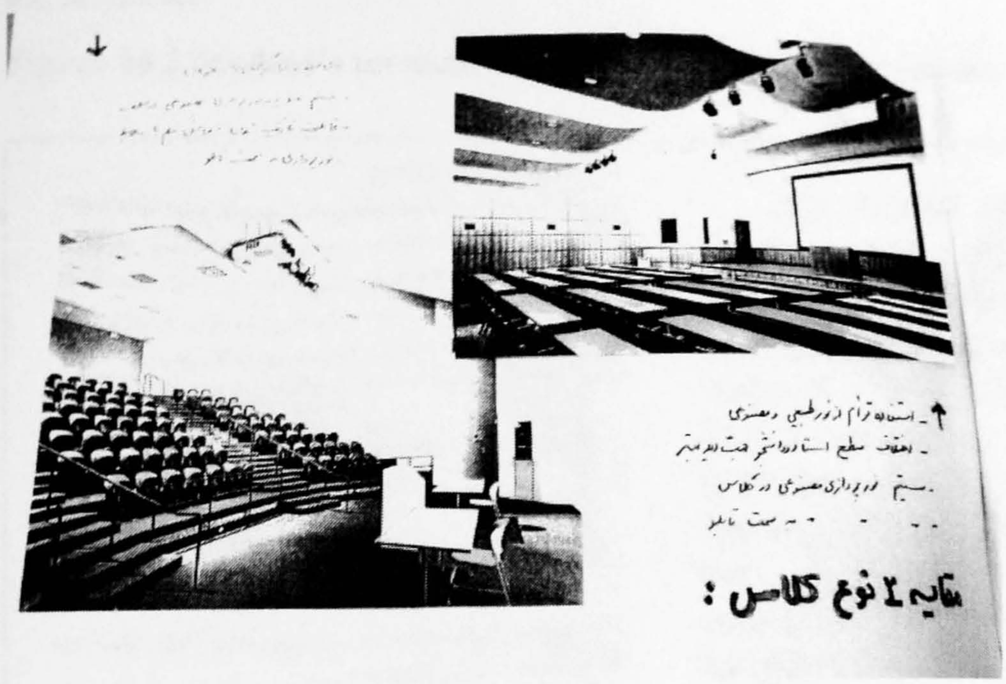
1) Writing Scenarios

In the first exercise, the Author explained the advantages of writing a scenario and asked students to write about their existing architecture school – with an emphasis on its spatial characteristics, with the help of graphic representations. The objective of this exercise was to encourage students to think about their own schools and get them started in raising design concerns to be discussed in the studio. This exercise was followed with writing a scenario about their ideal school of architecture which they visualised to be designed in the given site. Students were asked to describe the characteristics of different spaces – in terms of size, material, and form – with the help of words and graphics.

Figure 14.2 illustrates portions of a scenario written by Student #8 with relation to her description of an ideal classroom. In her first exercise, Student #8, describes the problems with her current school in depth and in her scenario, she attempts to illustrate her ideal solutions in her proposed school project. In Figure 14.2, she introduces two alternative spaces for design of a "good" classroom.

[3] Student #8's design samples are selected due to her comprehensive accomplishments in Design-III (see Table 14.1 for Student #8's Design profile).

Figure 14.2 Student's scenario describing the characteristics of a good classroom.



In this Figure, on the left, Student #8 describes the characteristics of a good classroom as meeting the following design criteria:

1. Providing slopped seating (for better viewing).
2. Providing mechanical and electrical provisions in the ceiling.
3. Controlling natural lighting (for viewing films and slides).
4. Projecting artificial light on the main board.

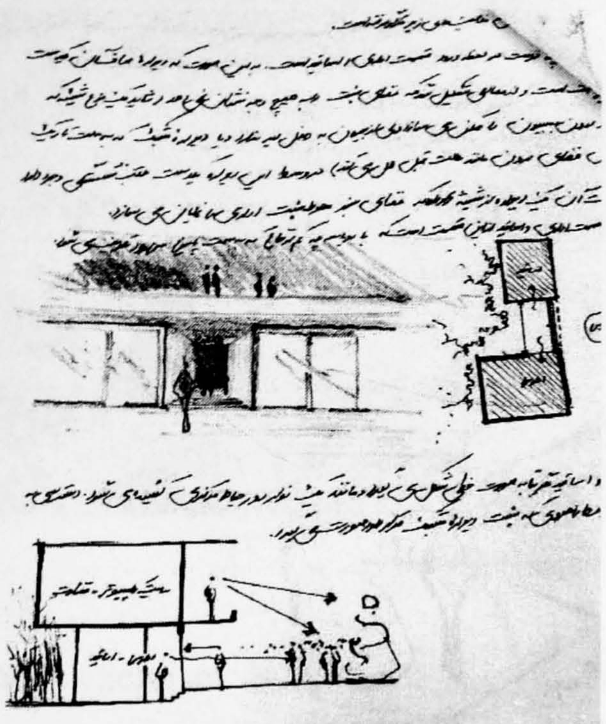
On the right, she describes the characteristics of an alternative solution in design of a classroom by proposing:

1. The combined use of natural and artificial light.
2. The use of a platform for placing instructors higher than students (for better viewing).
3. The use of artificial lighting above the main board.

Although most students only wrote scenarios at the beginning of the process, some students, took the advice of the Author and continued to re-examine their thoughts and wrote other scenarios throughout the semester. The nature of different scenarios vary as the designer proceeds into the process. The first couple of scenarios are usually more general, describing the behaviour of the users and characteristics of the spaces. However, later scenarios could be more refined focusing on details of various situations and/or spaces. Figure 14.3 illustrates

Student #2's scenario which was written in Week-10, six weeks before the end of the semester.

Figure 14.3 Student's scenario during the Design Development.



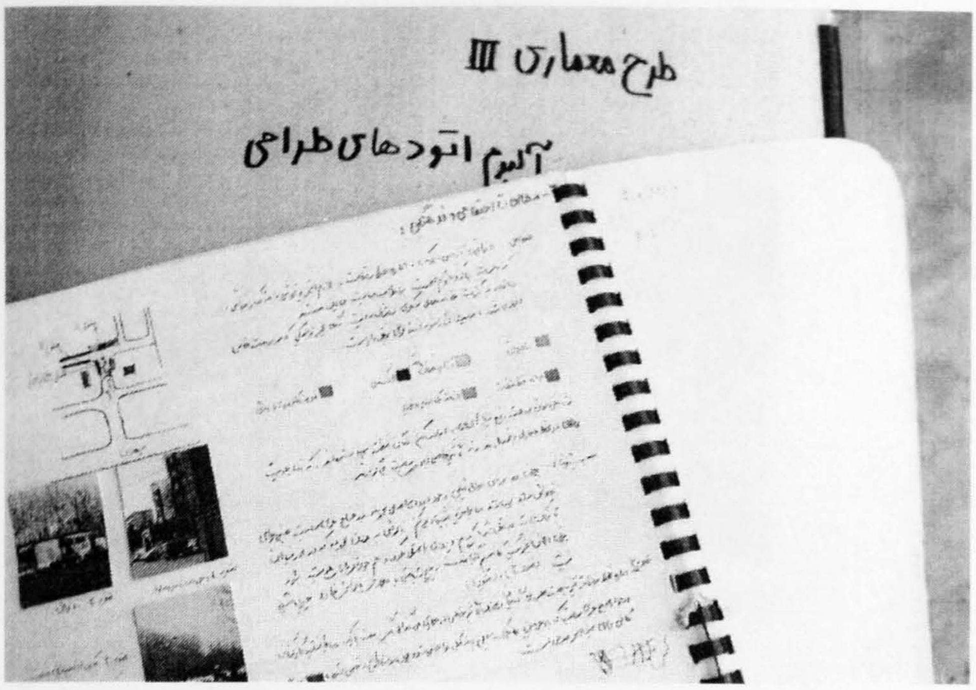
"... the central space is surrounded by many other activities. In the left, there is the offices for the faculties and the administration building. The walls on that side are translucent and they are meant to diminish the view from the outside... There will be an opening between this building and the next one which defines the main entrance to the administration building....The administration building takes a linear form which defines the perimeters of the central courtyard..."

In this Figure, Student #2 manages to find a spatial solution for her central courtyard which is surrounded by the administration buildings. In her scenario, she examines the possibility of defining the central courtyard by the use of linear form of the administration building. Although she breaks the linear form of the building in the ground level to define entrance, she keeps the straight line of the building in the upper floor where she defines a corridor for movement and viewing.

2) Issuing Daily Exercises

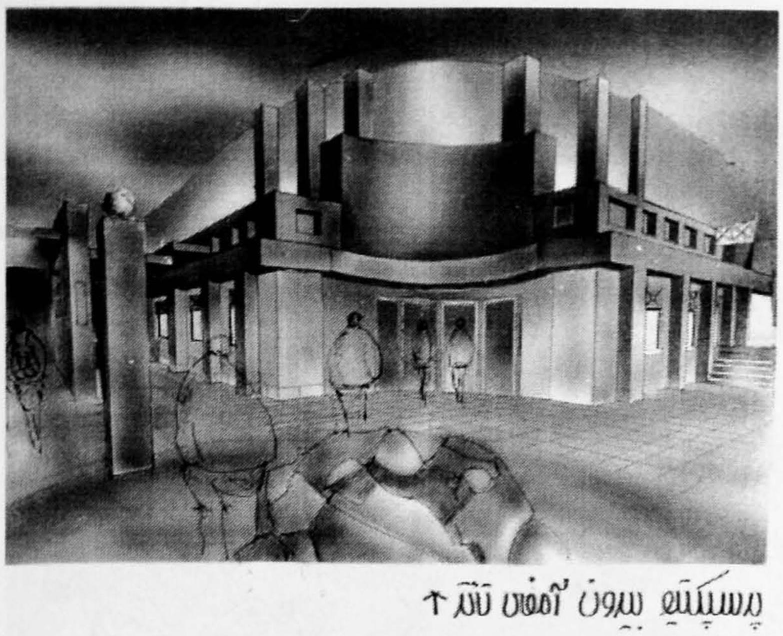
All design exercises were asked to be collected in an exercise book. Daily exercises were issued in order to keep students active in every studio session and they would give the opportunity to students to review their design ideas and/or drawing techniques with the Author. Figure 14.4 illustrates a page of Student #8's daily exercise book in which she has collected some social-cultural information about the site of her Architecture School.

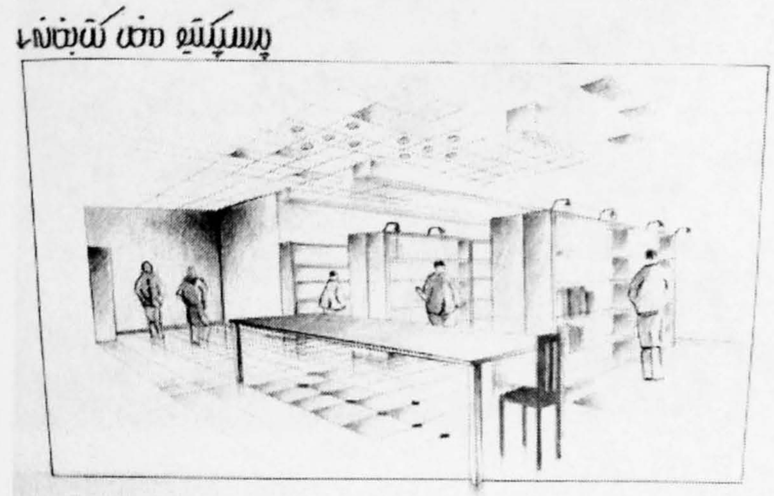
Figure 14.4 Daily exercises, analysing the site.



Daily exercises do not have to be always in the form of student's research work or conventional design exercises, (i.e. studying building forms, plans and elevations), they could also be in the form of technical exercises. These exercises are usually selected by the Author in his design studios with relation to the nature of the given design project. For example in Design-III – due to its relation to the subject of Interior Design – the Author gives some lectures about selecting materials, illuminating spaces, and even on some drawing/rendering techniques. The intention of these lectures, followed by studio exercises, is to familiarise students with various aspects of a design project. Many of these issues are never required by other educators and many students usually do not get a chance to ask questions about these issues from their design educators. Figure 14.5 illustrates two of Student #8's perspective drawings – on the top the view from her auditorium and on the bottom the view from her library – which she has drawn after lectures on Floor Materials, Building Materials, Illumination of Spaces, and Drawing Perspectives. Although students receive some lectures on many of these issues in their other classes, the Author suggests that a design educator should review these technical lectures since they appear more practical to students who are in the process of designing.

Figure 14.5 Perspective exercises drawn during the daily exercises.



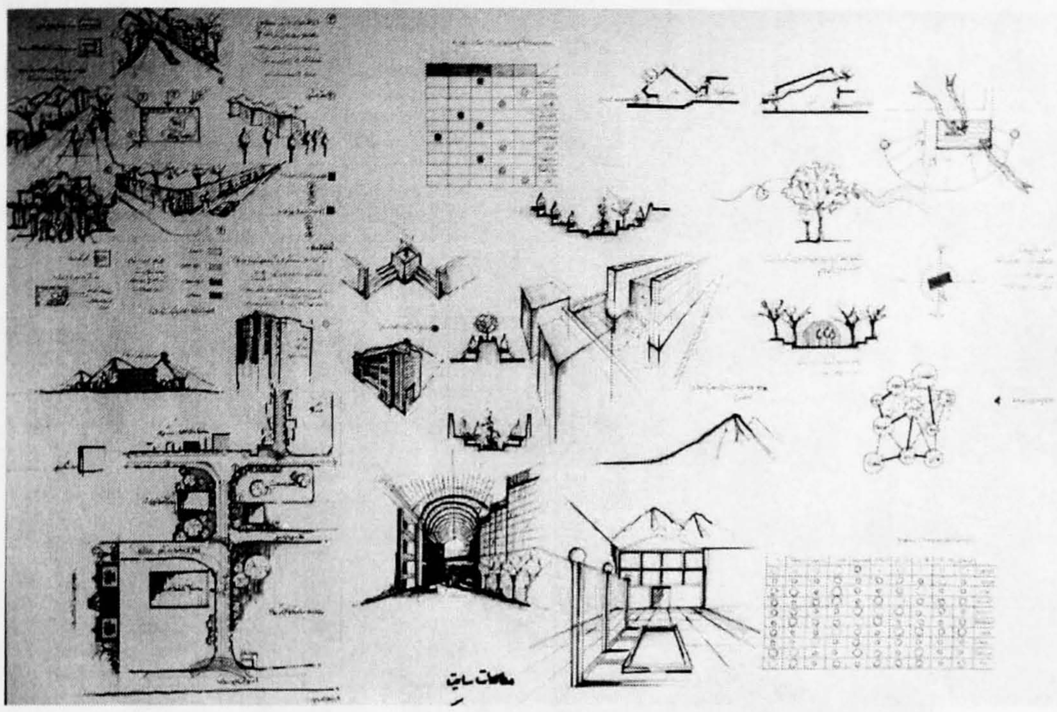


Daily exercises were controlled and evaluated, every day, and they provided an opportunity for the Author to keep track of student's progress throughout the semester. They provided a good opportunity for students to take various design issues into consideration and receive daily criticism from their educators on a variety of subjects related to architectural design (i.e., structures, interior design, mechanical and equipment, landscape design, and other technical issues usually underestimated in conventional design studios). These exercise books could be a great asset for design students in their future career when they need to review their previous design exercises.

3) Examining Design Factors

In order for students to examine various design factors which influence a design solution, the Author has provided a clear list of design factors (discussed in chapters 6, 11, and 12) – *space and user, climate and natural forces, social and cultural influences, material and construction, natural environment, the built environment, building systems, sensory systems, rules and regulations, and time* *and budget*. These factors were explained by the Author in Week-1, and students were asked to examine each of these factors graphically in their Daily Exercise Book. The results of their findings were required to be presented on 50x70 sheets of illustration boards in the fourth week of the semester.

Figure 14.6 Examining design factors influencing an architectural solution.



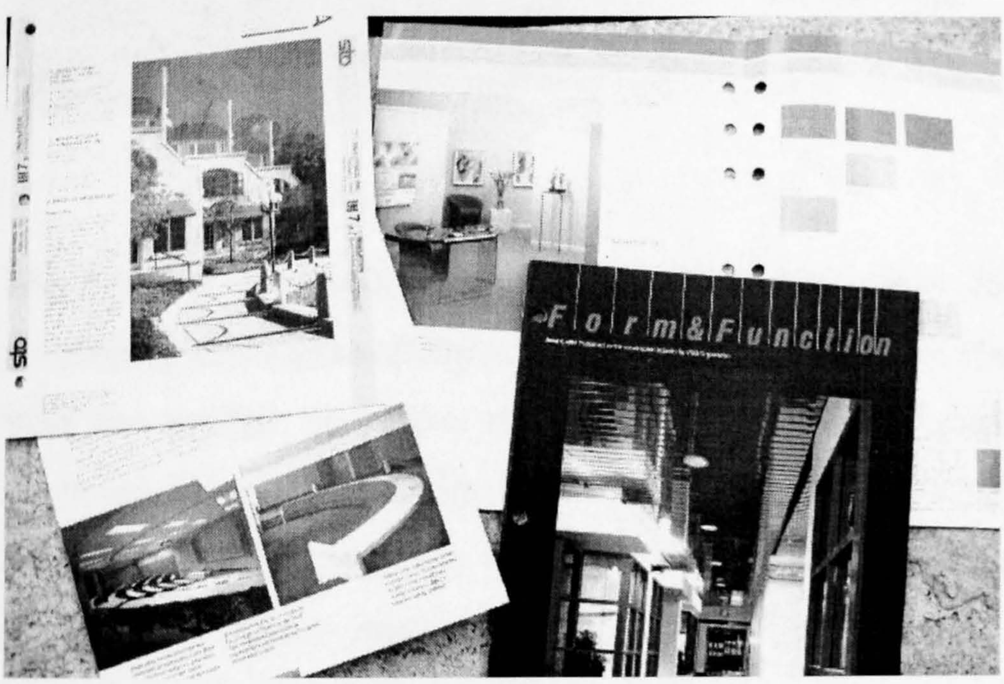
In this Figure, Student #8 has taken many environmental issues into consideration – i.e., wind direction and sun angles – in order to place spaces in their ideal locations. Also, many issues with regards to the site and its immediate surroundings are analysed – i.e. the built environment and surrounding buildings around the site, pedestrian and vehicular access to the site, views, noise pollution, neighbouring land-use and their characteristics, vegetation and site topography. Using tables, matrixes, and bubble diagrams, Student #8 has made an attempt to analyse and understand the relationship between spaces and locate them in the site with respect to their zoning considerations. She has developed at least two spatial ideas in this presentation, in one she has suggested an arcade between two studio buildings, and in the other, she has suggested a courtyard emphasised by the axis of the mountains surrounding northern Tehran.

4) Using Visual References

Visual references – in the form of sketches, photographs, images from books or journals, computer generated images, or even models – related to a design project could be great tools for design students to stimulate their creative thinking. The

Author encourages his students to use visual references throughout the design process in order to increase their architectural/visual experiences and improve their *content* thinking. In the proposed "interactive" design process, the interaction between *analytic*, *creative*, and *content* thinking could be stimulated by the use of visual references which could give the opportunity to students to analyse problems, generate design ideas, and express their ideas in 3-dimensions. One great application of visual references is to familiarise students with new materials and construction techniques. Figure 14.7 illustrates some technical catalogues which the Author lends to his students during the design process, encouraging them to develop an archive of their own throughout their professional lives[4].

Figure 14.7 Using references during the design process for collecting technical data.



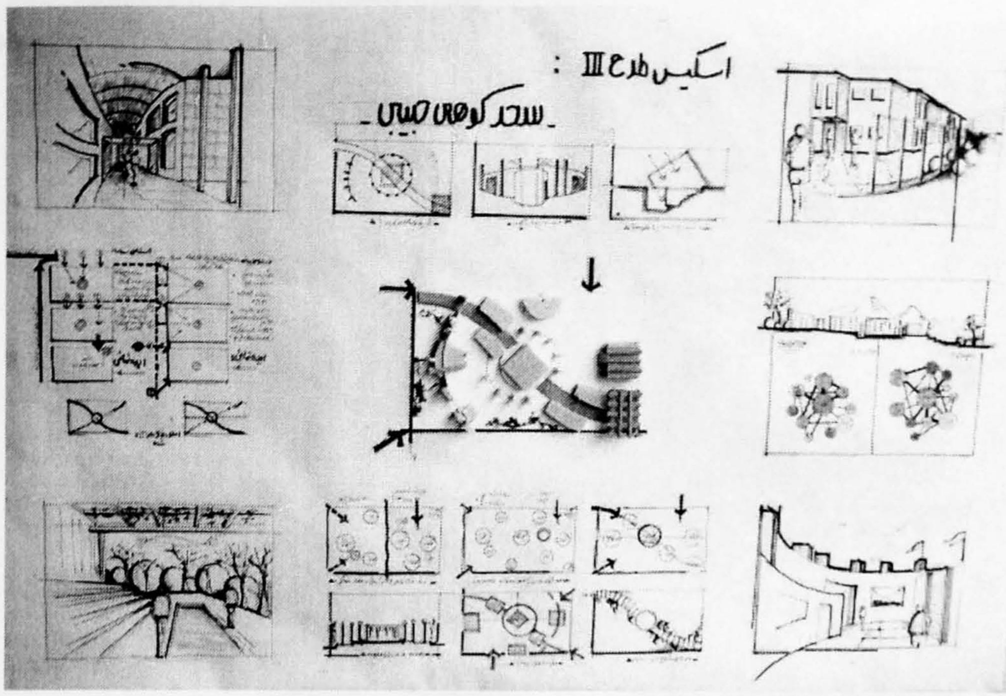
5) Issuing One-day *Esquisses*

After some weeks of design activities – understanding design issues, generating design ideas, and presenting solutions – the Author required his students to present their findings about the character of their architecture school in the form of a one-day *esquisse*. Figure 14.8 illustrates Student #8's *esquisse* [a brief sketch or presentation] during the sixth week of the project. By that time, most students had developed some major design ideas as far as where they wanted to enter the site, how and where they wanted to locate their spaces, and what character they expected their architecture to possess. The One-day *esquisse* set the stage for

[4] Due to some limitations in providing sufficient technical materials at many Iranian schools of architecture, the Author suggests that his students develop their own archive of

students to pull their thoughts together and present their design decisions under the pressure of time in the forms of diagrams, sketches, and mass models.

Figure 14.8 Presenting design ideas in the form of one-day *esquisse*.

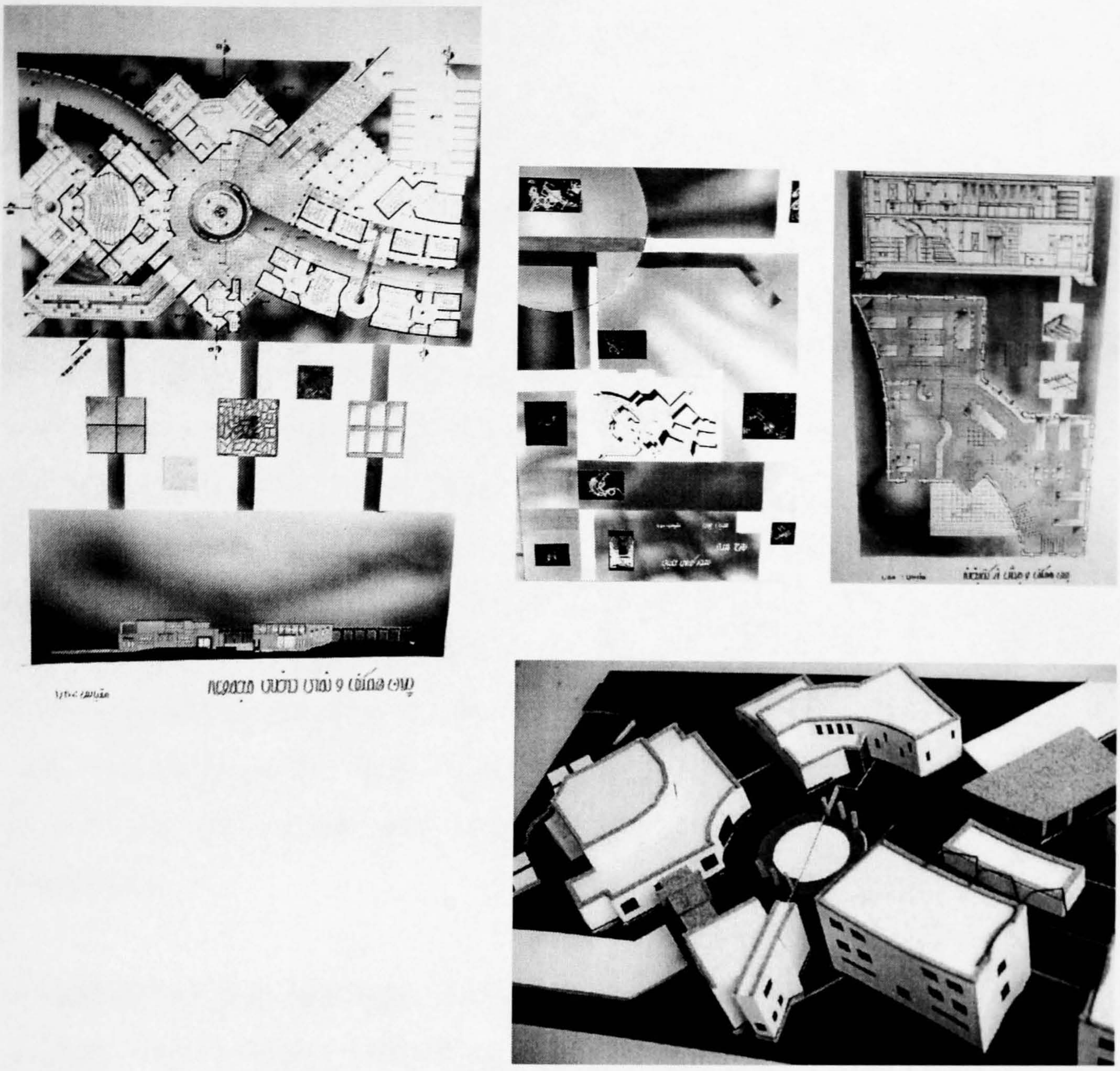


The one-day *esquisses* could help students throughout the design process by developing some general/overall solutions with regards to spaces and their relation with one another, as well as some detailed information about spaces. Figure 14.8 illustrates Student #8's design development of the site and her proposed scheme for the library. The integration between various educational spaces as well as the integration between interior spaces and their structural/mechanical systems are attempted to be illustrated by Student #8 in her design development presentation in Week-15.

---

technical materials by collecting journals and catalogues.

Figure 14.9 Developing design ideas, an interaction between detailed and general data in a project.



The above figures indicate that developing a design solution requires an in-depth investigation from inside out and outside in. For example, it is as important to compose different buildings appropriately on a site as it is to design the layout of the interior space and select appropriate structural, mechanical and electrical systems to suit the functional requirements of those spaces.

6) Structuring Meetings and Periodical Assessment

Design-III studio was arranged to meet for 15 weeks, two days a week from 2-6 PM. Based on the Author's teaching strategy which calls for daily design exercises and periodical assessment, students were asked to meet with the Author at least once a week. In these meetings, students were supposed to review their daily design exercises with the Author and he would record their performances in his assessment forms. Daily critiques/meetings were structured by informal appointments, each student would signup at the beginning of each period for a 15-minute meeting to discuss his/her project with the Author. These meetings were open to other students to sit in, however, the intention of making appointment was to give students the freedom to choose a time – with regards to their readiness – during a design period to discuss about their projects[5]. Every studio period would start with a short lecture by the Author about some specific design related subjects, (i.e., setting design criteria, selecting building material, and etc.). Then, students would review their previous exercises with the Author based on scheduled meeting times. The great enthusiasm of students to work in the studio with the Author usually kept them going a few hours longer than the designated 6 PM. In these meetings, many students were interested to sit in all other critiques and participate in discussions. It was most rewarding for the Author to find such enthusiasm among students to work hard and develop critical thinking in their design process. His intention was to give critiques to the students' works in order to improve their works rather than rejecting them. This way, those students with weaker design ideas would spend a few days on an idea and eventually they, themselves, would reach to this decision that their ideas may not be appropriate and they ought to revise them.

In addition to daily meetings, the Author gave three periodical assessments to students – one in Week-5 (after their studies of Design Factors), another in Week-9 (after One-day *esquisse*), and the other in Week-14 (just before the final presentation). These assessments were intended to give a better understanding to students about their performances and they could indicate the weaknesses of students' works to be strengthen for the next stage. Table 14.1 illustrates a blank sample of a periodical assessment form issued to students in Week-14. This form reviews students' performances along specific design exercises, it also reveals the Author's given grades to each student [on a scale of 0-20] to give an indication about his assessment priorities.

[5] One problem with unorganised critiques could be that educators would spend time only with those students who have prepared some work for review and the rest of the students would take advantage of this situation and do not produce consistent work.

Table 14.1 Sample of a blank periodical assessment form issued in Week-14.

Week-14 Evaluation	In the Name of God	
Design-III, Department of Architecture		
University of Tehran, 2nd Semester 1999-2000		
Instructor: Amir S. Mahmoodi		Student:............
		Grade:.............

	Comments
Daily meetings and performance	
Student's enthusiasm and participation in studio discussions	
Design exercises 1- Site plan 2- Architectural drawings 3- Lighting plans 4- Furnishing plans 5- Building material 6- Floor finishes 7- Interior perspectives 8- Exterior perspectives 9- Circulation 10- Planning and zoning 11- Structural consideration 12- Technical aspects of drawings 13- Completeness and rendering	

14.5 The Final Assessment

Based on the Author's proposed teaching methodology, students' final grades should represent their performances throughout a semester by giving grades – with different weights – to different design exercises from Week-1 through the final presentation. Also, in the previous chapter, it was made clear that students should be free to defend their final presentations in front of their educators in order to receive a fair assessment. During the final assessment, however – despite the Author's expectations – final grades were asked to be given in a private grading review without the presence of the students. Each educator in the four groups, plus the Course Co-ordinator, assigned a grade to each student (the total of five grades for each student) – based on students' final presentations. The Author did not agree with this method of assessment and argued that, since educators from other groups did not know about the progress of students during the process of the course, they would misjudge their works[6]. Also, he argued that – in different groups – students were supervised differently by their educators, therefore, students' works could not be judged fairly by other educators. In one group for instance, one educator had not told his students to consider the 5% slope in the site. In another group, there were students who had not paid any close attention to Design-III objectives and had not produced sufficient information about the interior design criteria.

One compromise which the other educators were willing to make, however, allowed the final grades to be adjusted. They agreed to let each educator's grades to count twice the weight of the other four educators' grades with relation to their own students. That means, each student would receive the average grade calculated from six grades – four from the other three educators and the Course Co-ordinator – and two from their own educator's. Table 14.2 illustrates the grades of the ten volunteer students who worked under the supervision of the Author in Design-III. This Table, also reveals the final grades of these students in Design-II and Design-IV – one semester before and after Design-III – in an attempt to reflect a wider range of design performances by these students[7]. Table 14.2 indicates that students' design performances in those three semesters are very much in the same range and sustainable. As indicated in the Table, almost all students' Design-III final grades (the ones on the right hand side) have slightly improved in comparison with their grades in Design-II; and their grades in Design-IV has slightly improved from their Design-III final grades. This is a positive indication of improvement for these students whose hard work has been paid off in Design courses.

Table 14.2 also reveals that all grades given by the Author to his volunteer students in Design-III – except for Student #7's grade, who had missed over four weeks of the course and could not finish her project completely due to some personal problems – are higher than their final calculated grades[8]. The reason for such a difference in the final grades is due to the students' performances throughout the semester which has been neglected in the final grades of the other educators.

[6] Not to mention that this method of grading would have benefited only those students who had drawn pretty drawings, neglecting students' effort throughout the process.

[7] Design grades in three consecutive semesters suggest a stable range of improvement.

Table 14.2 Final grades [out of 20] received by the ten volunteer students.

Student	Design-II (Final grades)	Design-III (Final grades)[9]	Design-IV (Final Grades)
#1	15.5	14-14	16
#2	17	18-17.25	17.5
#3	16.5	17.5-17.25	17
#4	15	17-16	16.5
#5	13.5	16-15.25	16.5
#6	17.5	18-17	16.5
#7	14	11-12.75	Dropped
#8	16.5	19-16.75	16.5
#9	16.5	15-14.75	16
#10	15	17.5-16.25	16.5

The highlighted grades given in Design-III – the one in the left by the Author and the one in the right as the average final grade – indicate that the Author has graded his students even higher than their final grades. This indicates that students' performances throughout the semester have helped them to improve their final grades. Although the above final grades in Design-III range between 14 to 17.25 (between C to A- [nothing extraordinary]), all volunteer students expressed complete satisfaction with the course and the teaching strategy presented by the Author (see students' complete feedback on the teaching strategy in the following chapter). This result could confirm students' answers in their questionnaire to Question No.3 (in Chapter 12), where majority of students claimed that the 'joy of learning' and satisfaction with a teaching strategy is more valuable to them than earning high grades. Students' complete satisfaction with the course proves that they are not after high grades, but quality teaching and fair assessment (see the students' 'joy of learning' in Figure 15.6 in the following chapter).

The Author suggests that the most practical way to assess students' projects should involve only the grade which is given by a design educator to his/her students. In

[8] Design-III final grades are based on the grades of the four other educators and the Author's given grades.

[9] Students' final grades in Design-III, in Table 14.2, the first grade represents the given grade by the Author including students' performances throughout the semester, and the second grade represents the final grade = (Grades of the four other educators) + {(Authors grade) x (2)} ÷ 6.

case other educators want to evaluate students' works from other groups, the most appropriate way for them to grade would involve some ranking scales between 'excellent' and 'weak', instead of issuing numerical grades. In an academic environment, the Author argues, it is not fair to the students to be graded by an outside educator who is not familiar with the students' accomplishments during the design process.

Chapter 15
Feedback and Validity

15.1. Introduction

This chapter will review the feedback collected from the volunteer students who participated in the case study and a group of colleagues who were also involved in teaching Design-III. Throughout this *action* research, the Author was thinking, planning, and executing activities about every single detail of the research. For example, in order to formulate the evaluation questions, he had to take notes from various activities/feedback from his students/colleagues throughout the semester. At the end, these notes helped him to structure his evaluation forms. Students' positive evaluation of the proposed teaching strategy was very important to the Author, since they were the ones whom this research was conducted for. Although some previous informal feedback which were collected from other groups of students in the previous years had refined the Author's teaching strategy, the results of this formal evaluation had to be comprehensive enough to express the general views of the students.

The final section of this chapter will make an attempt to justify the findings of this research by evaluating the validity and reliability of the research. Therefore, in addition to the students' and colleagues' feedback in Design-III, it introduces some feedback from an extended experience in which the Author has supervised a Design-I studio at the Islamic Art University of Tabriz. In that school, the Author's teaching strategy is experienced with the help of a colleague who worked directly with those students.

15.2. Evaluating the Case Study

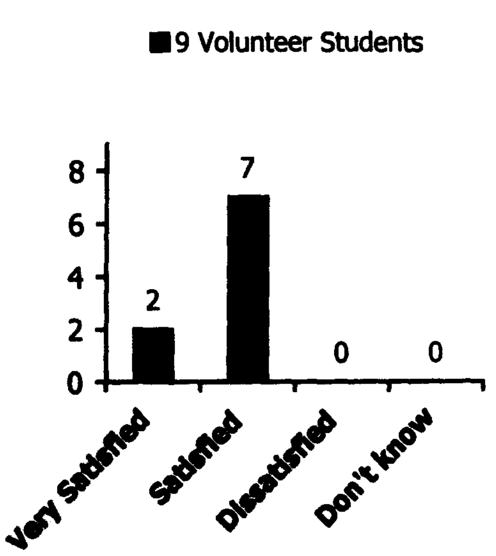
In order to collect the views of the volunteer students and his other colleagues about his methodology of teaching, the Author developed two evaluation forms – one for the students and one for the educators (the translated questions are reflected in this chapter). The evaluation forms included specific questions about the success rate of those strategies which were supervised by the Author. The following sections present the results of these evaluations which were collected at the end of the semester.

15.2.1. Students' Evaluation

Before issuing his final assessment, the Week-14 Evaluation form (introduced in the previous chapter), the Author collected students' evaluation forms during the last week of the course[1]. Nine out of ten students – Student #7 was absent on the day of evaluation – completed these evaluation forms. In students' evaluation forms, six major questions were asked to collect statistical responses from students with regards to different stages of the course and their views about the executed strategy of teaching Design-III. These questions, however, were followed by specific questions which allowed students to provide open answers. The following review, reflects a summary of students' responses to the evaluation questions[2].

Question 1- How satisfied are you with the results of your "Scenario" exercises?

Figure 15.1 Students' satisfaction with Scenario exercises.



As indicated in the chart, the majority of the students – 7 out of 9 – were satisfied with the results of their scenario exercises and 2 were very satisfied.

[1] The Author believes that collecting evaluation forms should take place before the final grade is issued to students. Otherwise, his experience shows, students tend to discuss more about their grades rather than providing constructive answers to the evaluation forms.

[2] In a few cases, some students did not provide any open answers. Therefore, in those cases, some students' responses will remain missing.

The Author welcomes the great enthusiasm shown for this exercise. Even some students who did not graphically communicate successfully, could present their design thoughts through the use of literature and/or photocopied images.

A- Did scenarios help you in your design? How?

Student #1: "I always had difficulties getting started; writing scenario helped me to overcome this problem. ... 50% of my final design ideas are taken from my scenario."

Student #2: "Yes. They were very helpful. I used scenarios in two stages, which I will discuss later. Writing scenarios helped me to get my work started with an understanding about what I was doing and what I should be doing next. In the past, I would develop solutions based on my feelings and free decisions. However, writing scenarios took that freedom away from me and I became hesitant to draw. In a way, I knew what would happen next, and that was not fun."

Student #3: "Writing scenarios helped me develop general ideas and based on those ideas, I could easily develop a general design concept and decide on the relationship between spaces and their location in the site."

Student #4: "Yes. They helped me during my site design, locating spaces, and determining design priorities."

Student #5: "Yes. This exercise encouraged me to think more about what I should do and/or not do during the design. I referred more to books and journals ... scenarios helped me make links between my thoughts and what I was learning about the new project through reading books and journals."

Student #6: "I first didn't think writing a few pages of scenario could develop so much energy during the design process. Writing scenarios allowed me to see spaces more vividly. I thought about what I should do next and the design process became clearer. However, this didn't happen during Design-I and II; I was confused about the process. Now that I think about it though, I would have rather remained confused and worked through the mysteries in design. I think it generates more creative solutions in the long term".

Student #8: "Yes. Writing scenarios provided a good opportunity for thinking. This thinking allows designers to develop an awareness toward their design problems. This awareness, in the long term, is helpful during the design process."

Student #9: "Yes, in a way. I consider scenarios as an analytical tool."

Student #10: "Yes. My main concept was formed by writing scenario. It gave me a chance to develop a logical solution by which I could generate a better feeling about spaces."

The Author detects that those students with a stronger sense of imagination, i.e. Students #2 and #6, might not particularly benefit from generating initial scenarios since they would rather create ideas based on their concurrent imaginations and not pre-planned ideas. However, these students too, could benefit from later scenarios by which they could develop design solutions (i.e., Student #2 was in favour of writing scenario in the later stages of the process). In general, most students welcomed the idea of writing scenarios and expressed strong satisfaction with this exercise.

B- Did you write more scenarios after your first one? Please explain.

Student #1: "I didn't actually write several scenarios, however, I kept on completing my initial scenario inside my mind".

Student #2: "I wrote scenarios in two stages: 1- At the beginning of the process, to collect initial data, 2- In the middle of the process, when I was thinking about the details of my spaces. In these stages, scenarios helped me greatly to get over my confusions."

Student #3: "I didn't write more than one scenario, but I tried to keep the spirit of the first scenario and build more ideas in my mind."

Student #4: "I just wrote the first scenario. However, I drew some further ideas based on the first scenario."

Student #5: "I just wrote the first scenario. In the later stages, however, I used images from books and journals to build on my first scenario."

Student #6: "No, I just wrote scenario once."

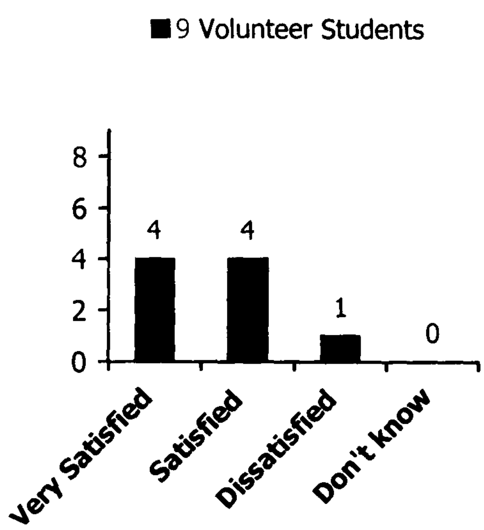
Student #8: "I wrote two scenarios. The first one was written at the beginning of the process to introduce spaces through movement. In the second scenario, I developed some spatial experiences in each of my spaces (i.e., where to enter, what materials to experience, and where to live). This method allowed me to develop some new ideas."

Student #9: "I just wrote one scenario."

Student #10: "I didn't write any more than one scenario. However, throughout the process I made some changes to my spaces, forms, and ideas based on new scenarios which I would develop in my mind."

Question 2- How satisfied are you with the results of the "Daily Exercises"?

Figure 15.2 Students' satisfaction with Daily exercises.



As indicated in the chart, the majority of the students – 8 out of 9 – were satisfied or very satisfied with the results of their daily exercises. However, one student was not satisfied with the results of daily exercises.

An overwhelming number of students were satisfied with daily exercises which had provided an opportunity for the Author to discuss design criteria and other neglected design issues (i.e., finishing materials, electrical plans, etc.). Daily exercises were formed through daily lectures, critiques, and assignments. Students were encouraged to use references throughout the process when they needed to communicate their design thoughts. The one student who was dissatisfied with daily exercises, wrote a note stating: "I am dissatisfied with my own work during daily exercises".

A- During those daily exercises, did you use references? How did they help you during the design process?

Student #1: "This semester I used books and other types of references to a great extent. I am pleased with the results and I learned quite a bit from them. However, I should state that in many of those references, we were exposed to completely foreign ideas which were strange to our social/cultural behaviour and/or needs."

Student #2: "Yes. I used journals whenever I run into problems. They were very helpful in getting me moving again."

Student #3: "Yes. However, there are many books and journals available which are not useful for students and we must learn to become selective".

Student #4: "Some. In many cases, projects in those references were interesting, however, they wouldn't fit our architectural context."

Student #5: "Yes. They were very helpful. I had never spent so much time reviewing books and journals, it was a great experience."

Student #6: "Yes. Using journals and other types of references was an excellent idea and I should continue this experience in my future projects."

Student #8: "Yes. I generated many new design ideas by using references. Journals are helpful in letting you know how practical your design ideas are.... I could generate design ideas and develop more self-esteem in my work."

Student #9: "Yes. I think good quality samples could be helpful since they allow students to enhance their senses of creativity."

Student #10: "Yes. Using references was very directive and useful."

B- Did you like the design methodology which you experienced during this course? Please explain.

Student #1: "It was pretty good. I liked the discipline and the organisation of the instructor. However, as always, I was behind the schedule and it was a good experience to keep up with class. Also, I liked the organisation of the design exercises and they were very educational."

Student #3: "Yes. I am very satisfied with this experience. Good organisation, helpful critiques, and the always available instructor who answered our questions are among the highlights of this educational experience."

Student #4: "It was great. Good time schedule and organisation. I was never confused during the process, in contrast to my previous experiences. I knew what I had accomplished and what I should be doing next."

Student #5: "Yes. I am very satisfied. I think the design process which we were introduced to was great. At last, I can confidently claim that it was the best method during the past five semesters. For the first time I got to like design and enjoy doing it. In previous terms, however, I would get bored easy. Good organisation."

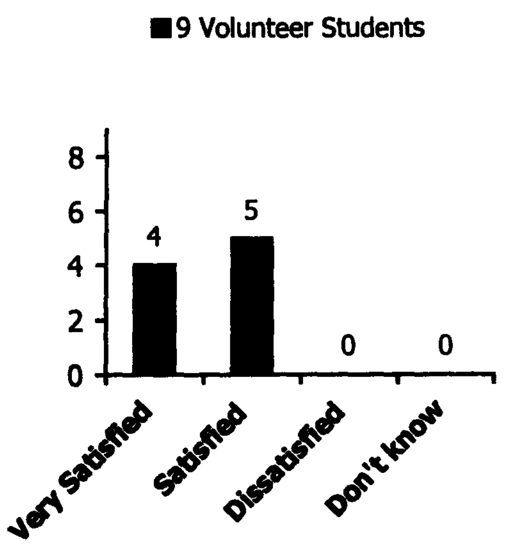
Student #8: "It was very good. I knew what I was doing and I was not confused like in my previous experiences. Another good experience for all of us was our exposure to more complex issues in architectural design than just drawing floor plans and elevations. I experienced a good design methodology and I am happy with the results."

Student #9: "Yes. We knew what our tasks were and organisation of the daily exercises helped us improve our design works. However, I don't know if all of this organisation and planning had any influence on our creativity? Maybe this method is too organised and it should loosen up. That way, students would get a chance to express themselves more freely."

Student #10: "For the first time, throughout our education here, we got a chance to work with an instructor who was organised and knew where he was taking us through. I really enjoyed the term. Our group was ahead of other groups in all stages of the process and we received an excellent instruction. Many of my friends claim that if they had another chance, they would have changed their groups and joined our group… I will try to use this methodology in my future experiences. We used to work only during the last week of the term, however, in this term we had to work and produce detailed ideas everyday.

Question 3- How satisfied are you with "Examining Design Factors" exercise?

Figure 15.3 Students' satisfaction with Examining Design Factors exercise.



As indicated in the chart, all students – 9 out of 9 – were satisfied or very satisfied with the results of their Examining Design Factors exercises.

These exercises were given in accordance to the ten design factors discussed in Chapter 6. Students were encouraged to use graphic analyses, in order to stimulate their visual thinking, and generate design ideas throughout the understanding stage of the problem. All students welcomed these exercises and developed very directive studies toward generating design solutions.

Did graphic analysis help you during this exercise? Please write your views about this exercise.

Student #1: "I used images from journals and they were very helpful during examination of design factors."

Student #3: "I generated my initial design idea from this exercise. It was great in speeding up the process."

Student #4: "The idea of using images and sketches was good. However, I couldn't relate my work to all design factors, some of them were beyond our concerns."

Student #5: "In a way, some parts of the exercise seemed unrelated to our projects. However, I think it is a good list of concerns to be considered in our future projects."

Student #6: "It was a good experience. For you, as an instructor, it is a great method since it demands some organised plan of work and keeps students busy thinking and generating ideas. However, for me as a student, it seemed too much pressure. I would rather to take my time during the process of design and move through it the way I want. Maybe in my way, I would not get to respond to all ten design factors, however, it is more meaningful for me to do it my way… I guess it would not be possible for you to leave students to do their own things, though. At the end of the semester you and the educational system expect a satisfactory result. I have to admit it, in my way, there would have been the possibility for me to not be able to develop a satisfactory solution on time."

Student #8: "It was a very helpful experience. This exercise made us think about various issues influencing our design solutions…"

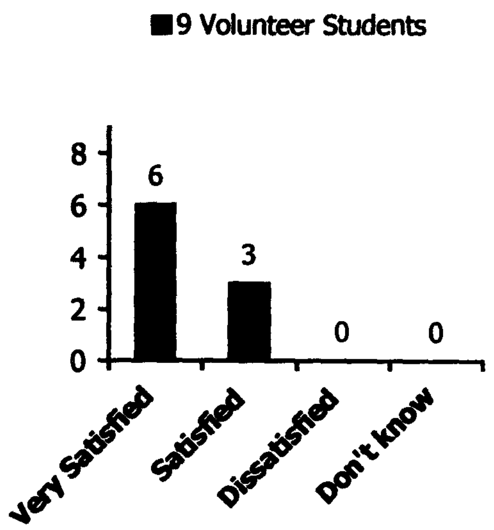
Student #9: "As I mentioned in previous questions, I think it was a very helpful strategy."

Student #10: "Using drawings and images was a wonderful experience. …In many cases, I developed many design ideas by looking through books and journals without any pre-planned objectives."

The Author observed that many of his students throughout the semester improved their graphic communication skills. He believes that since these students were exposed to professional presentations, they learned to express their own thoughts with a greater graphic quality.

Question 4- How satisfied are you with the method of critiques in this course?

Figure 15.4 Students' satisfaction with critique method.



As indicated in the chart, 3 out of 9 students were satisfied and the other 6 students were very satisfied with the method of critiques in this course.

The overwhelming positive response of students' who were satisfied with the course critique system, including daily crits and weekly formal crits, is most rewarding for the Author who had spent many hours discussing students' works throughout the semester.

Did this method help you in developing your design ideas? Please explain.

Student #1: "It was my best experience throughout my 6 terms of education. Crits were organised, clear, and well worth listening to."

Student #2: "They were excellent. You spent so much time with each of us and you were very patient with our problems. My friends and I think that you were very helpful during the crits and listened to any ideas which we would bring up. Usually most instructors don't want to hear students' views, they want to dictate their views to students… We usually don't get a chance to discuss or defend our thoughts for long enough."

Student #5: "It was great. Especially since, in this term, we had only one design instructor. In previous semesters, we were supposed to get the views of one or two other instructors about our works and it was nothing but a massive confusion…."

Student #6: "It was superb. I can't think of any suggestions to make your critique system better. The reason that I liked your critique system so much, is due to the fact that you would listen to our ideas and you would try to make those ideas work, rather than changing them. In our previous experiences, instructors would directly tell us "No" and we had to change our design ideas so many times to make them satisfied. Students views were not important, but in this semester, you let us be ourselves and develop our own personality in design."

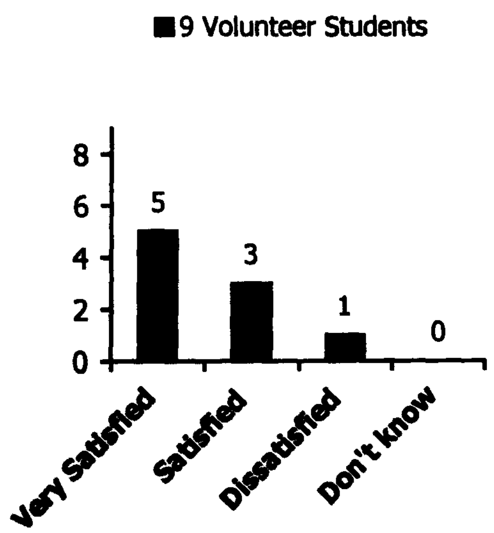
Student #8: "I am very satisfied. During the crits you would bring up some detailed issues which we never had thought about in our previous design projects. This encouraged me to think more in detail and provide some thorough solutions...I am most thankful to you for allowing students to work with their own ideas and you just directed them to solve their problems."

Student #9: "It was good. However, I think it would have been better if you had encouraged us to start with a concept at the beginning of the semester."

Student #10: "The number of crits were very sufficient. However, sometimes I couldn't quite understand whether you were telling me to continue on my ideas or change them. You wouldn't tell me what to do and you wanted me to find out for myself."

Question 5- How satisfied are you with the method of "Periodical Assessment" in this term?

Figure 15.5 Students' satisfaction with Periodical Assessments.



As indicated in the chart, 3 students were satisfied, 5 students were very satisfied, and 1 student was dissatisfied with periodical assessment method.

In addition to daily crits, students were given some periodical assessments about their design works in the sense of both qualitative and quantitative activities during the semester. Most students welcomed these periodical assessments since they could develop some ideas about where they were standing in the class throughout the semester. However, one student was dissatisfied since she had expected more than two periodical assessments. The Author believes that more than two periodical assessment would have diminished the importance of "assessment" – since students were given a grade in each periodical assessment – and it would have become more like weekly crits.

Did these assessments help you? Please explain.

Student #1: "Yes. I usually ask my friends' opinions about my work; however, this semester the periodical assessment helped me better to find out what the instructor thought about my work."

Student #2: "I am pleased with the quality of the crits. However, I expected to have more than two periodical assessments throughout the semester."

Student #3: "I think all daily crits were in a way some type of assessment. The two periodical assessments, however, were very helpful and they gave me good directions."

Student #4: "Yes. Assessments were very good. Unfortunately, I couldn't spend enough time on your correcting remarks and kept postponing them until the end of the semester."

Student #5: "The two periodical assessments were very useful. However, I wished there could have been more. I learned so much from those two and made necessary corrections on my work."

Student #6: "It was a unique experience. Periodical assessments were very meaningful to all of us students. You knew what you were talking about and your technical advice were very special for me. Your views were very helpful in directing our works and those periodical assessments were very well scheduled.

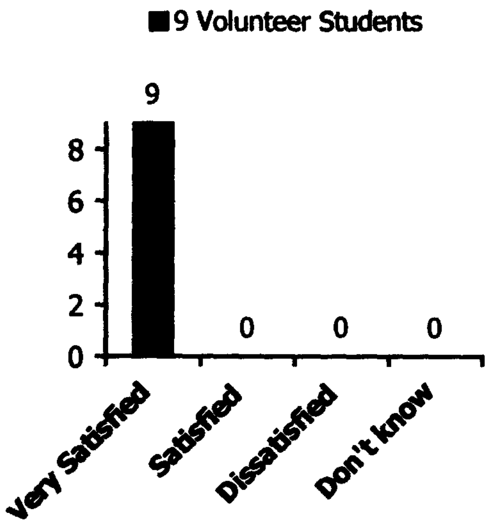
Student #8: "Yes. The two assessments were very good and well organised. I wished there could have been more.

Student #10: "I couldn't quite understand the instructors' views about my work during the crits. However, the two assessments were very clear and let me about my work."

One general note from the Author suggests that daily crits were meant to encourage students to keep on working and trying. Therefore, the Author chose to accept any ideas which students would propose and he would discuss how to make those ideas work better. However, the two periodical assessments, were more formal and comprehensive in the sense of the quality and quantity of the students' works.

Question 6- How would you rate the 'joy of learning' under this methodology comparing to your previous design courses?

15.6 Students' 'joy of learning' under the Author's design and teaching methodology.



As indicated in the chart, all 9 students expressed a total satisfaction with the exercised design and teaching methodology.

The most rewarding result of this research has been the students' feedback of the 'joy of learning'. Students' satisfaction with the Author's teaching method brought some productive co-operation between him and his students throughout the semester. In many cases during the semester, while students from the other groups had left the studio earlier than 6 P.M. – when the studio session is finished – the ten volunteer students would stay overtime to work and receive crits with enormous energy and enthusiasm. The Author believes that this energy and the 'joy of learning' is necessary and it could make the design-studio experience successful and productive.

Please write your general views about this Course and your new experience in the proposed design process.

Student #1: "As I mentioned earlier, your instruction methodology was so organised and well planned which brought an exciting experience for me after three years of confusion……I thank you very much and wish the very best for your future teaching career."

Student #2: "I liked so many things about this class which could be summarised as: encouraging students to use images and graphics from references, writing scenarios, receiving helpful daily crits, learning about design issues through daily exercises, encouraging students to think and develop their own personality in architectural design."

Student #3: "I am very pleased with the instructors' method of teaching....I am most grateful that you taught us how to design; and I will keep this experience throughout my professional life."

Student #4: "The teaching methodology was great. Particularly the instructor's enthusiasm and discipline during the semester. I am also most grateful for your kind personality and good rapport with students.....I thank God for this opportunity with which I got to know you and your methodology of teaching."

Student #5: "I should summarise the highlights of this methodology as: practical daily exercises, time schedule and organisation, using references, and being open to students' new ideas and encouraging them to develop their own ideas."

Student #6: "I would very much like to take another design studio with you."

Student #8: "It was an excellent educational experience. One suggestion though, I think it would be better if you would loosen up a little and break the serious mood of the studio."

Student #9: "I believe that this was a great educational experience. I enjoyed your organisation in work."

Student #10: "I can outline the most positive aspects of this methodology as: good organisation and helpful daily exercises, sufficient consideration of detailed issues in design, helpful usage of references, well organised daily crits, and sensible teaching strategy toward students' feelings and needs."

Students' overwhelming responses to the Author's proposed teaching methodology could be considered as a viable sign validating the practicality of his proposal. This strategy was based on the proposed method of "interactive" design methodology and the Author believes that many other strategies could be developed by the use of this methodology. One important issue about teaching methodology, however, concerns the personal characteristics of an educator. The Author suggests that most practical teaching strategies could turn to be unsuccessful if the educator cannot develop a satisfactory rapport with his/her class.

In an attempt to reflect the other four educators' views about his teaching strategy, the Author has collected their evaluations which will be discussed in the following section.

15.2.2. Educators' Evaluation

Despite prior arrangements made to explain his design methodology and collect educators' evaluation forms, the Author was informed that his colleagues were not able to come for the evaluation meeting. Only after the Author's insistence and the support of the Department Head, Dr. Einifar, did the other four educators agree to sit down after the final assessment was completed and spend half an hour to listen and evaluate the Author's design methodology. The Author suspects that the reason for such a cool response from his colleagues and their reluctance to co-operate with him throughout the semester and during the evaluation meeting could be related to one of the following reasons:

1- The sensitivity of the subject of the design process and teaching strategies in design. (Most design educators are set only on their own method of teaching and don't like to discuss new teaching ideas.)
2- The difficulty of saying "Yes". If the Author's proposed method was good, it would have been too risky for them to approve the methodology and validate it.
3- The difficulty of saying "No". If the Author's proposed method was not good, they would have feared loosing a friend, creating some hard feelings in the department by criticising his method of teaching.
4- The possibility of being busy with their own business and not having enough time to discuss about new educational prospects.

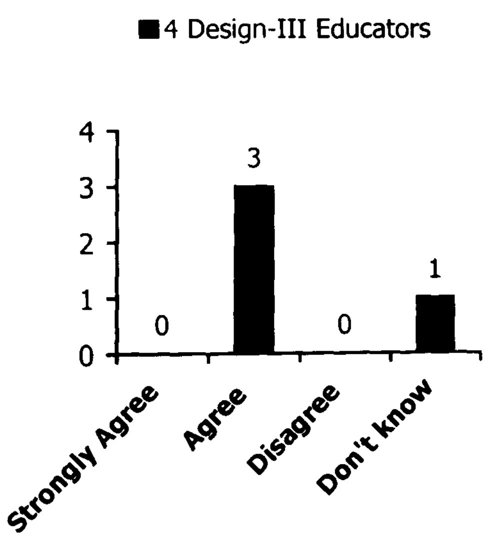
Whatever the case might have been, the Author believes that in order to develop a viable research result – in addition to responding to technical issues – a researcher should be persistent, patient, and understanding throughout the research, from collecting data through analysing and releasing the findings. The Author's persistence paid off at the end and educators agreed to fill up the evaluation forms. Before distributing the evaluation questions, the Author explained his teaching methodology by introducing some students' samples of work throughout their design processes. The evaluation questions were formed in the combination of closed answers – for collecting statistical results – as well as open answers, to collect general views about various teaching strategies conducted by the Author. Therefore, in the evaluation form, educators were encouraged to provide some additional thoughts to explain their selected responses. At the end of the evaluation form, some spaces were provided for the educators to express their general comments on the subject of design methodology exercised by the Author. Due to the lack of enthusiasm, however, some very limited responses were provided by the educators which will be presented in the following sections.

The evaluation form started by stating: *"Dear colleagues, since you have just gone through the same design project with a group of your own students in Design-III, the Author would like to collect your views about his teaching strategy and design methodology during this course".*

1- How much do you agree with the Author's teaching strategy on the following design exercises and or design issues?

- ***Using Scenarios at the beginning of the process.***

Figure 15.7 Educators' views about Scenario exercises.



As indicated in the chart, 3 educators agree that using scenario is a successful strategy, while 1 of the educators responded "I don't know".

Two of the colleagues provided some additional comments to their statistical responses. These comments are presented in the following form.

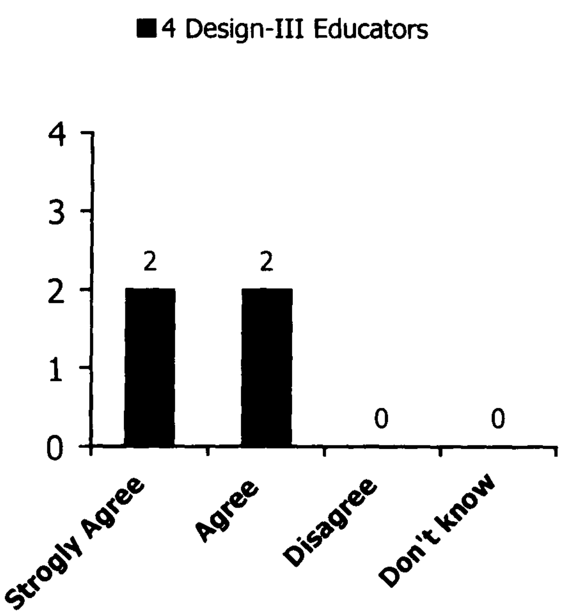
Dr. S. Ivasian: "Writing scenarios could be successful if students remain loyal to their original scenarios throughout the process."

Dr. A. Einifar: "This could be one strategy, however, there are other strategies which could be as well productive in getting students started."

In general, the Author believes that students would use some of their initial ideas gained by scenarios throughout the process. However, he does not encourage students to keep their original ideas throughout the process, since he is more in favour of letting students experience different ideas and feel free to change their thoughts. With regards to the other comment, "writing scenario" is the proposed strategy by the Author, of course, there could be other strategies to encourage students to start design work.

- ***Using a particular design methodology, by encouraging a simultaneous use of Understanding, Generating Ideas, and Presenting.***

Figure 15.8 Educators' views about the Authors' design methodology.

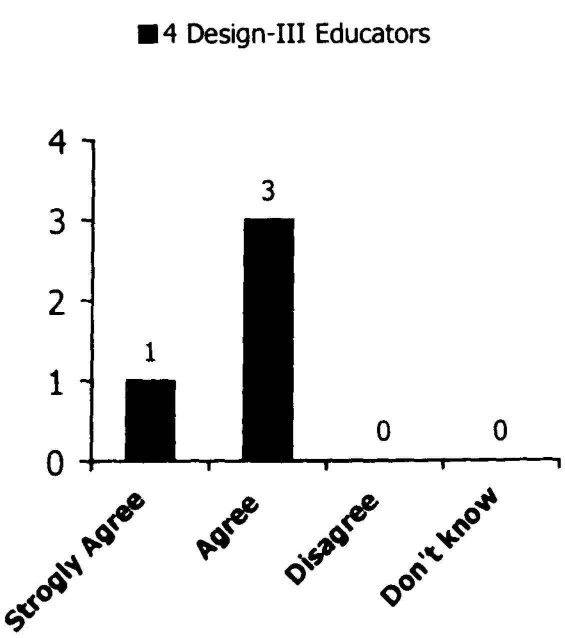


As indicated in the chart, 2 educators strongly agree with the Author's design methodology, while 2 of the educators only "agree" with such methodology.

No additional comments were provided by the colleagues for this question.

- ***Encouraging students to use references and borrow images from journals throughout the process.***

Figure 15.9 Educators' views about borrowing images from journals.

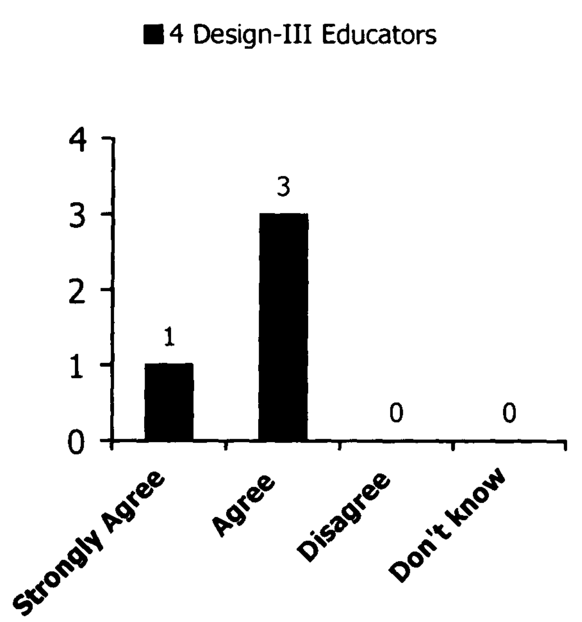


As indicated in the chart, 1 educator strongly agrees with the use of references throughout the design process, while 3 other educators "agree" with such strategy.

Dr. A. Einifar: "This strategy could be as much helpful, as it could be harmful. It is a risky task to leave students free to select any references by accident". The Author agrees that selection of journals and design ideas should be directed by the educators. However, he does not discourage students from browsing through journals or even selecting some ideas on their own. He usually requires his students though, to describe the reasons why they like an image; this way he develops a constructive discussion with his students and exerts control over their selection of images.

- ***Using mass models to introduce design ideas.***

Figure 15.10 Educators' views about the use of mass models in the design process.

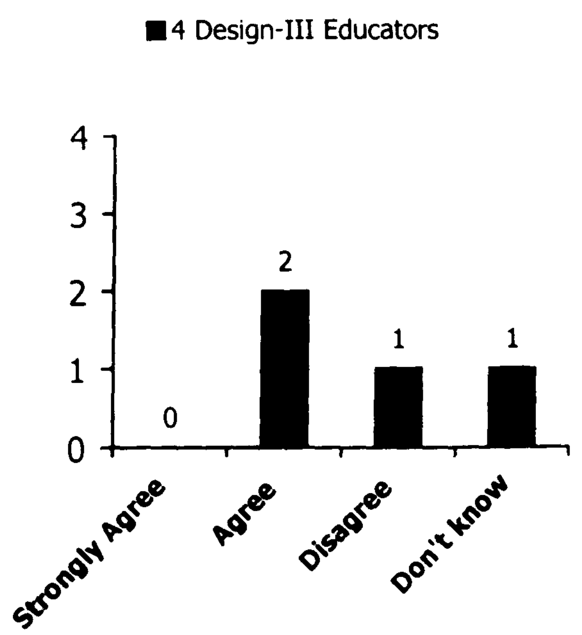


As indicated in the chart, 1 educator strongly agrees with the use of mass models to introduce design ideas, while 3 other educators "agree" with such strategy.

Dr. A. Einifar: "Mass models are very appropriate design tools. However, students could waste their time if they get too much involved with formative aspects of design. Models are most appropriate when they are used in complement with other design tools".

- ***Assigning Daily Exercises and giving daily critiques.***

Figure 15.11 Educators' views about assigning Daily exercises.



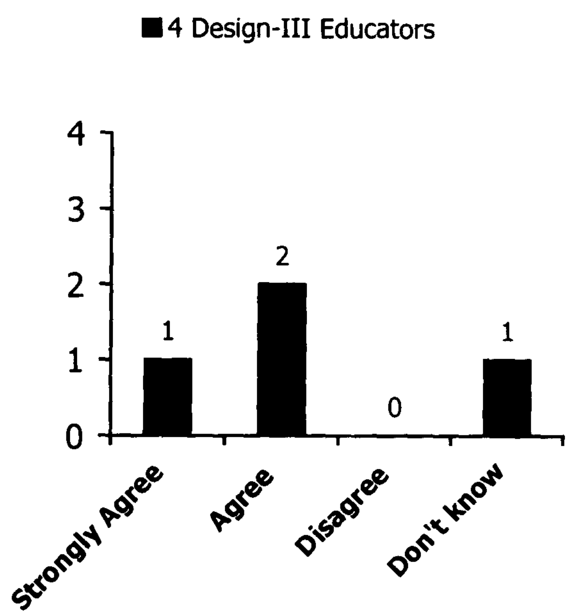
As indicated in the chart, 2 educators agree with assigning daily exercises and giving daily crits, while 1 educator "disagrees" and one "does not know".

Dr. A. Einifar: "Selecting the right order in daily exercises could be critical. Some students may require different processes to reach their final solutions".

The one educator who responded "disagree", was Dr. Sami Azar who didn't provide any further comments. The Author believes that daily exercises was a helpful strategy by which students design activities could be organised and controlled.

- ***Issuing periodical assessments.***

Figure 15.12 Educators' views about issuing Periodical Assessments.

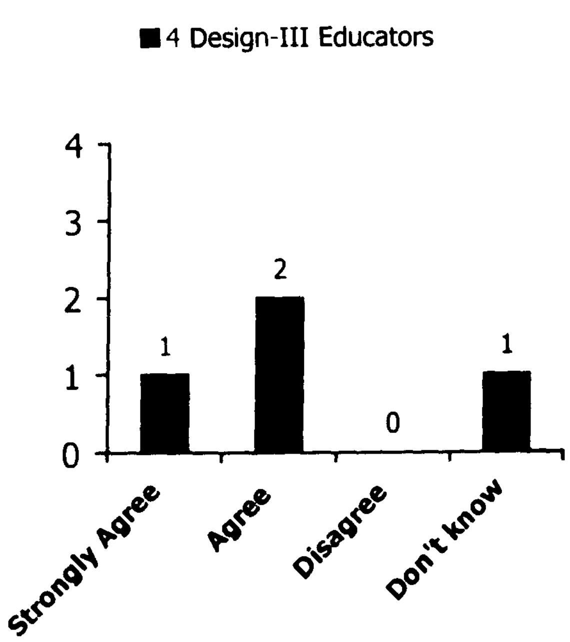


As indicated in the chart, 1 educator strongly agrees with periodical assessment, while 2 other educators "agree" and one "does not know".

Dr. A. Einifar: "I believe that assessments could be useful only when a proper method of assessment has been selected". The Author believes that his method of periodical assessment was very successful, as students responded in their feedback, and it let students to work on their weaknesses.

- ***Encouraging students to develop various design ideas.***

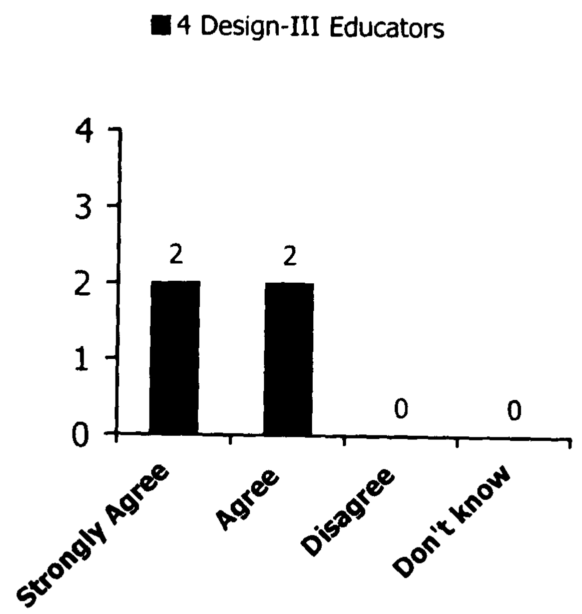
Figure 15.13 Educators' views about the Author's encouragement to students to develop various design ideas.



As indicated in the chart, 1 educator strongly agrees with the idea of encouraging students to develop various design ideas, while 2 other educators "agree" and one "does not know".

- ***Paying simultaneous attention to both logical and creative aspects of design.***

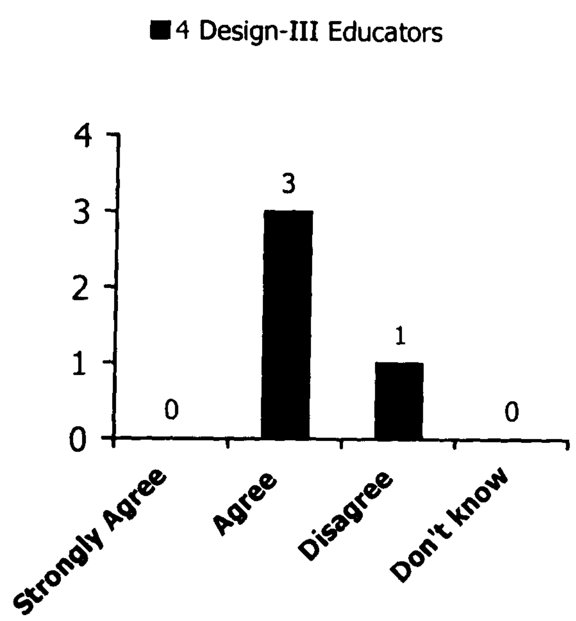
Figure 15.14 Educators' views about simultaneous thinking in design.



As indicated in the chart, 2 educators strongly agree with the idea of paying simultaneous attention to both logical and creative aspects of design, while 2 other educators "agree" on this issue.

- ***Discussing the most critical issues in Design III.***

Figure 15.15 Educators' views about the Authors' design exercises in Design III.



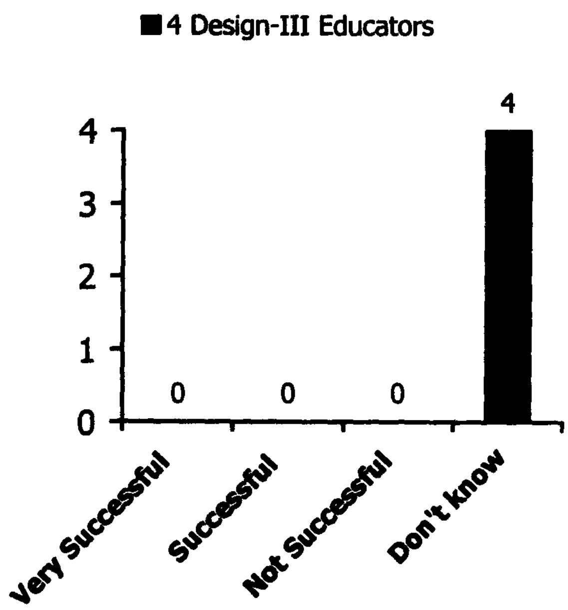
As indicated in the chart, 3 educators agree that the Author has discussed the most critical issues involved in Design-III through his teaching strategy, while 1 educator "disagrees" on this issue.

The one colleague who was disagree, Dr. Diba, didn't provide any further comments. The major intention of the Author in teaching Design-III was to work on the issues that the HCAE had suggested, (see Chapter 14), and co-ordinate the objectives of the Course with his other colleagues. Therefore, it seems a bit odd that a colleague does not agree with the Author's accomplishment.

The second section of the questions – Questions 2 and 3 – asking general views of the educators about the proposed teaching methodology required an open-end answer. The Author had provided half a page for responses, with a note to encourage his colleagues to write any additional comments on a separate sheet.

2- How successful do you consider the proposed/exercised teaching strategy?

Figure 15. 16 Educators' views about the success of the Author's teaching strategy.



As indicated in the chart, all 4 educators claimed they "didn't know" about the rate of success of the Author's teaching strategy.

3- Please write any further comments about the design methodology and/or teaching strategy exercised by the Author.

Dr. S. Ivasian: "Actually students' viewpoints and their works are more important than what I may think about your teaching strategy".

Dr. A. Einifar: "There are very many issues involved in teaching design. This case study was conducted with a total of ten students. You may not get the same results with a larger group. However, you must be credited for such a diligent attempt".

Dr. A. Sami-Azar: "Generally speaking, having a method and discipline in teaching design is necessary. However, I cannot tell how correctly you have directed students' creativity. I don't suppose a systematic method of teaching would be useful for all students".

Although most educators refused to make a final judgement about the overall rate of success of the Author and selected "don't know" – to Question 2 – they expressed a good support for all teaching strategies throughout the evaluation enquiry.

In the previous section, students feedback provided an overwhelming support for the Author's teaching strategy, while in this section, the colleagues feedback tended to take a conservative reaction by approving every design exercises but saying "don't know" to the overall success of the strategy. In the following section, the Author makes an attempt to find a judging procedure for evaluating the quality of his research.

15.3. Judging the Quality of the Research

Before the Author could make any judgement for the quality of his findings, he is needed to set a criteria for judging his research. There are four widely used tests which are commonly recommended for judging the quality of a case study (Robert Yin, 1994). These tests are common to all social science methods, including case studies. Kidder and Judd (1986, pp. 26-29) summarise these tests as:

- "*Construct validity*: establishing correct operational measures for the concepts being studied,
- *Internal validity* (for explanatory or causal studies only, and not for descriptive or exploratory studies): establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships,
- *External validity*: establishing the domain to which a study's findings can be generalised,
- *Reliability*: demonstrating that the operations of a study – such as the data collection procedures can be repeated, with the same results".

15.3.1. Constructing Validity

In order to construct validity – establishing correct operational measures for the concepts being studied – Robert Yin (1994) recommends the use of three tactics: using multiple sources of evidence; establishing a chain of evidence; and having a draft case study report reviewed by key informants. In this research, the Author made an attempt to collect data from various sources, i.e. literature review (see Chapters 2 through 9), also collecting data from different groups of educators from Iran, the UK, and some other countries (see Chapters 10 and 11); as well as students views on the subjects of the design process and design education from two universities in Iran within various design levels (see Chapter 12). With regards to establishing a chain of evidence, the Author developed a chain of enquiries in the form of questionnaires addressed to the educators and students of design before formulating the shortcomings of the conventional design teaching and developing his proposal for teaching design (see Chapter 13). By collecting evaluation forms from volunteer students and his colleagues, the Author made another attempt to provide further evidence to support the results of his proposed strategy in teaching design (see under External Validity).

15.3.2. Internal Validity

According to Yin (1994), since this study is designed as an exploratory – and not an explanatory – case study (also, see Chapter 14), the Author does not have to make justification and/or explanation for why event 'x' resulted in event 'z', therefore, an *internal validity* would not apply in this study. The problem with an explanatory approach in this case study would have been the need to introduce and control all possible events which could have been involved in such an educational research. The Author was cautioned about the difficulties with an explanatory case study during his Transfer Report and he made an attempt to focus on providing answers to "what" and "how" questions with regards to improving students performance in design.

15.3.3. External Validity

External validity – demonstrating that the data collection procedures can be repeated with the same results of the research – was also considered in order to justify the quality of the findings. During this research, the Author has enjoyed the opportunity to work with other colleagues in conducting different design studios. Some of these experiences were gained at the University of Tehran and Azad University, in Gazvin. In these experiences different design exercises were developed and students' feedback were collected, in an informal manner (as a pilot study), to assist the Author in developing his teaching strategy. In 2000, however, the Author asked two of his colleagues – Mrs. Naraghi and Mr. Seifoori both part-time educators at the University of Tehran – who had worked previously[3] with him for several semesters teaching Basic Design and Architectural Design courses, to

[3] Mrs. Naraghi and Mr. Seifoori worked with the Author from 1992 to 1998. Today, they continue to use many teaching strategies which were developed throughout those years.

write some comments about his teaching strategy. More than anybody on the teaching staff, probably, these two educators are familiar with the Author's design methodology and the six-step teaching strategy.

In her supportive reply Mrs. **Parivash Naraghi** wrote: "One problem we face with at the beginning of every semester is to get students ready, both physically and mentally, for a new project. They tend to be very slow and lazy during the first couple of weeks. When the new project is issued to them, many tend to be confused not knowing what to do and how to start. Of course, I think that is part of the process. However, the short design exercises which we give to students under the selected teaching strategy, motivate students to start their design works. These design exercises, however, should be carefully designed and selected by the educators to make the most out of them. That's why we work just as hard as students to plan on design activities and keep everything up-to-date. Daily exercises help students very much, they are designed to be short and clear (i.e., suggesting a zoning diagram for planning spaces). The quick results of daily exercises motivate students to work effectively, and look forward for more exercises and more achievements".

Mrs. Naraghi went on further discussing about the importance of the educator's discipline in the design studio, stating: "Having a plan of work and issuing them to students is very necessary, this way students know what they are supposed to achieve by the end of the week. However, the bottom line is the discipline of the educators themselves. If they are not serious enough to issue and collect daily exercises, that would spoil the whole idea project timetable. In our experiences, we make sure that students understand the importance of daily exercises and that they will receive a grade for them". The discipline that Mrs. Naraghi speaks of is not anything like an army camp. It is very necessary for students to realise their duties and feel responsible to be productive in the studio. In fact Mrs. Naraghi states: "… although the strict discipline sounds harsh and/or boring, most students appreciate the fact that they are given a plan of works that they are supposed to finish by the end of each week. In fact under the selected teaching methodology, students are left free to develop their design ideas any way they like, and we are very open to new ideas. I think that gives a very good feeling to students to know that we would give a crit on any ideas that they would develop and we are not "single minded" people to make them design in our ways. We just tell them what the advantages and/or disadvantages of their ideas are, and suggest different ways of improving them, but not changing them. We never tell students to change their design ideas, we let them to decide for themselves whether they want to continue on their design concepts or they want to change them". She wrote about the advantages of the conducted teaching strategy emphasising that: "... this way students develop some self confidence and they learn to think critically. We encourage students to develop some thoughts about their design exercises and discuss them with us and/or their classmates. This way students get to analyse their thoughts and develop some supportive discussions to defend their proposals. Many students tell us in their later years, that they had a very unique experience in our studio and they tend to follow our design methodology in their other design studios".

With regards to writing scenarios, Mrs. Naraghi wrote: "Writing scenarios help students to communicate verbally and non-verbally. This way they activate both of their hemispheres during the design process. With the help of fiction or non-fiction descriptions of their design project, they learn to develop some thoughts about their spaces and their spatial characteristics. Using graphic images (i.e., drawings and/or photocopied pictures from journals), help students to explain their design ideas. I find this exercise very creative, since it encourages students to think about every little details of their design proposals (i.e., the users, and the characteristics of their spaces)."

Mrs. Naraghi extended her support for the Author's teaching strategy, with regards to using visual references, stating: "The use of visual references and visual thinking ought to be the most wonderful experience of design students in our studio. We encourage students to develop design ideas and solution to their design problems with the help of visual techniques such as drawings, computer generated images, models, or even collage of images from design projects which already have been created by others. Except for a few exercises which we specifically ask students to use some certain techniques (e.g., to bring in some photocopies of their preferred entrances), in the majority of design exercises students are free to choose their own preferred visual techniques. This way students creativity boosts up since they feel free to choose any way they like to express their thoughts. For example, we had a student who used a cassette tape player to create the mood he was after during his slide presentation of his design ideas. All students are required to reflect their design ideas in their exercise notebooks. In their exercise notebooks, we encourage students to incorporate the characteristics of both hemispheres to develop some logical diagrams (i.e., bubble diagrams) as well as some "free" images related to their design thoughts. By "free" images I mean that students can develop unrestricted images to express their thoughts. For example, some students may choose to draw little details of their projects (i.e., the detail of a handrail), while the others may choose to draw spatial images of a portion of a space they are designing. It is not that important what they choose to draw, but how sincere their drawings are, and how they relate to their design thoughts at any particular time."

With regards to assessment methods, Mrs. Naraghi stated: "Periodical assessments are very helpful for both students and us, the educators. Students would get to know our views about where they are standing in the class, and for us it is a good way of controlling students' performance throughout the semester. I think this is the fairest method of assessing students' performances by considering every single activity throughout the semester.... I hate to give a grade to a student based on his/her final presentation. We think in addition to the students' final presentation, their daily exercises as well as periodical presentations ought to be considered in their final grades."

In her kind feedback, Mrs. Naraghi closed her comments by writing that: "... You didn't reach your teaching strategy easily, I witness that we had long hours of discussions over every single design exercise throughout the years. ...Through the means of research or by discussing it with students and/or colleagues, you are always searching for a better way to improve your teaching methods.... Even those semesters we don't work with one another, I continue to use your design and teaching methodology."

The other feedback was collected from **Mr. Seifoori**, who stated: "Daily exercises are great, they are so connected and inter-related that one could hardly miss the direction of the process. They are organised in a way which they put students in the right direction, however, they let students to choose their own preferred way of tackling each problem. ...The combination of these exercises help students to reach a final solution."

In his support for the studio organisation and the timetables given to students, Mr. Seifoori wrote: "Timetables help students to know when to start and what to do next. Although timetables are organised based on daily and weekly activities, there is a flexible time allowed in each week for those students who have fallen behind the schedule, to catch up. I think these timetables are good for two reasons; one that they tend to keep everybody know about the work which is expected from them, and two, they are very educational in the sense of teaching students about time management and how to distribute their time in their future design projects."

Mr. Seifoori's comments about one-day esquisses include: "Esquisses provide a good opportunity for students to develop solutions and wrap up their thinking achievements. It is a testing mechanism which allows students and educators to compare design achievements. Although it is an intimidating exercise for some students with difficulties to work under pressure, it could be a good educational tool to improve students' self-confidence and make them ready for the competitive world of the profession. In fact we try not to give disappointing grades to anyone, we issue 'excellent', 'good', and 'work harder' grades with a lot of written comments on how they can improve their design projects."

With regards to the design process, Mr. Seifoori stated: "I think the combination of creative thinking and analytic thinking contributes greatly to this process. The given design exercises encourage students to think both logical and spatial throughout the process. In these exercises, some require students to look into relationships, proportions, and orientation of spaces, while the others stimulate spatial thinking and developing 3-D studies. Although it is necessary for students to experience different design processes, I think that your design methodology is a very successful one. The major difference between your methodology and those I have experienced before, is that in yours, students are shown the direction of the process and they have to find the final solution on their own. In other processes, however, most educators either are not very directive (leaving students confused), or they tend to be too directive by telling students what they ought to design." One important issue that Mr. Seifoori suggested in his comments about the design process, however, was the need for students to be exposed to different methodologies. The Author agrees with Mr. Seifoori that no matter how successful a design methodology may be, students should experience different processes during their educational experiences and decide for themselves that which process would suit them best.

In his closing remarks, Mr. Seifoori kindly stated: "...Even in my private design projects, outside the university, I use your design methodology and I am very happy with their results."

The Author welcomes the comments made by his colleagues in which they brought up some issues which he had not thought about in the past. Although the supportive feedback from the two educators suggests that the Author's model of teaching and design methodology work successfully, at least in their opinions, he needed to extend the validity of his findings even further. Therefore, the Author organised a formal experience at the Islamic Arts University of Tabriz, in the year 2000. The Author had taught at that university for a couple of semesters in 1998 and 1999. When he was invited to teach Design-I in the year 2000, he suggested to work with one of his colleagues there, Mr. Roohi, who was familiar with his teaching strategy. The Author had discussed about the major elements of his teaching methodology with Mr. Roohi in a number of meetings. The proposed strategy, however, was a practical tool for the Author to let Mr. Roohi know about design exercises and what he should be prepared to do in different design sessions. The Design-I studio was conducted by Mr. Roohi and the supervision of the Author[4] using the proposed teaching strategy – see Chapter 13 for the 6-step "interactive" teaching plan. The subject of the project was decided to be the design of a residence for an architect and his family (see Appendix J for samples of student's design exercises).

The results of that experience were also overwhelming, most students and Mr. Roohi were very satisfied with the proposed teaching strategy. In an attempt to reflect the views of students and Mr. Roohi, the Author used the same format of

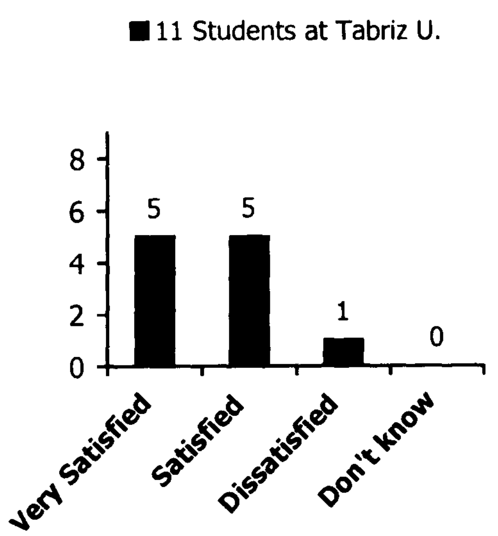
[4] The Author would fly to Tabriz once a week to supervise the Course.

evaluation forms given to volunteer students and educators of Design-III at the university of Tehran.

Students' evaluation forms, using the previous six questions, were distributed to Tabriz students by Mr. Roohi. The 11 students (all male) provided the following answers to the given questions. Since most students' feedback were very positive and supportive of the Author's teaching strategy – similar to those reflected by students at the University of Tehran – the Author has chosen to reflect only those comments which were dissatisfied with some exercises or had some different point of views from those students at the University of Tehran.

Question 1- How satisfied are you with the results of your "Scenario" exercises?

Figure 15.17 Tabriz students' satisfaction with Scenario exercises.

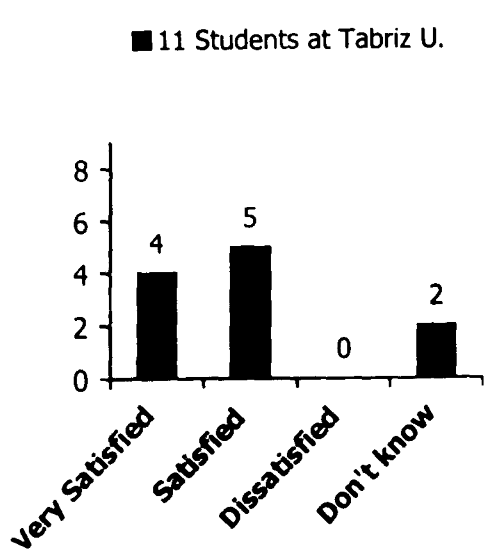


As indicated in the chart, the majority of the students – 10 out of 11 students – were satisfied or very satisfied with the results of their scenario exercises and only 1 student was dissatisfied.

The one student who was dissatisfied with writing scenario, S. Shengehpoor, wrote: "I didn't like to write scenarios". He added: "Scenarios could not help me in design, they just were helpful in providing a starting point in design".

Question 2- How satisfied are you with the results of the "Daily Exercises"?

Figure 15.18 Tabriz students' satisfaction with Daily exercises.

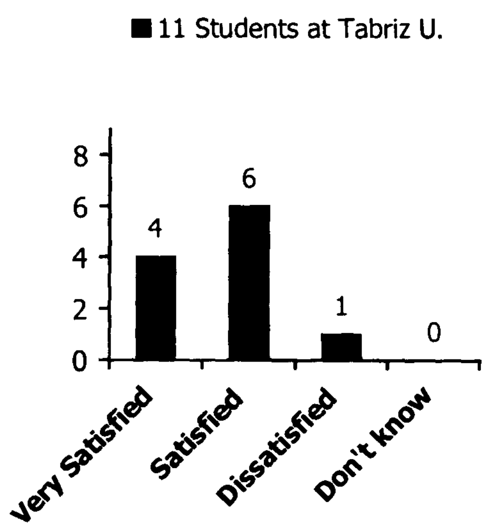


As indicated in the chart, the majority of the students – 9 out of 11 students – were satisfied or very satisfied with the results of their daily exercises. However, two students did not know whether they were satisfied or not.

E. Ahmadi who was satisfied with daily exercises wrote: "The proposed design process was very helpful for me; I learned a good strategy to express my design ideas. In previous Courses, I could never explain my design ideas. however, with the help of graphic images from books and journals. I could express my ideas and I feel good about myself".

Question 3- How satisfied are you with "Examining Design Factors" exercise?

Figure 15.19 Tabriz students' satisfaction with Examining Design Factors exercises.



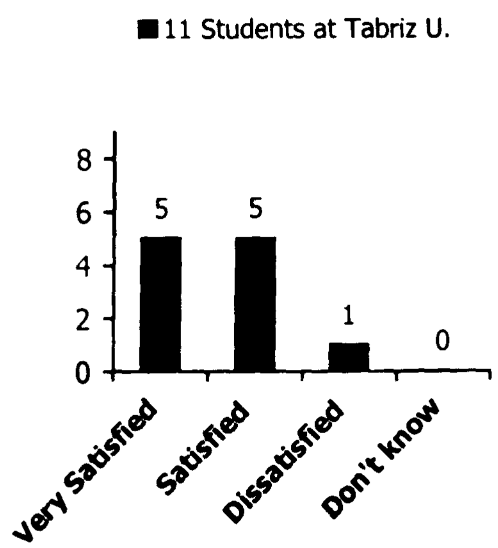
As indicated in the chart, the majority of the students – 10 out of 11 – were satisfied or very satisfied with the results of their Examining Design Factors exercises. Only one student was dissatisfied with these exercises.

The one student who was dissatisfied with Examining Design Factors exercises, V. Mirtaghi, wrote: "These exercises didn't help me very much. Only the analysis of a couple of factors – climatic and cultural factors – gave me some ideas in design."

The Author would like to re-emphasise that the study of the ten Design Factors all do not have to be always generating design ideas. For some students these studies are more productive than the others. The list of the ten Design Factors could be used as a starting checklist for design students in their design studies.

Question 4- How satisfied are you with the method of critiques in this course?

Figure 15.20 Tabriz students' satisfaction with critique method.

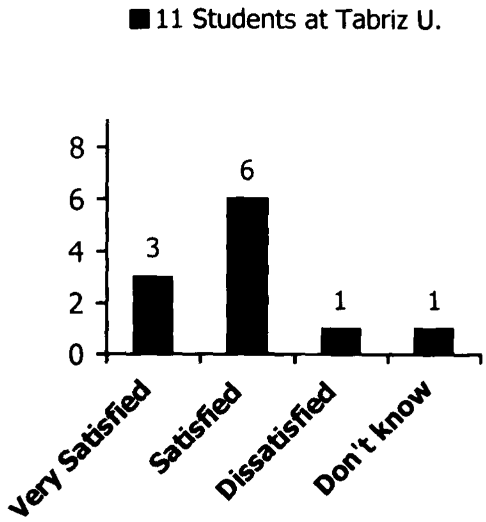


As indicated in the chart, the majority of the students - 10 out of 11 students – were satisfied or very satisfied with the method of critiques in this course. Only one student was dissatisfied.

The one student who was dissatisfied with the method of critiques. V. Mirtaghi. stated: "I was not very happy. But now that I think about it, maybe I am not happy with my own performance."

Question 5- How satisfied are you with the method of "Periodical Assessment" in this term?

Figure 15.21 Tabriz students' satisfaction with Periodical Assessments.

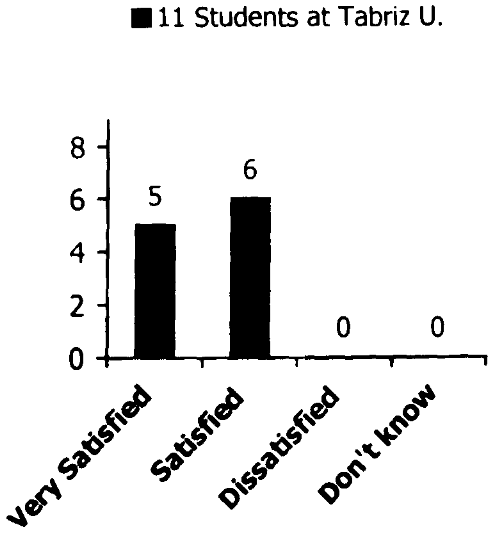


As indicated in the chart, the majority of the students – 9 out of 11 students – were satisfied or very satisfied with periodical assessment method. Only one student was dissatisfied and one did not know whether he was satisfied or not.

The one student who was dissatisfied with Periodical Assessment, M. Abbasspoor, wrote: "We were encouraged to consider many issues during the design process, however, in the final assessments some of us did not receive enough credits for those issues." This is a very rare situation that a student has complained about periodical assessment. In this case, the Author suspects that the student has been more unhappy with his grade than the use of periodical assessments.

Question 6- How would you rate the 'joy of learning' under this methodology comparing to your previous design courses?

Figure 15.22 Tabriz students' 'joy of learning' under the Author's design and teaching methodology.



As indicated in the chart, all 11 students were satisfied or very satisfied with Mr. Roohi's instruction and they expressed high levels of 'joy of learning' in comparing to their previous design experiences.

Almost all students were very satisfied with the exercised teaching strategy. F. Khorami, was very satisfied with the Author's teaching strategy. He stated: "One great aspect of your teaching strategy is that you work with any kind of design ideas and encourage students to find a better way to improve their works. Usually other educators disappoint students by rejecting their weak design ideas. You let students find their problems on their own and this is very educational."

In his evaluation form, **Mr. Roohi**, the colleague at the Islamic Art University of Tabriz stated: "I found the Writing of Scenario exercise very helpful. Students were very excited in writing those scenarios and they could generate some fresh ideas from those writings. I had worked with these students in the previous year and they had difficulties getting started in that semester."

With regards to Issuing Daily exercises and Examining Design Factors, Mr. Roohi was very supportive. He wrote: "In my previous design teaching experiences, I always felt the need for a systematic design studies and your Ten Design Factors are very helpful in that respect. They could be used as stimulating studies for design students to generate design ideas with the help of graphic images....I think that the use of photocopies and photographs were extremely helpful for many of these students who were not strong in drawing sketches. ...Their daily design exercises seemed a bit too much at the beginning, however, the students got to realise that if they wanted to move with the rest of the class, they needed to put more time and effort into it."

As a concluding statement in his evaluation form, Mr. Roohi wrote: "Any teaching methodology needs time to be completed and refined. Your teaching methodology, throughout the past two semesters that I have been introduced to, has been successful and rewarding."

The Author has learned that Mr. Roohi is continuing to use the "interactive" teaching strategy in Tabriz and his students are very satisfied with his Design courses.

15.3.4. Reliability

In order to justify the *reliability* – demonstrating the possibility of generalising the findings – of the research, first, it is necessary to categorise the findings of this research in the following two groups.

- **Theoretical findings/discussions**

Interactive design methodology in architecture (discussed in Chapter 6)
Modes of thinking (discussed in Chapter 7)
An interactive model of thinking (discussed in Chapter 9)
The need for a design methodology (discussed in Chapters 10, 11, and 12)
Design methodology and the design process (discussed in Chapters 6, and 9)
Design factors influencing architectural design (discussed in Chapters 6, 11, and 12)

- **Practical findings/exercises**

Shortcomings with conventional teaching strategies in Design (discussed in Chapter 13)
Proposing a new teaching methodology in Design (discussed in Chapter 13)
Proposing an "interactive" teaching strategy for Design (discussed in Chapter 13)
Students' overwhelming satisfaction with the proposed strategy (discussed in this chapter)

Among these finding, the "theoretical" findings were based on literature review, interviews, questionnaires, and correspondences which involved many educators from different countries. The findings of this section could most likely be expandable and reliable to be generalised in other researches.

Although the "practical" findings of this research reflect the views of students and educators of architectural design in Iran, they are based on the "theoretical" findings of this research which reflect general views of educators world-wide. Therefore, they could be expandable in other architecture schools world-wide which suffer from similar shortcomings in their Design education.

PAGE NUMBERING AS IN THE ORIGINAL THESIS

Chapter 16
Conclusions

16.1. Introduction

This final chapter is designed to present the output of the research. The Context gives an overview of the thesis. The Specific Conclusions reviews the findings of this research by re-stating what was looked for and what was found – with regards to the specific aims and objectives of the research. It will also include discussions on the significance of findings and contribution of findings to the knowledge. The final section of this chapter is devoted to provide some specific recommendations for further research in the area of architectural design and teaching design.

16.2. Context

In this research, the Author investigated two major aims with respect to architectural teaching and architectural Design – developing an alternative design methodology for Architectural Design education, and developing a teaching strategy for design students during the design process. Although conducting research in the areas of architectural education and architectural design, due to their subjective nature, requires more intense studies, this attempt by the Author could be considered as innovative and introductory. The limited access to students and/or educators of architecture in order to reflect their views on the subject of the research, are among the reasons why the findings of this research could not be considered comprehensive or ultimate. Therefore, further intense and well-defined studies are needed to fully examine all the issues concerning the subject of design education and the design process.

Since the nature of the architectural education and architectural design process require a wide range of studies with regards to many variables – i.e., students' and/or educators' backgrounds, educational programmes and the educational environment – the Author selected the methodology of *action research* which could be most beneficial in an educational context (see Chapter 1). In the initial stage of the research, many questions had been developed by the Author in relation to his teaching experience with architectural design students. The Author's major concerns were related to the lack of a pedagogic process of design from which many students were suffering throughout their design education. As a result, many students are dissatisfied with their design experiences and cannot generate creative design solutions. Some initial research questions were formed in relation to the Author's teaching observations throughout the years – i.e., how can students become more successful during the process of design? Are students' levels of success in design directly related to their levels of creativity? And can educators improve students' level of creative works through their teaching strategies? Throughout the research, however, the Author examined many other design/education related issues and developed more questions for investigation. For example, the human thinking process involved during the act of design, generated some new questions which could be summarised as: Do students have hidden talents? Could students' hidden talents become stimulated during the design process? What type of thinking is involved during problem-solving, decision-making, and designing? Is there any priority in activating designers' thinking types and could there be simultaneous thinking processes in design?

Throughout the research, the number of these concerns were increased and the area of the research enveloped a wider spectrum of issues – since each educational/design related issue would generate several other questions. As mentioned earlier, "action research" is potentially a suitable research methodology in educational contexts and it allowed the Author to adapt appropriate research techniques throughout his investigation. This thesis required some research techniques – i.e., literature review (eg., Internet search for thinking methods), distribution of inquiries, and conducting a case study – in order to collect data and investigate about the questions of the research.

With regards to the topic of the design process and design methodology, the Author had to investigate the nature of Architecture and review different architectural theories in order to set the context for defining "what", and "how" to develop a design methodology. By examining different types of design methods and enquiring about educators' and students' views concerning issues involved in the process of design, the Author collected some valuable data which enabled further investigation and analysis. In addition to general questions, many detailed questions were asked in the form of questionnaires – i.e., the role of educators/students in the design process, and the role of educational programmes and teaching strategies in improving students' design works (eg., the system of assessing students' design projects was reviewed) – by which the educators' and students' comments helped the Author to develop the proposed model of design methodology and teaching methodology.

16.3. Specific Conclusions

The "specific conclusions" are directly related to the objectives of the research. As indicated earlier, the two major aims of the research – developing an alternative design methodology for architectural design education, and developing a teaching strategy for the design process – were not formulated until the end of the first year of the research. With regards to these aims, the Author developed four major objectives to pursue in the research. The specific conclusions of this research, their significance and contribution to knowledge are discussed under each major *objective*.

- *Investigating about the shortcomings of architectural education and design studios.*

This research found some shortcomings with architecture programmes and the design studios which range from student-admission related subjects to the lack of teaching methodology in design studios. Specific findings of this research – revealed in Chapters 3, and 10-12 – suggest that architecture schools, in order to improve the quality of their educational programmes, should give the priority of admission to those students with higher personal characteristics (i.e. motivation to work and/or qualification in the sense of developing creative works) suitable for the profession of architecture. This finding would require a mechanism for selecting the most fit students for architecture. Those educators and students who participated in this research specified that "student's higher level of creativity" is the most influential factor in providing potential for educational progress in architectural design courses.

Another finding of this research indicates that architectural design is a highly complex activity which involves a number of issues in various subjects. Therefore, it would be necessary to expose students to suitable supporting design/theory courses. One practical approach to improve the status of theory in architectural education, is to provide a closer tie between theory courses and design studios. That way, design students could discover the relation between what they learn in their theory courses and the practical exercises in their design studios.

With regards to the environment of the design studios, it was established that they should provide a comfortable environment – in the sense of their physical atmosphere and their teaching/learning conducts – to satisfy all students regardless of their genders and/or social/cultural backgrounds.

Although many critics have suggested that the design process is a "learning by doing" experience, the Author found from the questionnaires, that most students were dissatisfied with the lack of design methodology and a clear sense of knowing what to do during the design process. The findings of this research indicate that most students are in favour of those design educators who incorporate some teaching methodologies/strategies and provide students with a clear sense of knowing what to do during the design process. The students expressed that Design educators should incorporate flexible teaching strategies to fulfil all students with different talents. The ideal Design educators would be those who have a good rapport with students and encourage them to express new design ideas, show students the framework of the process, and let them find their own ways through the process.

One great dissatisfaction which students expressed with their design courses remain the problem with assessment methods. The findings of this research indicate that students would like to be present during the final assessment of their projects to defend their works. Many students are in favour of periodical evaluations, rather than one final assessment, to support the value of the process of design and allow students to know where they are standing throughout the project.

With regards to the specified findings, the Author suspects that most issues which are raised against design studios and/or architectural education are somehow related to deficient educational programmes which have incorporated unsuitable educational patterns. The shortcomings with these educational patterns should be investigated in the works of educators, the qualification of students, and the appropriateness of educational programmes. Therefore, in the Author's opinion Architecture schools, in general, and design education, in particular, should develop appropriate educational patterns to suit the educational conditions of their own specific schools – with regards to the potentials of their own students, educators, and professional conditions. The Author does not recommend architecture schools to follow any 'international' educational pattern for design studios and encourages design educators to develop a teaching methodology suitable for the conditions of students and educational environment in which they are involved with.

The significance of this conclusion indicates that architecture schools should seek to improve their educational qualities through their own potentials. Many schools theses days, particularly those in developing countries, try to imitate some successful educational patterns to improve their educational programmes, however, this search should direct them to understand and then improve the conditions of their own students, educators, and educational approaches.

The conclusion contributes to knowledge in the sense of encouraging architecture schools to develop local/practical solutions for their educational problems. Many shortcomings with architectural education today will be overcome when educational planners and educators of architecture look into developing appropriate solutions suitable for the conditions of their students and architectural profession. The above conclusion indicates that a successful educational pattern in one school is not necessarily appropriate in the other schools and architectural educators should develop design/teaching methodologies suitable for their own educational environment.

- *Investigating about "thinking" and the human thought process during the design process.*

Due to the current most critical concerns in architecture, as indicated in Chapter 4, the issues of man and his environment are the most influential factors in design which require some research and investigation during the design process. Cognitive Psychology and other human sciences contribute to the process of designing by introducing man and his environment to designers – see Chapter 7. Findings in cognitive psychology suggests that human brain consists of two hemispheres with different characteristics - i.e., the left brain is in charge of analytic thinking while the right brain is dominated by creative thinking. Although the characteristics of both hemispheres are present in daily tasks, conducting activities associated with the theories of two hemispheres, students are more likely to activate their full potentials in drawing exercises and he has extended this finding into design exercises. Since the act of designing involves problem-solving, decision-making, and creative activities, by reviewing different types and modes of thinking, it became obvious that the act of designing requires certain characteristics/talents by which designers should be stimulated during the act of designing. Both "left" characteristics of the brain, the "creative hemisphere" – using logical, analytical, verbal, and abstract reasoning – and "right" characteristics of the brain, the "analytic hemisphere" – using intuitive, synthetic, non-verbal, and concrete reasoning – are required to be stimulated interactively in order for designers to produce comprehensive and successful design solutions. This stimulation should be reinforced by design educators through introducing appropriate design exercises in order to develop 'interactive' creative thinking in students.

The Author found many creative design strategies which are consistent with the idea of different hemispheres dominating the design process. However, his major finding suggests that "visual thinking", as a design strategy, activates the characteristics of both left and right brain through the use of visual representations (graphic images) to understand a problem, generate design ideas, and present design solutions. This pedagogic approach, was applied to various stages of the design process by which design students communicated their design ideas in a spatial manner and developed creative solutions throughout the process.

With respect to the above findings, the Author derives the following conclusion. Since the act of designing is complex and involves multi-dimensional activities, Design educators should stimulate an 'interactive' mode of thinking in students, by issuing appropriate design exercises, which would encourage them to activate their full potentials throughout the design process.

The significance of this conclusion is that all students are creative but with different potentials. However, those students with hidden talents ought to be identified and developed by themselves and their design educators. Despite the old belief that the number of creative students are limited in a design studio, the new finding suggests that all students are able to produce creative works once they are introduced to use 'interactive' thinking methods. The proposed interactive thinking method provides students with a flexible approach throughout different stages of the design process. However, in order for students to succeed completely, a flexible design methodology and teaching methodology ought to be applied in design studios to provide the opportunity for students to stimulate their creative talents and develop creative works. The results of teaching changes based upon this conclusion will benefit the students of architecture and they will develop more creative solutions in their design projects. Consequently, the profession of architecture and the built environment will benefit from it since creative students will develop creative solutions for the living environment.

The conclusion contributes to the knowledge in the sense of improving the thinking process in design. It argues with conventional thinking methods in which students would be put in a one directional thinking process (i.e., analysing, synthesising, and then evaluating) and suggests an 'interactive' thinking approach for the design process. In the proposed 'interactive' thinking method, students are encouraged to take the control of thinking in their own hands by considering different design issues simultaneously and developing appropriate design strategy to move through the process.

- *Investigating and reviewing the views of architectural educators/students on the subject of design methodology and the need for a model of the design process.*

Most design students who responded to the questionnaires, in Chapter 12, expressed a serious need for design methodology in design courses. However, among those educators who responded to the questionnaires, in Chapters 10 and 11, a large number of them misunderstood the difference between the two terms 'design methodology' and 'design strategy' and expressed disagreement with teaching students design methodology. However, in their explanations, it becomes clear that they disagree with dictating a 'design strategy' to students. The Author made a clear differentiation between the two terms expressing: Design methodology (i.e., creative thinking) is concerned with a wide but planned strategy of action which may be consisted of many "methods" to execute that strategy. Design strategy, however, is a set of techniques (i.e., making mass models) which are implemented to execute a design methodology. Therefore, the Author suggests that it is necessary for deign educators to develop a design methodology and practice them with their students; however, they should be flexible in allowing students to choose their preferred design strategies throughout the design process.

Despite previous emphasises on the product of design in the education of architects, the Author found that application of "positive" design theories – which indicate that architectural design requires a theoretical perspective in which the process of design is live and dynamic – ought to be considered as a viable procedure in the process of design and production of appropriate design solutions. Conventional design methods – i.e., stage-phase or rational approaches in design, reviewed in Chapter 5 – engage a linear interaction between the three realms of analysis, synthesis, and evaluation. As a result, design students have to restrict their creative activities to a specific/appropriate period within the design process. The proposed 'interactive' design methodology suggested by the Author speaks of a simultaneous interaction between the three stages of understanding, idealising, and presenting. In each of the proposed realms, the three conventional realms – of analysis, synthesis, and evaluation – are at work in a conical form (suggesting that the interaction between the three realms becomes closer once the process gets underway and reaches the final solution), and a design process starts at any given point; as a result, the final design solution is the product of engaging all student's talents throughout the process of design. The interaction between the proposed design realms requires an interactive model of thinking. The Iowa State University's "Complex Model of Thinking" – which is consisted of analytic, content/basic, and creative thinking – is selected by the Author since it fits his earlier findings about students' talents and human brain characteristics in developing an 'interactive' design methodology.

The Author concludes that: Design students need to be introduced to a design methodology by their educators and the proposed 'interactive' design methodology is an alternative approach which involves 'interactive' thinking within different realms of the design process.

The significance of the above conclusion is the recognition of the importance of an 'interactive' design process in the development of a design solution. Despite the underestimation of the value of the design process by some educators, the Author has found that design students perform better in design studios when they work under a clear design methodology and they are more satisfied with their design experiences. The results of the proposed conclusion will benefit students of architecture who struggle through a design project by allowing them to develop their hidden talents in design within their preferred design strategies.

The proposed 'interactive' design methodology contributes to the knowledge in the sense of providing a practical design methodology for students in which they are in charge of the process. In contrast to the linear approaches of the design process in which students were supposed to go through the process stage by stage, the proposed 'interactive' methodology gives the opportunity to students to consider the interaction between various influencing factors of design simultaneously. This could occur in the light of an 'interactive' mode of thinking in which all thinking modes – analytic, creative and content – are at work simultaneously throughout the process.

- *Developing a proposal for a model of teaching and conducting design work in architecture.*

Based on the previous findings, i.e., design methodology discussed in Chapter 6, and particularly those views collected from students/educators' questionnaires, the Author developed a teaching methodology and a teaching strategy for design and tried them with a group of students at the University of Tehran, see Chapters 13 and 14. The proposed teaching methodology for design suggests that design activities are interrelated and the design process should be based on an 'interactive' design methodology. It suggests that all students are potentially creative, however, their creative talents should be stimulated through appropriate design exercises. Design educators should implement an organised teaching plan by which students could follow a framework of design activities, and yet demonstrate some flexibility to different design ideas and/or design approaches by their students. As supported in the students' questionnaire, the Author believes that it is important to view a student's progress throughout the process of design and give the final assessment based on the student's performance throughout the project and not just the final presentation.

The 'interactive' teaching strategy in design which applies to the proposed teaching methodology suggests that design educators should implement some working techniques by which design students could get started with their projects, stay active throughout the term, find a framework by which they could conduct their studies, stimulate their creative thinking, develop design ideas, and receive periodical assessments for a fair final judgement.

The Author concludes that: In order for a design methodology to work properly, it is necessary for it to incorporate consistent teaching methodology and teaching strategy to formulate an ideal educational environment in architecture.

The significance of the conclusion is the recognition that consistency between different elements of an educational pattern is necessary within all levels of its structure. In contrast to many educational patterns adapted in many architecture schools which tend to borrow their educational patterns from various sources, the conclusion suggests that an educational environment could only succeed when it follows a consistent/appropriate model.

The conclusion contributes to the knowledge in the sense of improving educators' and students' performances in architectural education, particularly in design studios, by suggesting that consistent educational methodology is necessary to be carried out by design educators. The effectiveness of an educational element (i.e., teaching methodology) strongly depends on its relation and integration with other elements in an educational environment (i.e., design methodology and teaching strategy). Therefore, in order to improve the educational conditions of an architecture school, it is necessary to examine all related elements within that educational environment.

16.4. New Conclusion

The information which was investigated and collected in relation to developing a model of design methodology, led the Author to a new conclusion which he had not foreseen at the beginning of this research. His findings with regards to the influencing design factors in developing a design solution – discussed in Chapters 6, 10, 11, and 12 – brought a new perspective to the environment of a design process. The Author called this environment as the 'contextual factors' influencing a design process. These factors are categorised based on the issues which they concern into ten groups: Space and User, Climate and Natural

Forces, Social and Cultural Influences, Material and Construction, Natural Environment, the Built Environment, Building Systems, Sensory Systems, Rules and Regulations, and Time and Budget Factors. Although many of these factors are discussed in most design studios around the world, the Author claims that this is the first time that such a complete list of design factors have been prepared to be used as a checklist during the design process.

The Author concludes that: There are Ten Design Factors which formulate the context of a design process and influence a design solution. These factors should be examined by students during the design process.

The significance of the conclusion is that it outlines the ten specific factors which are influential in the design process. In the past, there has been some attempts made to identify these factors, however, in none of these attempts have critics been able to develop such a clear/distinct list of factors to be applicable in design education.
The conclusion contributes to the knowledge in the sense of assisting design educators with a list of design concerns which they should ask students to examine. It will benefit students of architecture in the sense that they can rely on these factors as a checklist during the design process to make sure that they have covered all influencing factors on their design solutions. And consequently, it will contribute to the profession of Architecture since it will encourage students to develop some design solutions which are concerned with a wide range of design issues.

16.5. Aims

Although the area of research was selected to investigate the ways of improving students' performance in design studios, the two major aims of this research, developing an alternative design methodology and developing a teaching strategy which would benefit design students during their design education, were not formulated until the later stages of the research. At the beginning of the research, the Author had not anticipated the significance of cognitive psychology and thinking methods in this research. Nor had the Author expected to find such a close tie between the design methodology and the educators' teaching strategies. However, in order to develop the model of design methodology and the design process, the Author had to examine thinking processes involved in design and collect students' and educators' views about design related issues.

By integrating the four major 'specific conclusions' developed in this section, the Author suggests that architectural education, in general, and architectural design studios, in particular, need to incorporate appropriate/consistent educational patterns suitable for their educational environment. Due to the complexity of the act of designing, it is necessary for design educators to develop a design methodology based on 'interactive' thinking to stimulate students' talents during the process of design. Such an 'interactive' design methodology, requires a consistent teaching methodology to integrate between the educators' principles of teaching and his teaching strategy during the design process. The consistent findings of this research help to realise the aims of this research – developing an alternative design methodology for Architectural Design education, and developing a teaching strategy in design – by demonstrating the need for an alternative design methodology and then proposing a consistent teaching methodology to make it practical in a design studio.

16.6. Recommendations for Further Research

The Author did not have the opportunity to examine many issues related to the subject of architectural education and the design process in this research. In order to extend on the findings of this research, he would recommend that further research should be conducted in the following areas:

- Examining the validity of the proposed interactive design methodology in other schools.
- Extending on the subject of "creativity", and students' preferred design strategies.
- Identifying other flexible teaching strategies to be integrated with the proposed design methodology.
- Examining design studios and their pedagogic influence on the proposed design methodology in other schools.
- Investigating the implications of remote learning and computer aided education on the proposed design methodology.

particular, need to incorporate appropriate/consistent educational patterns suitable for their educational environment. Due to the complexity of the act of designing, it is necessary for design educators to develop a design methodology based on 'interactive' thinking to stimulate students' talents during the process of design. Such an 'interactive' design methodology, requires a consistent teaching methodology to integrate between the educators' principles of teaching and his teaching strategy during the design process. The consistent findings of this research help to realise the aims of this research – developing an alternative design methodology for Architectural Design education, and developing a teaching strategy in design – by demonstrating the need for an alternative design methodology and then proposing a consistent teaching methodology to make it practical in a design studio.

16.6. Recommendations for Further Research

The Author did not have the opportunity to examine many issues related to the subject of architectural education and the design process in this research. In order to extend on the findings of this research, he would recommend that further research should be conducted in the following areas:

- Examining the validity of the proposed interactive design methodology in other schools.
- Extending on the subject of "creativity", and students' preferred design strategies.
- Identifying other flexible teaching strategies to be integrated with the proposed design methodology.
- Examining design studios and their pedagogic influence on the proposed design methodology in other schools.
- Investigating the implications of remote learning and computer aided education on the proposed design methodology.

References

Alberti, Leone Battista, (1485). *"De re aedificatoria"*. English translation by James Leoni (1726), Ten Books on Architecture. London: Alec Tiranti.

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

Alexander, C., (1969). *Houses Generated by Patterns.* Berkeley: Centre for Environmental Structure.

Alexander, Christopher, et al., (1975). *The Oregon Experiment.* New York: Oxford University Press.

Alexander, C., (1977). *A Pattern Language.* Oxford University Press.

Alexander, C., et al., (1979). *The Timeless Way of Building.* New York: Oxford University Press.

Alexander, C., **Ishikawa**, S., and **Silverstein**, M., (1967). *A Pattern Language which Generates Multi-Service Centres.* Berkeley: Centre for Environmental Structure.

Alger, John R., and **Hays**, Carl V., (1964). *Creative Synthesis in Design.* NJ: Prentice-Hall.

Anderson, John, (1995). *Cognitive Psychology and Its Implications*, 4th ed. New York: W.H. Freeman and Company.

Ando, Tadao, (1991). "Beyond Horizons in Architecture". In: Harriet Schoenzholz Bee, ed. Tadao Ando. New York: Museum of Modern Art, 1991, pp. 75-76.

Annet, Marian, (1985). *Left, Right, Hand and Brain: The Right Shift Theory.* London: Lawrence Erlbaum Associates.

Archer, LB., (1963). "Systematic Method for Designers". *Design.*

Archer, LB., (1974). "Design Awareness and Planning Creativity in Industry", *Design Council.*

Argyris, Chris, (1981). "Teaching and Learning in Design Settings: in Consortium of East Coast Schools of Architecture", *Architectural Education Study*, Vol. 1: The Papers. New York: Andrew W. Mellon Foundation.

Arieti, Silvano, (1976). *Creativity: A Magic Synthesis.* New York: Basic Books.

Arnheim, Rudolf, (1969). *Visual Thinking.* Berkeley: University of California Press.

Ashbrook, J.B., (1988). *The Brain and Belief.* Bristol: Wyndham Hall. (Cited by Iaccino, 1993, p. 3).

Broadbent, Geoffrey, (1995). "Architectural Education". In: Martin Pearce and Maggie Toy ed. Educating Architects. London: Academy Editions, 1995, pp. 10-23.

Broadbent, Martinez, Cardaci, Zoilo, (1998). "The Design Studio Revisited". *Environmental Design*. Vol.2, Number 1.

Bruner, J.S., (1966). *Toward a Theory of Instruction*. New York: Norton.

Bryden, M.P., (1982). *Laterality, Functional Asymmetry in the Intact Brain*. Academic Press.

Buchanan, William, (edition) (1989a). *Mackintosh's Masterwork – The Glasgow School of Art*. Berlin: Ernst and Sohn.

Buchanan, P., (1989b). "What Is Wrong with Architectural Education?", *Architectural Review*. Vol. 185, No. 1190, pp. 24-26.

Bulletin 1992-1993, University of Tehran, School of Fine Arts, Departments of Architecture and Urban Planning. Tehran: University of Tehran Press. [Mahmoodi, Amir S., translated and compiled data from the School's Education Office, in 1992]

Capon, David Smith, (1999a). *Architectural Theory, Volume One: The Vitruvian Fallacy, A History of the Categories in Architecture and Philosophy*. West Sussex: John Waley & Sons.

Capon, David Smith, (1999b). *Architectural Theory, Volume Two: Le Carbusier's Legacy, Principles of Twentieth-century Architectural Theory Arranged by Category*. West Sussex: John Waley & Sons.

Carr, Edwards H. (1964). *What is History?* Harmondsworth: Penguin.

Carlhian, J.P., (1976). "Beaux-Arts or Bozarts?". *Architectural Record*, 159 (1), 131-134.

Carolin, P., (1992). "Expectation Versus Reality in Architectural Education". In: F. Duffy ed. Strategic Study of the Profession Phase 1: Strategic Overview. London: RIBA Publications, 1992, p. 171.

Cattel, R.B. and **Drevdahl**, J.E., (1955). "A Comparison of the Personality Profile (16PF) of Eminent Researchers with that of Eminent Teachers and Administrators, and of the General Population". *British Journal of Psychology* 46, 248-261.

Chi, MTH., **Glser**, R., and **Rees**, E., (1982). "Expertise in Problem Solving". In: R.J. Sternberg ed. Advances in the Psychology of Human Intelligence. N.J.: Lawrence Erlbaum Associates, 1982, Vol. 1.

Ching, Francis DK., (1979). *Architecture: Form, Space and Order*. NY.: Van Nostrand Reinhold.

Ching, Francis DK., (1996). *A Visual Dictionary of Architecture*. NY.: Van Nostrand Reinhold.

Chomsky, Noam, (1957). *Syntactic Structures*. 'S-Gravenhage: Mouton and Co.

Asimow, M., (1962). *Introduction to Design.* New Jersey: Prentice-Hall.

Baker, T.L., (1988). *Doing Social Research.* New York: McGraw-Hill.

Balfour, A., (1995). "The Architectural Association". In: Martin Pearce and Maggie Toy ed. Educating Architects. London: Academy Editions, 1995, pp. 78-79.

Banham, Reyner, (1960). *Theory and Design in the First Machine Age.* New York: Praeger.

Barron, Frank, (1965). "The Psychology of Creativity", *New Directions in Psychology II.* New York: Holt, Rinehart and Winston. pp. 1-134.

Bartlett, Sir F., (1961). *Remembering.* Mass: Cambridge University Press.

Bayer, H., et al., (1959). *Bauhaus, 1919-1928, Branford, Boston*, New York: The Museum of Modern Art.

Bazjanac, Vladimir, (1974). "Architectural Design Theory: Models of the Design Process". In: Basic Questions of Design Theory. New York: American Elsevier, 1974, pp. 3-20.

Bever, T.G., (1970). "The Cognitive Basis for Linguistic Structures". In: J.R. Hayes ed. Cognition and the Development of Language . New York: Wiley.

Bloor, David, (1983). *Wittgenstein: A Social Theory of Knowledge.* New York: Columbia University Press.

Bogen, JE., (1977). "Some Educational Implications of Hemispheric Specialisation". In: M.C. Wittrock ed. The Human. N.J.: Prentice Hall.

Boring, E., (1950). *A History of Experimental Psychology.* New York: Appleton-Crofts.

Bradshaw, JL., and **Nettleton**, NC., (1983). *Human Cerebral Asymmetry.* N.J.: Prentice Hall.

Broadbent, Geoffrey, (1973). *Design in Architecture: Architecture and the Human Sciences.* UK: John Wiley and Sons.

Broadbent, Geoffrey, (1975). "Function and Symbolism in Architecture". In: Basil Honikman ed. Responding to Social Change. Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1975, pp. 73-95.

Broadbent, G., **Bunt**, R., and **Jenks**, C., (edition) (1980). *Signs, Symbols and Architeure.* Chichester: Wiley.

Broadbent, Geoffrey, (1985). "On Reading Architectural Space". *Espaces et Societes*, no.47, Paris: L'Harmattan.

Broadbent, Geoffrey, (postscript), (1988). *Design in Architecture: Architecture and the Human Sciences.* London: David Fulton Publishers.

Broadbent, Geoffrey, (1990). *Emerging Concepts in Urban Space Design.* London: Van Nostrand Reinhold.

Broadbent, Geoffrey, (1995). "Architectural Education". In: Martin Pearce and Maggie Toy ed. Educating Architects. London: Academy Editions, 1995, pp. 10-23.

Broadbent, Martinez, Cardaci, Zoilo, (1998). "The Design Studio Revisited". *Environmental Design*. Vol.2, Number 1.

Bruner, J.S., (1966). *Toward a Theory of Instruction*. New York: Norton.

Bryden, M.P., (1982). *Laterality, Functional Asymmetry in the Intact Brain*. Academic Press.

Buchanan, William, (edition) (1989a). *Mackintosh's Masterwork – The Glasgow School of Art*. Berlin: Ernst and Sohn.

Buchanan, P., (1989b). "What Is Wrong with Architectural Education?", *Architectural Review*. Vol. 185, No. 1190, pp. 24-26.

Bulletin 1992-1993, University of Tehran, School of Fine Arts, Departments of Architecture and Urban Planning. Tehran: University of Tehran Press. [Mahmoodi, Amir S., translated and compiled data from the School's Education Office, in 1992]

Capon, David Smith, (1999a). *Architectural Theory, Volume One: The Vitruvian Fallacy, A History of the Categories in Architecture and Philosophy*. West Sussex: John Waley & Sons.

Capon, David Smith, (1999b). *Architectural Theory, Volume Two: Le Carbusier's Legacy, Principles of Twentieth-century Architectural Theory Arranged by Category*. West Sussex: John Waley & Sons.

Carr, Edwards H. (1964). *What is History?* Harmondsworth: Penguin.

Carlhian, J.P., (1976). "Beaux-Arts or Bozarts?". *Architectural Record*, 159 (1), 131-134.

Carolin, P., (1992). "Expectation Versus Reality in Architectural Education". In: F. Duffy ed. Strategic Study of the Profession Phase 1: Strategic Overview. London: RIBA Publications, 1992, p. 171.

Cattel, R.B. and **Drevdahl**, J.E., (1955). "A Comparison of the Personality Profile (16PF) of Eminent Researchers with that of Eminent Teachers and Administrators, and of the General Population". *British Journal of Psychology* 46, 248-261.

Chi, MTH., **Glser**, R., and **Rees**, E., (1982). "Expertise in Problem Solving". In: R.J. Sternberg ed. Advances in the Psychology of Human Intelligence. N.J.: Lawrence Erlbaum Associates, 1982, Vol. 1.

Ching, Francis DK., (1979). *Architecture: Form, Space and Order*. NY.: Van Nostrand Reinhold.

Ching, Francis DK., (1996). *A Visual Dictionary of Architecture*. NY.: Van Nostrand Reinhold.

Chomsky, Noam, (1957). *Syntactic Structures*. 'S-Gravenhage: Mouton and Co.

Churchman, C. West, **Ackoff**, Russell L., and **Leonard**, E., (1967). *Introduction to Operations Research*. New York: John Wiley.

Cobb, H.N., (1985). "Architecture and the University". *Architectural Record*. September, 43.

Cohen, Louis, and **Manion**, Lawrence, (1994). *Research Methods in Education*. 4th ed. NY.: Routledge.

Cold, Brigit, (1995). "Tree of the Sketch". In: Martin Pearce and Maggie Toy ed. Educating Architects. London: Academy Editions, 1995, pp. 60-63.

Collins, P., (1979). "The Eighteenth Century Origins of Our System of Full-Time Architectural Schooling". *Journal of Architectural Education*. 33 (2), 2-6.

Colquhoun, Alan, (1981). *Essays in Architectural Criticism: Modern Architecture and Historical Change*. Cambridge: Oppositions Books and MIT Press. 43-50.

Conway, Hazel, and **Roenisch**, Rowan, (1994). *Understanding Architecture: An Introduction to Architecture and Architectural History*. London: Routledge.

Crinson, M., and **Lubbock**, J., (1994). *Architecture, Art or Profession?* Manchester: Manchester University Press.

Cross, A., (1983). "The Educational Background to the Bauhaus". *Design Studies*, 4(1), 43-52.

Cross, A., (1984). "Towards An Understanding of the Intrinsic Values of Design Education". *Design Studies*, Vol. 5, No 1.

Cross, N., and, **Nathenson**, M., (1981). "Design Methods and Learning Methods". In: R. Jacques and JA. Powell ed. Design Science. (s.l.): Method IPC.

Crotty, Michael, (1998). *The Foundations of Social Research*. Australia: Allen & Unwin.

Crowe, Norman, and **Laseau**, Paul, (1984). *Visual Notes for Architects and Designers*. New York: Van Nostrand Reinhold.

Crysler, Greig, (1995). "Critical Pedagogy and Architectural Education". *Journal of Architectural Education*. Vol. 48, No. 4, pp. 208-217.

Culter, Laurence Stephan, and **Culter**, Sherrie Stephens, (1982). *Recycling Cities for People: The Urban Design Process*. 2nd ed. Boston, Mass.: CBNI Publishing.

Cunningham, A., (1980). "Educating Around Architecture", *Studies in Higher Education*. 5(2), 131-142.

Cunningham, A., (1993). *Architecture as Education*. London: University of Westminster.

Curtis, William J.R., (1982). *Modern Architecture; since 1900*. New Jersey: Prentice-Hall, Inc.,

Darke, J., (1978). "The Primary Generator and the Design Process". In W.E. Rogers and W.H. Ittelson ed. New Directions in Environmental Design Research: Proceedings of EDRA 9. Washington: EDRA, 1978, pp. 325-337. [Cited by Bryan Lawson, 1990].

Darke, J., (1979). "The Primary Generator and the Design Process". *Design Studies*. Vol. 1, No.1.

Davey, p., (1989). "Profession or Art?". *Architectural Review*. 185 (1109), 59-66.

Day, Christopher, (1990). *Places of Soul*. London: The Aquarian Press.

de Bono, E., (1970). *Lateral Thinking: A Textbook of Creativity*. (s.l.): Ward Lock.

de Bono, E., (1981). "What is Design?". *The Designer*. July.

Descartes, Rene, (1637). *Discourse on Method*. Translated by A. Wollaston. Harmondsworth: Penguin.

Dewey, John, (1920). *How We Think?* London: Heath.

Diamond, SJ., and, **Beaumont**, JG., (1974). *Hemisphere Function in the Human Brain*. (s.l.): Paul Elek.

Dickerson, S.L., and **Robertshaw**, J.E., (1975). *Planning and Design the Systems Approach*. Lexington, Mass.: (s.n.)

DiPasquale, R. (1990). "Case-study Method: Architectural Education". *Progressive Architecture*. Vol. 71, (5), p. 63.

Duerk, Donna P., (1993). *Architectural Programming: Information Management for Design*. New York: Van Nostrand Reinhold.

Duffy, Francis, (1995). "Education in Architecture". In: Martin Pearce and Maggie Toy ed. Educating Architects. London. Academy Editions, 1995, pp. 120,121.

Dutton, Thomas, (1991). "Cultural Politics and Pedagogy". In: Thomas Dutton ed. Voices in Architectural Education. New York: Bergin & Gravey, 1991.

Dunker, (1945). *On Problem Solving*. Translated by Lynne S. Lees. Washington: American Psychology Association.

Edwards, Betty, (1981). *Drawing on the Right Side of the Brain*. Souvenir.

Edwards, Betty, (1992). *Drawing on the Right Side of the Brain: How to Unlock Your Hidden Artistic Talent*. New revised edition. London: Harper Collins.

Eisenman, Peter, (1992). "Visions' Unfolding: Architecture in the Age of Electronic Media". *Domus*, 734 (January), pp. 21-24.

Ellington, H., **Percival**, F., and **Race**, P., (1993). *Handbook of Educational Technology*. London: Kogan Page.

Esherick, J., (1983). "The Beaux-Arts Experience". *Architectural Education*. 1, 23-51.

Faruque, Omar, (1984). *Graphic Communication as a Design Tool.* NY.: Van Nostrand Reinhold.

Filson, R., (1985). "Can Schools Span the Gap to Practice?". *Architectural Record.* November: 59.

Fisher, T., (1989). "P/A Reader Poll: Education". *Progressive Architecture.* February: 15.

Fowler, T., (1985). "What Are Students Concerned About?". *Architectural Record.* May: 61.

Forbes, P., (1985). "Why can't Johnny learn to read?". *Architectural Record.* February: 45.

Foster, Michael, (1982). *The Principles of Architecture: Style, Structure and Design.* UK: Quill Publishing.

Fox, R.D., (1984). "A Student's Long Path to Arcadia". *Architectural Record.* April: 53.

Freud, Sigmund, (1900). *Die Traumdeutung.* (s.l.): Leipzig and Wien.

Frye, Richard, N., (1962). *The Heritage of Persia.* London: Weidenfeld and Nicolson.

Gage, N.L., and **Berliner**, D.C., (1991). *Educational Psychology.* 5th ed. Boston: Houghton Mifflin Company.

Garcia, Raul, (1982). "Towards a Comprehensive Design Methodology". (mimeographed)[cited by Jon Lang, 1987].

Gardner, R., (1974). "The Development of Architectural Education in the UK". *The Architects' Journal*, 9, 873-881.

Gardiner, Bruce, (1969). *Solving Problems in Mechanics.* Edinburgh: Oliver and Boyd.

Gazzaniga, M., (1983). "Right Hemisphere Language Following Brain Bisection: A 20 Year Perspective". *American Psychologist*, Vol. 38, No 5, May.

Ghauri, P. N., **Gronhaug**, K., and **Kristianslund**, I., (1995). *Research Methods in Business Studies: A Practical Guide.* New York: Prentice Hall.

Ghiselin, Brewster, (edition), (1952). *The Creative Process.* Berkeley, California: University of California Press.

Ghonaimah, Abdol-rahim, (1993). "History of Great Islamic Universities". Translated into Persian by Noor-allah Kassaii. Tehran, Iran: University of Tehran Press.

Giedion, S., (1954). *Walter Gropius.* New York: Reinhold.

Gilhooly, K.J., (1996). *Thinking: Directed, Undirected and Creative.* 3rd ed. London: Academic Press.

Gill, J., and **Johnson**, P., (1997). *Research Methods for Managers.* 2nd ed. London: Paul Chapman Publishing.

Giroux, H.A., 1991. "Border Pedagogy and the Politics of Modernism/Postmodernism". *JAE.*, 44(2), 69-79.

Good, T.L., and **Brophy**, J.E., (1990). *Educational Psychology: A Realistic Approach.* 4th ed. New York and London: Longman.

Gordon, J., (1961). *Foundation Design Simply Explained.* London: Oxford University Press.

Gradidge, R., (1990). "Pupils or Students". *Architectural Journal*, 192, (23), 26-27.

Grant, Brad, (1991). "Cultural Invisibility: The African American Experience in Architectural Education". In: T. Dutton ed. Voices in Architectural Education, 1991, p. 151.

Grant, Donald P., (1975). "Aims and Potentials of Design Methodology". In: Basil Honikman ed. Responding to Social Change. Stroudsburg, Pa.: Hutchinson and Ross, 1975, pp. 96-108.

Grant, Donald P., (1982). *Design by Objectives: Multiple Objective Design Analysis and Evaluation in Architectural, Environmental and Product Design.* San Luis Obispo, Ca.: Design Methods Group.

Green, Ronald, (1962). *The Architect's Guide to Running a Job.* London: Architectural Press.

Greenberg, Allan, (1994). "Why Classical Architecture is Modern?". *Architecture*, 83 (November), 57-63.

Gregory, S.A., (edition), (1966). *The Design Method.* London: Butterworths.

Groat, Linda, and **Ahrentzen**, Sherry, (1996). "Reconceptualising Architectural Education for a More Diverse Future: Perceptions and Visions of Architectural Students". *Journal of Architectural Education*, Vol. 49, No. 3, pp. 166-183.

Gropius, W., (1935). *The New Architecture and the Bauhaus.* Translated by Shand P. Morton. London: Faber.

Gropius, W., (1983). "The Bauhaus", *Architectural Education*, 1, 53-79.

Gugelot, H., (1963). "Industrial Design in Practice". *Zeitschrift der Hochschule fur Gestaltung.*

Gutman, R., (1987). "Education and the World of Practice". *Journal of Architectural Education*, 40 (2), 24.

Hamilton, Richard, and **Ghatala**, Elizabeth, (1994). *Learning and Instruction.* New York: Mc Graw-Hill.

Hampden-Turner, C., (1981). *Maps of Mind.* (s.l.): Mitchell Beazley.

Hanna, Paul R., and **Hanna**, Jean S., (1987). *Frank Lloyd Wright's Hanna House: The Client's Report.* 2nd ed. Carbondale, Ill.: Southern Illinois University Press.

Iansford, G.J., and **Smith**, R.A., (1980). "Design Education - the Ecole des Beaux-Arts Approach". *SIAJ*, 99, 5-9.

Harris, Cyril M., (1998). *American Architecture: An Illustrated Encyclopaedia*. New York: WW. Norton and Company.

Hasegawa, Itsuko, (1991). "Architecture as Another Nature". In: Andreas Papadakis ed. Architectural Design. London: Academy Group Ltd. 1991, pp. 14-15.

Hearn, M.F., (1990). *The Architectural Theory of Viollet-le-Duc*. Mass.: Massachusets Institute of Technology.

Heath, Tom, (1984). *Method in Architecture*. New York: Van Nostrand Reinhold.

Heinlein, T.G., (1981). *Rethinking Architectural Education*. New York: Mc Graw-Hill.

Helmholtz, (1912). *Founder of Modern Psychology*. N.Y.: Appleton and Co..

Hume, D., et.al., (1930). *Five Types of Ethical Theory*. London: Kegan Paul and Co.

Humphery, G. (1963). *Thinking: An Introduction to Its Experimental Psychology*. New York: John Wiley and Sons.

Iaccino, James, C. (1993). *Left Brain- Right Brain Differences- Inquiries, Evidence, and New Approaches*. New Jersey: Lawrence Elbaum Associates, Inc.

International Association of Universities, (1998). 15th ed. UK.: Macmillan Reference Ltd.

Jackson, Anthony, (1995). *Reconstructing Architecture for the Twenty-First Century: An Inquiry into the Architect's World*. Canada: University of Toronto.

Jamison, K., (1995). *An Unquiet Mind: A Memoir of Moods and Madness*. London: Picador.

Jenks, C., (1987). *Modern Movements in Architecture*. Harmondworth: Penguin Books.

Jenks, Charles, and **Kropf**, Karl, (edition), (1997). *Theories and Manifestoes of Contemporary Architecture*. West Sussex: Academy Editions.

Johnson-Larid, P.N., (1988). *The Computer and the Mind*. Cambridge, Ma.: Harvard University Press.

Johnson-Larid, P.N., (1989). "Freedom and Constraint in Creativity". In: R.J. Sternberg ed. The Nature of Creativity. New York: Cambridge University Press, 1989, pp. 202-219.

Jones, JC., (edition), (1963). "A Method of Systematic Design". *Conference on Design Methods*. Oxford: Pergamon.

Jones, JC., (1970). *Design Methods*. (s.l.): Wiley Interscience.

Jordan, Furneaux R., (1969). *A Concise History of Western Architecture*. London: Thames and Hudson.

Kasprisin, Ronald J., (1995). *Visual Thinking for Architects and Designers*. NY.: Van Nostrand Reinhold.

Kaufman, (1955). *An American Architecture: Frank Lloyd Wright*. N.Y.: Horizon Press.

Kemmis, S., and **McTaggart**, R., (1998). *The Action Research Planner*. 3rd ed. Victoria: Deakin University.

Kiani, M.Y., (1987). *Iranian Architecture: Islamic Period*. Tehran: Ershad-e Islami Publications. [The original text in Persian]

Kidder, L., and **Judd**, C., (1986). *Research Methods in Social Relations*. N.Y.: Holt, Rinehart and Winston.

Kimura, D., (1961). "Cerebral Dominance and the Perception of Verbal Stimuli". *Canadian Journal of Psychology*, 15, 166-171.

Kirton, M., (1989). *Adaptors and Innovators: Styles of Creativity and Problem-solving*. London: Routledge.

Klinger, Eric, (1971). *Structure and Functions of Fantasy*. N.Y.: Wiley-Interscience.

Klinger, Eric, (1977). *Meaning and Void: Inner Experience and the Incentives in People's Lives*. Minneapolis: University of Minnesota Press.

Klinger, Eric, (1978). "Modes of Normal Conscious Flow". In: K.S. Pope and J.L. Singer ed. The Stream of Consciousness . N.Y.: John Wiley.

Koestler, A., (1964). *The Act of Creation*. London: Hutchinson.

Koffka, K., (1935). *Principles of Gestalt Psychology*. New York: Harcourt and Brace.

Kohler, Wolfgang, (1929). *Gestalt Psychology*. New York: Liveright.

Konya, Allan, (1980). *Design Primer for Hot Climates*. London: Architectural Press.

Kostof, Spiro, (edition), (1977). *The Architect – Chapters in the History of the Profession*. New York: Oxford University Press.

Krier, Rob, (1979). *Urban Space*. N.Y.: Rozzoli.

Krier, Rob, (1995). "Architecture and Urban Design". In: Martin Pearce and Maggie Toy ed. Educating Architects. London: Academy Editions, 1995, p. 105.

Lang, Jon, (1987). *Creating Architectural Theory: The Role of the Behavioral Sciences in Environmental Design*. New York: Van Nostrand Reinhold Company.

Lang, Jon, **Burnette**, Charles, **Moleski**, Walter, and **Vachon**, David, (1974). *Designing for Human Behaviour: Architecture and the Behavioural Sciences*. Stroudsburg, Penn.: Dowden, Hutchinson, and Ross.

Laseau, Paul, (1989). *Graphic Thinking for Architects and Designers*. New York: Van Nostrand Reinhold.

Laugier, Marc-Antonie, (1753). *Essai sur L'architecture.* Republished 1966. Farborough: Gregg Press.

Lawson, Bryan. R., (1990). *How Designers Think? The Design Process Demystified.* 2nd ed. London: Butterworth Architecture.

Lawson, Bryan, (edition), (1993). *The Art of the Process.* London: RIBA, pp. 6-10.

Le Corbusier, (1923). *Vers une architecture.* English translation by F. Etchells, *Towards a New Architecture.* New York: Praeger.

Levy, J., (1969). "Possible Basis for the Evolution of Lateral Specialisation of the Human Brain". *Nature.*

Levy, J., (1983). "Language, Cognition, and the Right Hemisphere: A Response to Gazzaniga". *American Psychologist,* Vol. 38, No 5, May.

Lowe, Jeremy, (1970). "Reliability of Assessments". *Journal of Architectural Research and Teaching.* Vol.1.

Mac Cormac, Richard, (1968). "The Anatomy of Wright Aesthetic". *Architectural Review,* Vol. 143, No. 852, pp. 143-146.

MacKinnon, Donald W., (1962). "The Personality Correlates of Creativity: A Study of American Architects". In: G.S. Nielsen ed. Proceedings of the XIV International Congress of Applied Psychology. Copenhagen: Munksgaard.

MacKinnon, Donald W., (1963). "The Characteristics of Creative Architects and Further Reflections on the Implications for Architectural Education". In: Marcus Wiffen ed. The Teaching of Architecture. Washington, D.C.: AIA Press.

MacKinnon, Donald W., (1967). "The Study of Creative Persons: A Method and some Results". In: Jerome Kagan ed. Creativity and Learning. Boston: Houghton Mifflin.
Maldonado, T., (1972). *Design, Nature and Revolution: Toward a Critical Ecology.* New York: Harper and Row.

Maldonado, T., and **Bonsiepe**, G., (1964). "Science and Design". *Ulm,* May :10-11.

Maxwell, Joseph A., (1996). *Qualitative Research Design: An Interactive Approach.* Thousand Oaks, Ca.: SAGE.

Mayer, R.E., (1983). *Thinking, Problem Solving, Cognition.* New York: W.H., Freeman and Company.

McKim, RH., (1980). *Thinking Visually: A Strategy Manual for Problem Solving.* (s.l.): Wadsworth.

Mesarovic, MD., (1964). *Views on General Systems Theory.* New York: Wiley.

Meyer, Hannes, (1928). "Building Bauhaus". *Zeitschrift fur Gestaltung* (Dessau), 2, 4: 153 [cited by Rowe, 1987].

Mitchell, O.J., (1984). "ACSA – The Member Schools Should Celebrate Their Diversity". *Architectural Record,* January: 17.

Mitgang, Lee, and **Boyer**, E.L., (1996). "A Special Report: Building Community: A New Future for Architecture Education and Practice". US.: Carnegie Foundation.

Moore, G.T., (edition), (1970). "Emerging Methods in Environmental Design and Planning". *Proceedings of the Design Methods Group First International Conference*. Mass.: MIT Press.

Moore, G.T., and **Gay**, L.M., (1967). "Creative Problem-solving in Architecture – A Pilot Study". *Department of Architecture*. Berkeley: University of California at Berkeley.

Muir, T., (1991). "All Together". *Architects' Journal*, 20 March: 32.

Mukarovsky, Jean, (1981). *Structure, Sign and Function*. New Haven: Yale University.

Nadimi, Hamid, (1996). *Conceptualising a Framework for Integrity in Architectural Education with Some References to Iran*. Ph.D. thesis, University of York, U.K.

Nesbitt, Kate, (edition), (1996). *Theorising A New Agenda for Architecture – An Anthology of Architectural Theory 1965-1995*. New York: Princeton Architectural Press.

Newell, A., **Shaw**, JC., and **Simon**, HA., (1957). "Elements of a Theory of Problem Solving". *Rand Corporation Report P-971*. March. [Cited by Rowe, 1987].

Norberg-Schultz, C., (1966). *Intentions in Architecture, Universitetsforlaget*. (s.l.): Allen and Unwin.

Osborn, A.F., (1953). *Applied Imagination*. New York: Scribners.

Palladio, (1570). *Quattro Libri dell' Architectura 4Pt*. Fol. Venetia: (s.n.)

Palmer, Mickey A. (1981). *The Architect's Guide to Facility Programming*. Washington, D.C.: AIA Press.

Papadakis, Andreas, **Broadbent**, Geoffrey, and **Toy**, Maggie (edition), (1992). *Free Spirit in Architecture*. London: Academy Editions.

Pawley, M., (1983). "Canterbury: The Architect's Tale". *Architects' Journal*. October 12, : 68.

Pearce, Martin and **Toy**, Maggie, (edition), (1995). *Educating Architects*. London: Academy Editions.

Pena, William M., **Parshall**, Stephen A., and **Kelly**, Kevin A.. (1987). *Problem Seeking: An Architectural Programming Primer*. 3rd ed. Washington, D.C.: AIA Press.

Perkins, P.N., (1981). *The Mind's Best Work*. Cambridge, Mass.: Harvard University Press.

Pohl, Jens, A. **Chapman**, L. **Chirica**, R. **Howell**, and **Myers** L. (1998). *Implementation Strategies for Prototype ICADS Working Model*. Technical Report, CADRU-02-88, CAD Research Unit, Design and Construction Institute, College of Architecture and Environmental Design, Cal Poly, SanLuis Obispo, California.

Pohl, J., **Myers** L., and **Chapman** A. (1994). *Thoughts on the Evolution of Computer-Assisted Design.* Technical Report, CADRU-09-94, CAD Research Center, Design and Construction Institute, College of Architecture and Environmental Design, Cal Poly, SanLuis Obispo, California.

Poizner, H., **Klima**, and **Bellugi**, (1990). *What the Bands Reveal about the Brain.* Cambridge, Ma.: MIT Press. [Cited by Iaccino, 1993]

Popper, K., (1963). *Conjectures and Refutations: The Growth of Scientific Knowledge.* London: Routledge and Kegan Paul.

Preiser, Wolfgang, (edition), (1978). *Facility Programming: Methods and Applications.* Stroudsburg, Pa.: Dowden, Hutchinson and Ross.

Preiser, Wolfgang F. E., (edition), (1985). *Programming the Built Environment.* New York: Van Nostrand Reinhold.

Pressley, M., and **McCormick**, C.B., (1995). *Advanced Educational Psychology, for Educators, Researchers, and Policymakers.* New York: Harper Collins College Publishers.

Rapoport, Amos, (1982). *Human and Energy Factors in Urban Planning.* MA.: Hingham.

Rapoport, A., (1983). "Studious Questions". Architects' Journal. (26 Oct.): 55.

RIBA, (1991). *Handbook of Architectural Practice and Management.* London: RIBA.

RIBA, (1996). *Schools of Architecture Recognised by the Royal Institute of Architects.* London: RIBA.

Rickards, T., (1980). "Designing for Creativity: A State of the Art Review". *Design Studies.* Vol. 1, No 5, July.

Ricouer, Paul, (1977). *The Rule of Metaphor.* Translated by R. Czerny, et al. Toronto: University of Toronto Press.

Risebero, Bill., (1982). *Modern Architecture and Design: An Alternative History.* Mass.: MIT Press.

Rittel, Horst, (1970). "Some Principles for the Design of Educational Systems for Design". *Journal of Architectural Education* 26, No. 1-2 : 16-26.

Rittel, Horst, (1972). "Son of Rittel Think", *Design Methods Group 5th Anniversary Report.* January: 5-10.

Roe, A., (1952). *A Psychological Study of Eminent Biologists.* Washington: American Psychological Association.

Rogers, Richard, (1985). "Observations on Architecture". In: Frank Russell ed. <u>Architectural Monographs: Richard Rogers + Architects</u>. London: Academy Editions.

Rowe, Colin, (1983). *Collage City.* Mass.: MIT Press.

Rowe, Peter G., (1987). *Design Thinking.* Cambridge, Mass.: MIT Press.

Rudofsky, Bernard, (1964). *Architecture Without Architects*. New York: Museum of Modern Art.
Salvadori, Mario G., (1974). "Is Automated Design Possible?" In: R. Spillers ed. Basic Questions of Design Theory. New York: American Elsevier. pp. 95-102.

Sanoff, Henry, (1977). *Method of Architectural Programming*. Stroudsburg, Pa.: Dowden, Hutchinson and Ross.

Sanoff, Henry, (1991). *Visual Research Methods in Design*. New York: Van Nostrand Reinhold.

Sayer, A., (1992). *Method in Social Science*. London: Routledge Publication.

Sergeant, John, (1984). *Frank Lloyd Wright's Usonian Houses – The Case for Organic Architecture*. New York: Watson-Guptill.

Schon, Donald, (1984). *The Reflective Practitioner*. New York: Basic Books.

Schon, Donal, (1985). *Architecture and the Higher Learning; The Design Studio, An Exploration of its Traditions and Potentials*. London: RIBA Publications.

Schon, D.A., 1988. "Toward a Marriage of Artistry and Applied Sciences in the Architectural Design Studio". *Journal of Architectural Education*, 41 (4), 4-10.

Scruton, Roger, (1994). *The Classical Vernacular: Architectural Principles in an Age of Nihilism*. Manchester: Carcanet.

Simon, Herbert A., (1957). *Models of Man*. New York: John Wiley.

Simon, Herbert A., (1960). *The New Science of Management Decisions*. N.Y.: Harper.

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

Simon, H.A., and **Hyes**, J.R., (1976). "The Understanding Process: Problem Isomorphs". *Cognitive Psychology* 8, 165-190.

Skinner, B.F., (1953). *Science and Human Behaviour*. New York: Free Press.

Slavin, R.E., (1984). *Research Methods in Education: A Practical Guide*. New Jersey: Prentice-Hall, Inc.

Slavin, R.E., (1991). *Educational Psychology, Theory into Practice*. 3rd ed. Boston: Allyn and Bacon.

Slavin, Robert E., (1984). *Research Methods In Education: A Practical Guide*. Englewood Cliffs, NJ.: Prentice Hall Inc.

Smith, H. L., (1984). "1984 – Architectural Education's Year of Challenge". *Architectural Record*, January : 43.

Smith, H.W., (1981). *Strategies of Social Research*. 2nd ed. London: Prentice-Hall International Inc.

Smith, Peter, and **Fredrick**, Peter, (1987). *Architecture and the Principle of Harmony*. London: RIBA Publications.

Smith, Peter, and **Leslie**, Peter, (1992). *Canal Architecture*. (s.l.): Shire.

Sperry, RW., (1974). *Lateral Specialisation in the Surgically Separated Hemispheres*. Mass.: MIT Press.

Sperry, RW., (1982). *Science and Moral Priority: Merging of Mind, Brain, and Values*. N.Y.: Columbia University Press.

Sperry, RW., (1985). *Consciousness, Personal Identity, and the Divided Brain*. (s.l.): Guilford Press.

Sperry, RW., (1990). *Brain Circuits and Functions of the Mind: Essays in Honour of Roger W. Sperry*. Cambridge University Press.

Springer, S. P., **Deutsch**, G., (1989). *Left Brain, Right Brain*. New York: W. H. Freeman.

Springer, Sally P., and **Deutsch**, George, (1998). *Left Brain, Right Brain: Perspectives from Cognitive Neuroscience*. 5th ed. New York: Freeman and Company.

Stein, Morris, (1975). *Stimulating Creativity*. N.Y.: Academic Press.

Stenhouse, L., (1979). *What Is Action-Research*? Norwich C.A.R.E., Norwich: University of East Anglia, (mimeo).

Sternberg, Robert J., (1997). *Thinking Styles*. New York: Cambridge University Press.

Stevens, Garry, (1998). "Angst in Academia: Universities, the Architecture Schools and the Profession". *Journal of Architectural and Planning Research*, 15: 2, pp. 152-169.

Stirling, J., (1978). "Beaux-Arts Reflections", *AD*., 48 (11-12).

Stubbs, M.S., (1987). "Technical Education of Architects". *Architecture*, August: 73.

Studer, Raymond, (1970). "The Dynamics of Behaviour-Contingent Physical Systems". In: Harold Proshansky et al. Ed. Environmental Psychology: Man and his Physical Setting. New York: Holt, Reinehart and Winston.

Sudman, Seymour, and **Bradburn**, Norman M., (1982). *Asking Questions: A Practical Guide to Questionnaire Design*. San Francisco, Ca.: Jossey-Bass Inc.

Swinburne, Herbert H., (1967). "Change Is the Challenge". *AIA Journal*, (May) :83-90.

The Great Encyclopaedia of Islam. (1995). Centre of the Great Encyclopaedia of Islam, Tehran. [Original text in Persian]

Teymur, Necdet, (1992). *Architectural Education: Issues in Educational Practice and Policy*. London: (s.n.)

Thornley, D.G., (1963). "Design Method in Architectural Education". In: C. Jones and D.G. Thornley ed. Conference on Design Methods. Oxford: Pergamon.

Tovey, Michael, (1984). "Designing with Both Halves of the Brain". *Design Studies*, 5,4 (October), 219-228.

Tsui, Eugene, (1999). *Evolutionary Architecture: Nature as a Basis for Design*. N.Y.: John Wiley.

Varnelis, Kazys, (1994). *The Spectacle of the Innocent Eye: Vision, Cynical Reason, and the Discipline of Architecture in Postwar America*. Ph.D. thesis, Cornell University.

Varnelis, K. (1998). "The Education of the Innocent Eye". Journal of Architectural Education, 51, 4.

Vitruvius, (1914). "The Ten Books on Architecture". Translated by MH. Morgan, New York: Dover Publications.

Wakely, PI., (1983). "Architectural Education in Latin America; Concerns and Conflicts". *Architectural Education*, 2, 37-46.

Wallas, G., (1926). *The Art of Thought*. London: Jonathan Cape.

Watson, J., (1930). *Behaviourism*. New York: Norton.

Watts, Ronald D. (1966). "The Elements of Design". In: S.A. Gregory ed. The Design Method. London: Butterworths. p. 85.

Watson, J.B., (1913). "Psychology as the Behaviourist Views It". *Psychological Review*, 20, : 158-177.

Weaver, Nicholas, (1997). "Atelier Principle in Teaching". Paper delivered at the Conference on Project Based Learning. University of Roskilde, Denmark, 14-17 September.

Wertheimer, Max, (1945). *Productive Thinking*. New York: Harper and Row.

White, Edward T., (1972). *Introduction to Architectural Programming*. Tuscon, Arizona: Architectural Media.

White, Edward T., (1983). *Site Analysis: Diagramming Information for Architectural Design*. Tuscon, Arizona: Architectural Media.

Whitfield, PR., (1975). *Creativity in Industry*. (s.l.): Penguin.

Wigley, Mark, and **Johnson**, Philip, (editions), (1988). *Deconstructivist Architecture*. New York: The Museum of Modern Art.

Wines, J., (1984). "A Vivid Challenge to the Status Quo". *Architectural Record*, November: 51.

Wingler, Hans, (1969). "The Bauhaus". Ttranslated by Wolfgang Jabs and Basil Gilbert, edited by Joseph Stein. Cambridge, Mass.: MIT Press.

Wittrock, M., 1987. "Models of Heuristic Teaching". In: M. Dunkin ed. The International Encyclopaedia of Teaching and Teacher Education. Oxford: Pergamon Press.

Wright, Frank Lloyd, (1936). "Recollections. The United States: 1893-1920," July 16 - August 6. [Cited by Edgar Kaufmann (1955), p. 258.]

Yin, R.K., (1984). *Case Study Research, Design and Methods*. London: SAGE Publications.

Yin, R.K., (1994). *Case Study Research, Design and Methods*. 2nd ed. London: SAGE Publications.

Zeisel, John, (1981). *Inquiry by Design: Tools for Environment-Behaviour Research*. Monterey, Ca.: Brooks/Cole.

URL References

URL-0, Dick, B., (1999), "What Is Action Research?", http://www.scu.edu.au/schools/sawd/ari/whatisar.html **[Accessed 22/9/1999]**

URL-1, CADRC, Computer Assisted Design Research Center, California Polytechnic State University, San Luis Obispo, Ca. http://www.csc.calpoly.edu. **[Accessed 23/10/2000]**

URL-2, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, Brain Based Visual Education, Laterality, Department of Art and Design, Iowa State University, http://www.design.iastate.edu/ART/NAB/laterality2.html, **[Accessed 5/1/2000]**

URL-3, De Bono, Thinking messages, http://www.edwdebono.com/debono/msg04.htm, **[Accessed 15/2/2000]**

URL-4, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, Laterality: Key Functions of the Two Hemispheres, Department of Art and Design, Iowa State University, http://www.public.iastate.edu/~design/ART/NAB/laterality2d.html, **[Accessed 5/1/2000]**

URL-5, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, What Is New Art Basic, Department of Art and Design, Iowa State University, http://www.public.iastate.edu/~design/ART/NAB/nab.html, **[Accessed 5/1/2000]**

URL-6, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, VAIS Standards, Department of Art and Design, Iowa State University, http://www.public.iastate.edu/~design/ART/NAB/vais.html , **[Accessed 5/1/2000]**

URL-7, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, Definition of Brain-based Visual Education, Department of Art and Design, Iowa State University, http://www.public.iastate.edu/~design/ART/NAB/brainb1.html, **[Accessed 5/1/2000]**

URL-8, Caldwell, Barbara, **Dake**, Dennis, **Safly**, Mat, and **Ulch**, Lisa, Integrated HOTS Thinking Model, Department of Art and Design, Iowa State University, http://www.design.iastate.edu/ART/NAB/hots.html , **[Accessed 5/1/2000]**

URL-9, ACSA, Association of Collegiate Schools of Architecture, http://www.acsa-arch.org **[Accessed 3/10/1999]**

Bibliography

Anderson, John R., (1983). *The Architecture of Cognition.* (s.l.): (s.n.)

Annett, M., and, **Kilshaw**, D., (1982). "Mathematical Ability and Lateral Asymmetry". *Cortex*, Vol. 18.

Archer, LB., (1979). "Design as A Discipline: the Three R's". *Design Studies*, Vol. 1, No 1, July.

Arnheim, Rudolf, (1954). *Art and Visual Perception: A Psychology of the Creative Eye.* Berkeley, Ca.: University of California Press.

Arnheim, Rudolf, (1966). *Gestalt Psychology and Artistic Form.* Ind.: Indiana University Press.

Baker, Geoffrey H., (1989). *Design Strategies in Architecture: an Approach to the Analysis of Form.* London: E&F Spon.

Bahrainy, Hossein, (1998). *Urban Design Process.* Iran: University of Tehran Press, [Original text in Persian]]

Bayley, S., (1979). "In Good Shape". *Design Council.*

Belyi, BI., (1979). "A Possible Holographic Principle of Right Hemisphere Function". *Human Psychology*, Part 5, Nov-Dec.

Benevolo, Leonardo, (1971). *History of Modern Architecture.* Vol. I,II. Mass.: MIT Press.

Best, Gordon, (1969), *Method and Intention in Architectural Design*, George Wittenborn, Inc.

Bogen, JE., and, **Bogen**, GM., (1969). "The Other Side of the Brain, III: the Corpus Callosum and Creativity". *Bulletin of the L.A. Neurological Society*, 34.

Bonta, Juan Pablo, (1972). "Notes for Semiotics: Theory of Graphic Languages", *Paper presented to the International Conference on Semiotics*, Ulm, Germany.

Ching, Francis D.K., (1990). *Drawing: A Creative Process.* New York: Van Nostrand Reinhold.

Clark, Roger H., and , **Pause**, Michael, (1985). *Precedents in Architecture.* New York: Van Nostrand Reinhold.

Cook, Peter, (1967). *Architecture: Action and Plan.* London: Studio Vista Ltd.

Cross, N., (1982). "Designerly Ways of Knowing". *Design Studies*, Vol. 3, No 4, October.

Cross, N., and **Nathenson**, M., (1981). "Design Methods and Learning Methods". In: R. Jacques and JA. Powell ed. Design Science. (s.l.): Method IPC.

Davies, Ann, and **Shakespeare**, Rob, (1993). "Mixing With Metaphors". *Landscape Design*, No 22.

Dennett, Daniel C., (1979). *Brainstorms: Philosophical Essays on Mind and Psychology*. Hassocks: Harvester Press.

Evans, Jonathan, **Newstead**, Stephen, and **Byrne**, Ruth, (1993). *Human Reasoning: The Psychology of Deduction*. UK.: Lawrence Erlbaum Associates.

Federico, Pat-Anthony, (1983). *Brain Event-Related Potential Correlates to Concept Learning*. California: Navy Personnel Research and Development Center.

Frampton, Kenneth, (1980). *Modern Architecture: A Critical History*. London: Thames and Hudson.

Gardiner, Margaret M., and **Christie**, Bruce, (?). *Applying Cognitive Psychology to User-Interface Design*. (s.l.): (s.n.)

Gazzaniga, M., (1967). "Split Brain in Man". *Scientific American*, August.

Gropius, Walter, (1965). *The New Architecture and the Bauhaus*. Mass.: MIT Press.

Guilford, J.P., (1968). *Intelligence, Creativity and Their Educational Implications*. California: R. Knapp Publisher.

Hamilton, Alaine, (1990). *Writing Dissertations*. London: RIBA Publications.

Hamilton, Alaine, (1989). *Writing Matters, Professional Communication series*. London: RIBA Publications.

Hanks, K., and, **Belliston**, L., (1977). *Draw*. Ca.: William Kaufman Inc.

Hart, Anna, (1989). *Knowledge Acquisition for Expert Systems*. London: Kogan Page.

Hoffman, Ann, (1986). *Research for writers*. (s.l.): A&C Black.

Howard, Darlene V., (1983). *Cognitive Psychology*. New York: Macmillan Publishing.

Jenks, C., (1977). *The Language of the Post Modern Architecture*. London: Academy Editions.

Juster, NP., (1985). *The Design Process and Design Methodologies*. (s.l.): (s.n.)

Kirton, Michael J., (?). *Adaptors and Innovators: Styles of Creativity and Problem Solving*. (s.l.): (s.n.)

Koberg, Don, and **Bagnall**, Jim, (1976). *The Universal Traveler*. Los Altos, Ca.: William Kaufman, Inc.

Leytham, Geoffrey, (1990). *Managing Creativity*. (s.l.): (s.n.)

Lytton, **Hugh**, (1971). *Creativity and Education*. Gateshed, UK.: Northumberland Press.

March, Lionel, and **Steadman**, Philip, (1971). *The Geometry of Environment*. London: RIBA Publications Limited.

Mc Graw, Karen L., (1989). *Knowledge Acquisition and Guidelines*. NY.: Prentice-Hall International.

McKim, RH., (1972). *Experiences in Visual Thinking*. Monterrey, Ca.: Brooks/Cole.

Middleton, Robin, (1982). *The Beaux-Arts: and Nineteenth-Century French Architecture*. London: Thames and Hudson.

Miller, Sam F., (1995). *Design Process: A Primer for Architectural and Interior Design*. New York: Van Nostrand Reinhold.

Mitchell, William J., (1990). *The Logic of Architecture: Design, Computation, and Cognition*. Mass.: MIT Press.

Palmer, Richard, (1996). *Brain Train: Studying for Success*. London: Spon.

Pinel, John PJ., (1993). *Biopsychology*. Boston, Mass.: Allyn and Bacon.

Pohl, Jens, **Chapman**, A., **Chirica**, L., **Howell**, R., and **Myers**, L. (1998). *Implementation Strategies for Prototype ICADS Working Model*. Technical Report, CADRU-02-88, CAD Research Unit, Design andConstruction Institute, College of Architecture and Environmental Design, Cal Poly, SanLuis Obispo, California.

Pohl, J., **Myers**, L., and **Chapman**, A., (1994). *Thoughts on the Evolution of Computer-Assisted Design*. Technical Report, CADRU-09-94, CAD Research Center, Design and Construction Institute, College of Architecture and Environmental Design, Cal Poly, SanLuis Obispo, California.

Porter, Tom, (1997). *The Architect's Eye: Visualization and Depiction of Space in Architecture*. London: E & FN Spon.

Potter, Norman, (1969). *What Is a Designer: Education and Practice: a Guide for Students and Teachers*. New York: Van Nostrand Reinhold.

Rasmussen, Steen Eiler, (1978). *Experiencing Architecture*. Mass.: MIT Press.

Ritter, Paul, (1979). *Educreation and Feedback: Education for Creation, Growth, and Change: the Concept, General Implications, and Specific Applications to Schools of Architecture, Environmental Design, or Ekistics*. Oxford: Pergamon Press.

Salisbury, Frank, (1990). *Architect's Handbook for Client Briefing: Butterworth Architecture Management Guides*. Cambridge, Mass.: University Press.

Steadman, Philip, (1990). *The Logic of Architecture: Design, Computation, and Cognition*. Mass.: MIT Press.

Sternberg, Robert J., (?). The Nature of Creativity: Contemporary Psychology. (s.l.): (s.n.)

Strik, James, (1991). *Construction into Design: the Influence of New Methods of Construction on Architectural Design. 1690-1900*. Oxford: Butterworth Architecture.

Taylor, David, (1997). "Architecture Foundation Goes Site Specific". *Architect's Journal*, Vol. 206, No 5,.

Temple, Christine, (1993). *The Brain: an Introduction to the Psychology of the Human Brain and Behaviour*. London: Penguin.

Trimble, G., (1988). *Knowledge Acquisition for Expert Systems in Construction*. H.E.: Adeli.

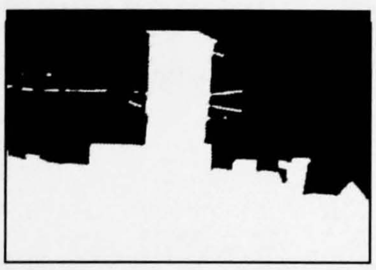
Vincent, Tomas, (1964). *Creativity in the Arts*. (s.l.): (s.n.)

Wade, John W., (1977). *Architecture, Problems, and Purposes: Architectural Design as a Basic Problem-Solving Process*. New York: John Wiley and Sons.

Wiersma, William, (1991). *Research Methods in Education: An Introduction*. 5th ed. Boston, Mass.: Allyn and Bacon.

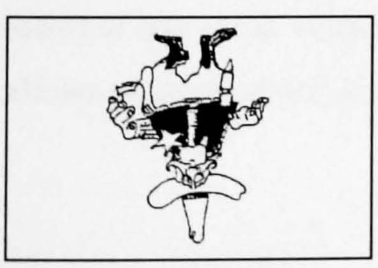
Williams, Peter, (1983). *RIBA Dissertation Handbook: A Guide to Research and Writing*. London: RIBA Publications.

Samples of drawing exercises given to a group of architecture students at the University of Tehran in 1997. In these drawing exercises, using Dr. Betty Edwards (1992) drawing exercises, students are encouraged to look at drawing subjects in a different way by stimulating the characteristics of their right hemispheres.



Negative Space Drawing

This drawing technique calls for students to focus on the negative space (the dark space) around their drawing subject. The intention behind this technique is to encourage students to look not at the actual subject, but the surrounding spaces around it. In this drawing, students are asked to use a frame to look at a scene, in this case a wind catcher in Iran, and draw the background of that subject. This drawing technique allows students to use their right mode of thinking and instead of looking at the positive image, they are asked to draw the negative space surrounding it.

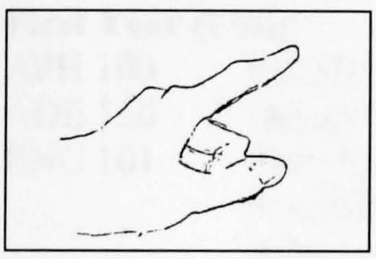


Upside-down Drawing

In this drawing technique, students are asked to look at their drawing subjects in an upside-down orientation; in this case a slide projected image of an American sheriff who is going to draw his pen and paper was used. The intention is to encourage students to draw what they see and the right hemisphere just helps them to that. The left hemisphere, which majority of students rely on in their drawing exercises, usually tells them to look at their drawing subjects in a symbolic manner – i.e., a hand has five fingers. However, the way these fingers are really positioned and their proportions need some very careful investigation. That is why the results of upside-down drawings are so successful.

Shadow Drawing

In this drawing technique, students are asked to draw only the shadows casted by the sun. In another attempt to get students to use the characteristics of their right hemisphere, this drawing exercise teaches students to look very carefully for the shape and proportion of the shadows which they see. In this case, the subject of drawing is the central sky light of a historic house in Iran, *Brojerdiha.* This drawing technique has to be developed without any line drawings, only shading surfaces.



Contour Drawing

In this drawing technique, students are asked to look at a subject and draw the profile of that object without looking down on the paper. This drawing exercise allows students to coordinate the speed of their moving pen on the paper with the speed of their moving eyes on the object. This coordination needs practice and the illustrated hand drawing is the result of one week of practice. Again the right hemisphere takes charge in this exercise and allows student to look at the drawing subject free of symbolic (pre-determined) images.

Appendix B

A typical 4-Year Architecture programme in the United States of America contains a two-year (pre-architecture) programme in which admission is open to all students who are interested to major in Architectural Studies. Following the initial two years, students must apply for admission to the second two-years of the programme (the B.S. degree). Acceptance is based on competitive review of the student's academic record and professional promise and a portfolio of creative work. The following list introduces the curriculum of Architecture at Arizona State University, for the Year 2001-2002, using the WEB site: www.asu.edu/architecture.

First Year (Fall)

APH 100	Introduction to Environmental Design	3
ADE 120	Design Fundamentals I	
ENG 101	First-Year Composition	3
	Soc/Behavioral Science Elective	3
	Approved Elective (Mat 170 if needed)	3
	Approved Elective	3
	Total	15

First Year (Spring)

APH 100	Introduction to Environmental Design or	3
ADE 120	Design Fundamentals I	
ENG 102	First-Year Composition	3
MAT 210	Brief Calculus	3
	Cultural Awareness Elective	3
	Approved Elective	3
	Total	15

Second Year (Fall)

ADE 221	Design Fundamentals II	3
ADE 223	Design Fundamentals II Lecture	1
APH 200	Introduction to Architecture	3
PHY 111	General Physics	3
PHY 113	General Physics Lab	1
AVC 294	Drawing Module	1
PHI 103	Principles of Sound Reasoning	3
	Total	15

Second Year (Spring)

ADE 222	Design Fundamentals III	3
ADE 224	Design Fundamentals III Lecture	1
PHY 112	General Physics	3
PHY 114	General Physics Lab	1
ANP 236	Introduction to Computer Modeling	3
AVC 294	Drawing Module	1
ECN 112	Microeconomic Principles	3
	Total	15

Third Year (Fall)

ADE 321	Architectural Studio I	5
APH 313	History of Western Architecture I	3
ATE 353	Architectural Construction	3
	Approved Elective	3
	Total	14

Third Year (Spring)

ADE 322	Architectural Studio II	5
ANP 331	Analysis and Programming	3
APH 314	History of Western Architecture II	3
ATE 361	Building Structures I	3
	Total	14

Summer

ARP 484	Clinical Internship	1

Fourth Year (Fall)

ADE 421	Architectural Studio III	5
ATE 451	Building Systems I	3
ATE 462	Building Structures II	3
	Approved Elective	3
	Professional Elective	3
	Total	17

Fourth Year (Spring)

ADE 422	Architectural Studio IV	5
ATE 452	Building Systems II	3
	Architectural History Elective	3
	Professional Elective	3
	Total	14

	Minimum	**120**

Appendix C

A typical 4-Year Architecture programme in Iran contains over 140 semester credit units. Entrant students are admitted each year through a nationwide competition (*concoore*), in which 10% of the applicants get the opportunity to enter the national universities. The following list of architectural courses was obtained from the Department of Architecture, University of Tehran, in 2001.

First Year (Fall)

Geometry I		3
Architectural Communication		2
Environmental Communication		3
Mathematics and Statistics		3
Ethics I		2
Persian Literature		3
Physical Education		1
	Total	17

First Year (Spring)

Basic Architectural Design I		5
Architectural Sketching I		2
Geometry and Landscape		2
Structures		2
Building Materials		2
Ethics II		2
English		3
	Total	18

Second Year (Fall)

Basic Architectural Design II		5
Architectural Sketching II		2
Structures		2
Surveying		2
Man, Nature, and Architecture		2
Islamic Education		2
Physical Education II		1
	Total	16

Second Year (Spring)

Architectural Design 1	5
Structures	2
Building Construction I	2
Islamic Architecture I	3
Islamic Revolution	2
Esquiss I	1
Total	15

Third Year (Fall)

Architectural Design 2	5
Environmental Control of Buildings	2
Building Construction II	3
Structural Systems	2
Islamic Architecture II	2
History of Islam	2
Esquiss II	1
Electives	2
Total	19

Third Year (Spring)

Architectural Design 3	5
Village I	3
Mechanical Systems	2
Architectural Theory	3
World Architecture	2
Islamic Texts	2
Total	17

Summer

Internship	1

Fourth Year (Fall)

Architectural Design 4	5
Village II	3
Acoustics and Electrical Equipment	2
City Planning	2
Contemporary Architecture	2
Electives	2
Total	16

th Year (Spring)

Architectural Design 5	5
Building Technology	3
Estimates and Shop Management	2
Restoration	3
Analysis of Urban Spaces	3
Total	16
Final Project	6

Minimum **142**

AMIR SAEID MAHMOODI
SCHOOL OF CIVIL ENGINEERING
UNIVERSITY OF LEEDS Tel: (0113) 233-2319 Fax:(0113) 233-2265

LEEDS LS7 9JT E-mail: cenasm@leeds.ac.uk

16 October, 1997

Sir Norman Foster and Partners
Riverside 3, 22 Hester Road
London SW11 4AN

Dear Mr. Foster,

I am a Ph.D. Research student in Architecture at the University of Leeds. I am working under the supervision of Professor Peter Dale on the subject of "Preliminary Design in Architecture: Visualisation and Conceptual Thinking".

I went to school in the U.S. and have been teaching as well as practising architecture for the last eight years. I am mostly interested on the subject of design strategies in architecture and would like to come up with some guidelines for design students.

You were suggested to me by Professor Dale as one of the major architectural offices here in Britain and I would appreciate it if you could give me a maximum of one hour of your time to discuss about your strategy in design.

I am looking forward for an opportunity to meet you. Your prompt response will be appreciated.

Sincerely yours,

Amir S. Mahmoodi

Name:(optional)................................. Male/Female:......... Age:....... Date:........................
Institution:..................................... Program/Degree:....................................... What year:..........

INTRODUCTION- This questionnaire is prepared to collect some information in regards to the application of drawings and other visual thinking techniques during the design process in architecture. The ultimate objective of the research is to investigate the application of "visual thinking" in an "interactive design" process which would benefit both groups of students and educators of architecture.

Your participation in this questionnaire will be greatly appreciated.

INSTRUCTION- Please read the specific instruction of how to respond to each question, some may require more than one responses from you. If you would like to make a comment on any of these questions, feel free to write it after each question or response.

Pilot Questions

(FOR ARCHITECTURAL STUDENTS)

1- How do you usually start your design projects? (choose the most likely approach)

☐ By developing concepts and then starting on studies.

☐ By doing research and then developing concept.

☐ By developing an interactive process (by developing concept and studies at the same time).

☐ None, please explain ....

2- How do you usually develop your design concepts? (on a scale of 1-4, rank the following items, "1" for the most likely approach)

☐ Manipulating others' ideas ☐ Getting ideas from what you have studied

☐ Getting ideas from the nature ☐ Playing with forms

☐ Other, please explain ....

Most students have a way of design which they use in solving design problems. Do you have a consistent approach in design process?

Yes ☐ No ☐

4- Overall in design education, would you recommend a design methodology which would assist you through your design process?

Yes ☐ No ☐

4- In your architectural design education, do you believe you have been introduced to vital design methodologies?

Yes ☐ No ☐

6-Would you consider drawing as one of your favourite hobbies?

Yes ☐ No ☐

7- Do you see any relation between drawing capabilities and creativity in design?

Yes ☐ No ☐

8- How often do you draw in a day? (choose only one)

☐ Less than 5 minutes ☐ 5 min. to 1/2 hr. ☐ 1/2 hr. to 1 hr.
☐ More than 1 hr.

9- "Visual thinking" is the term used to emphasis on the use of graphics or other 3-D techniques during the act of problem solving and design thinking. Which of the following "visual thinking" techniques do you use more often for developing design ideas? (on a scale of 1-4, rank the following techniques, "1" for the most favourite technique)

☐ Drawing sketches (by pen, pencil, or computer)
☐ Using photographs and/or photocopies (from buildings, books and or journals)
☐ Developing collages of images (by cutting and pasting pieces together)
☐ Making rough models

How successful do you consider the above visual techniques in developing gn ideas? (choose only one)

☐ Not very much ☐ Some how ☐ Very much

11- In drawing sketches, which tool would you rather to draw with? (on a scale of 1-3, rank the following tools, "1" for the most preferred tool)

☐ Computer

☐ Pen/Marker

☐ Pencil

12- Based on your previous experiences in design courses, how do you rate your success in developing design solutions?

☐ Poor ☐ Average ☐ Good

13- How do you rate the relation between what you study in your architectural courses and what you do in your design courses?

☐ Poor ☐ Average ☐ Good

14- Which part of a design process is most interesting to you? (on a scale of 1-7, rank the following items, "1" for the most interesting stage of the process)

☐ Developing ideas and conceptual thinking

☐ Doing research

☐ Analysing, synthesising, and evaluating design issues

☐ Developing working drawings

☐ Building finished models

☐ Preparing architectural presentation and rendering

☐ Construction and supervision

15- What do you consider most viable in a successful architectural education program? (on a scale of 1-4, rank the following items, "1" for the most viable issue)

☐ Educational system (i.e., curriculum, programs,...)

☐ Instructors (knowledge, availability, ...)

☐ Students (motivation, support, intelligence, ...)

☐ Facilities (libraries, studios, ...)

Based on your educational experiences and what you have seen or heard ı other architectural programs, are you satisfied with your architectural euucation?

Yes☐ No☐

please explain. ....

17- On a scale of 1-10, (1 being the most governing factor in your prediction), rank the importance of the following design factors in developing any architectural solution.

☐ **SPACE FACTORS**

Organization and Circulation of Space, Client and/or Users wants and needs, User types, ...

☐ **CLIMATE AND NATURAL FORCES**

Sun angles, Temperature, Precipitation, Winds, Earthquake, Tornado, Hurricane, Flood, ...

☐ **SOCIAL AND CULTURAL INFLUENCES**

History, Religion, Culture, Arts, Aesthetics, Thoughts, Designer objectives ...

☐ **MATERIAL AND CONSTRUCTION**

Availability, Durability, Reliability, Skills, Knowledge, ...

☐ **NATURAL ENVIRONMENT**

Geography, Topography, Soil, Vegetation, ...

☐ **BUILT ENVIRONMENT**

Neighborhood, Architectural characteristics, Roads and access, Utilities and Infrastructures, ...

☐ **BUILDING SYSTEMS**

Structural, Mechanical, Electrical, ...

☐ **SENSORY SYSTEMS**

Views, Noise, Feelings, ...

☐ **RULES AND REGULATIONS**

Country/State/City/Building regulations

☐ **TIME AND BUDGET**

Investments, Interest rates, Development opportunities, Seasons, Time of day, ...

Please list any other design factors which you consider are influential in developing an architectural solution.
....
....

Thank you for completing this questionnaire. Please return it to the distributor.

School of Civil Engineering
University of Leeds
Leeds, LS2 9JT

8 October, 1999

Professor P. Fawcett
School of Architecture
University of Nottingham
Nottingham NG7 2RD

Pilot study for getting feedback on the structure of questionnaires to be distributed among architectural educators and students

Dear Professor P. Fawcett

I am a Ph.D. student at the University of Leeds working under the supervision of Professor Peter Dale. I would like to ask for your assistance in giving me some feedback about the quality and structure of the enclosed questionnaires which will be shortly finalised and distributed in several universities in relation to my Ph.D. research at the University of Leeds. The title of the research is: "Interactive Design Process in Architecture, Using Visual Thinking as an Educational Approach of Dealing with Design Factors".

The outcome of this research shall benefit both groups of "students" and "educators" of architectural design during an educational design process. This research shall investigate the usefulness of "visual thinking" as a design strategy in dealing with various design factors in solving an architectural design problem. Some terms used in the research as well as these questionnaires are described below:
"Interactive design process", suggests an interactive relation during "analysis, synthesis, and evaluation" of design issues and design factors. It suggests a simultaneous consideration of design factors in order to provide a design solution. **"Design factors"** are design issues influencing an architectural solution.
"Visual thinking" is a design strategy which involves spatial thinking while dealing with design factors in a design process.

With respect to the objective of this research, two sets of questionnaires are prepared, one for students and the other for educators of architectural design. I would appreciate it if you would take a look at these two questionnaires and write your comments on each sheet.

Thank you for your time and co-operation.

Amir S. Mahmoodi

Please return your comments to the postgraduate secretary, Mrs. D. Carr, at the above address.

:: .... Male/Female: ..... Date: ....

ution: .... Number of years teaching: ....

Courses taught: ....

INTRODUCTION- This questionnaire has been prepared for a Ph.D. research under the title of "Interactive Design Process in Architecture, Investigating the Use of Visual thinking in an Educational Approach of Dealing with Design Factors". The ultimate objective of the research is to investigate the application of "visual thinking" techniques in an "interactive" design process which would benefit both groups of students and educators of architecture. Your participation in this questionnaire will be greatly appreciated.

INSTRUCTION- Please read the specific instruction of how to respond to each question, some may require more than one responses from you. If you would like to make a comment on any of these questions, feel free to write it after each question or response.

Pilot Questions

(FOR ARCHITECTURAL EDUCATORS)

1- Architectural educators have different approaches dealing with Design students, Do you suggest to your students to start a design problem in any particular way?

Yes ☐ No ☐

2- Which of the following design approaches do you consider more useful in your student's problem solving process? (on a scale of 1-4, rank the following approaches, "1" for the most appropriate approach)

☐ Start with a concept and modify it through the process.

☐ Start with research and studies and then develop concepts.

☐ Use an interactive process of developing concepts and doing studies simultaneously.

☐ None, please explain ....

3- Do you suggest to your students to use library materials to get some design ideas right from the beginning?

Yes ☐ No ☐

4- In your Design studios, do you introduce any design methodology to students?

Yes ☐ No ☐

ow do you think students learn better to design? (choose one)

☐ When they find their own way through solving a problem.

☐ When they are given advanced directions by the instructors and then left free to design.

6- What do you consider more vital for an architectural design student? (on a scale of 1-4, rank the following items, "1" for the most vital.

☐ Knowing how to draw and communicate well.

☐ Being creative and independent.

☐ Working hard and willing to learn.

☐ Being able to analyze and think logically.

7- "Visual thinking" is the term used to suggest thinking with the help of 2-D or 3-D techniques in describing design issues. Which of the following "visual thinking" techniques do you prefer to see your student's use in their design process? (on a scale of 1-4, rank the following techniques, "1" for the most preferred one)

☐ Drawing sketches (by pen, pencil, or computer)

☐ Using Photographs and/or photocopies (from buildings, books, journals)

☐ Developing collages of their ideas (by cutting and pasting pieces together)

☐ Making rough models

7- How useful do you consider "visual thinking" techniques in developing architectural solutions for students? (choose only one)

☐ Not very much ☐ Some how ☐ Very much

8- Which of the following drawing tools do you prefer to see your students use in their design studies? (on a scale of 1-3, rank the following tools, "1" for the most preferred tool)

☐ Using computer

☐ Using pen/marker

☐ Using pencil

Although architects draw very often, how often do you draw for pleasure n a day?

☐ Less than 5 minutes ☐ 5 min. to 1/2 hr. ☐ 1/2 hr. to 1 hr.
☐ More than 1 hr.

10- Which part of a design process do you consider most viable in students' architectural education? (on a scale of 1-6, rank the following stages, "1" for the most viable stage)

☐ Developing concepts
☐ Analysing and research
☐ Synthesising and design development
☐ Developing working drawings and construction documents
☐ Architectural presentation and communication
☐ Construction and supervision

11- What do you consider most influential in a successful architectural education program? (on a scale of 1-4, rank the following items, "1" for the most influential)

☐ Educational system (i.e., curriculum, program objectives, ...)
☐ Instructors (knowledge, availability, ...)
☐ Students (motivation, intelligence, ...)
☐ Facilities (i.e., libraries, studios, ...)

12- Based on your views about an "ideal" architectural program, do you consider your school's educational program successful?

Yes ☐ No ☐

13- Based on your educational experiences in Architectural Design, what do you think about the subject of design process in architecture?

....

....

....

Throughout this research, the author has come across many factors influencing design solution in architecture. The following list is a random representation of different design factors categorised under ten major factors.
On a scale of 1-10, (1 being the most considered design factor in most educational exercises), rank the importance of the following design factors in developing an architectural solution. If necessary, please add other factors to the proposed list.

☐ SPACE FACTORS
Organisation and Circulation of Space, Client and/or Users wants and needs, User types,...

☐ CLIMATE AND NATURAL FORCES
Sun angles, Temperature, Precipitation, Winds, Earthquake, Tornado, Hurricane, Flood, ...

☐ SOCIAL AND CULTURAL INFLUENCES
History, Religion, Culture, Arts, Aesthetics, Thoughts, Designer objectives ...

☐ MATERIAL AND CONSTRUCTION
Availability, Durability, Reliability, Skills, Knowledge, ...

☐ NATURAL ENVIRONMENT
Geography, Topography, Soil, Vegetation, ...

☐ BUILT ENVIRONMENT
Neighbourhood, Architectural characteristics, Roads and access, Utilities and Infrastructures, ...

☐ BUILDING SYSTEMS
Structural, Mechanical, Electrical, ...

☐ SENSORY SYSTEMS
Views, Noise, Feelings, ...

☐ RULES AND REGULATIONS
Country/State/City/Building regulations

☐ TIME AND BUDGET
Investments, Interest rates, Development opportunities, Seasons, Work hours, ...

Other Factors:

Thank you for your time and interest, **please return this questionnaire to:**
Amir Mahmoodi, C/O Post Graduate Secretary, School of Civil Engineering, University of Leeds, Leeds LS2 9JT, UK.

Head of the Department of Architecture
Scott Sutherland School of Architecture
The Robert Gordon University
Aberdeen, AB9 2QB

Head of the Department of Architecture
School of Architecture and Civil Engineering
University of Bath
Bath, BA2 7AY

Head of the Department of Architecture
Department of Architecture
The Queen's University of Belfast
Belfast, BT7 1NN

Head of the Department of Architecture
Birmingham School of Architecture
University of Central England in Birmingham
Birmingham, B42 2SU

Head of the Department of Architecture
School of Architecture and Interior Design
University of Brighton
Brighton, BN2 4AT

Head of the Department of Architecture
Department of Architecture
University of Cambridge
Cambridge, CB2 1PX

Head of the Department of Architecture
Canterbury School of Architecture
Kent Institute of Art and Design
Canterbury, CT1 3AN

Head of the Department of Architecture
The Welsh School of Architecture
University of Cardiff
Cardiff, CF1 3NB

Head of the Department of Architecture
School of Architecture
University of Dundee
Dundee, DD1 4HT

Head of the Department of Architecture
School of Architecture
Heriot-Watt University
Edinburgh, EH3 9DF

Head of the Department of Architecture
Department of Architecture and Building Science
University of Strathclyde
Glasgow, G4 0NG

Head of the Department of Architecture
Department of Architecture
University of Glasgow
Glasgow, G3 6RQ

Head of the Department of Architecture
Department of Architecture
The University of Huddersfield
Huddersfield, HD1 3DH

Head of the Department of Architecture
The Hull School of Architecture
University of Lincolnshire and Humberside
Hull, HU1 3BW

Head of the Department of Architecture
Faculty of Design and the Built Environment
Leeds Metropolitan University
Leeds, LS2 8BU

Head of the Department of Architecture
Department of Architecture
De Montfort University
Leicester, LE1 9BH

Head of the Department of Architecture
Liverpool School of Architecture
University of Liverpool
Liverpool, L69 3BX

Head of the Department of Architecture
Centre for Architecture
Liverpool John Moores University
Liverpool, L3 5UZ

ı of the Department of Architecture
Bartlett School of Architecture
ıersity College London
London, WC1H 0QB

Head of the Department of Architecture
Faculty of Design and Built Environment
University of East London
London, E15 3EA

Head of the Department of Architecture
School of Architecture and Landscape
University of Greenwich (Dartford Campus)
Kent, DA1 2SZ

Head of the Department of Architecture
School of Architecture
Kingston University
Surrey, KT1 2QJ

Head of the Department of Architecture
School of Architecture and Interior Design
University of North London
London, N7 8JL

Head of the Department of Architecture
School of Architecture and Interior Design
Royal College of Art
London, SW7 2EU

Head of the Department of Architecture
School of Architecture and Civil Engineering
South Bank University
London, SW8 2JZ

Head of the Department of Architecture
School of Architecture and Engineering
The University of Westminster
London, NW1 5LS

Head of the Department of Architecture
School of Architecture
University of Manchester
Manchester, M13 9PL

Head of the Department of Architecture
Department of Architecture
University of Newcastle
Newcastle, NE1 7RU

Head of the Department of Architecture
The Nottingham Institute of Architecture
University of Nottingham
Nottingham, NG7 2RD

Head of the Department of Architecture
School of Architecture
Oxford Brookes University
Oxford, OX3 0BP

Head of the Department of Architecture
Plymouth School of Architecture
University of Plymouth
Plymouth, PL1 2AR

Head of the Department of Architecture
School of Architecture
University of Portsmouth
Portsmouth, PO1 3AH

Head of the Department of Architecture
School of Architectural Studies
University of Sheffield
Sheffield, S10 2TN

30th November, 1999

Head of the Department of Architecture
The Nottingham Institute of Architecture
University of Nottingham
Nottingham, NG7 2RD

Initial Data Capture: Design Methodology and Design Factors

Dear Head,

I am a faculty member of the Department of Architecture at the University of Tehran who am also a postgraduate student at the University of Leeds. I am working on an architectural research programme toward my Ph.D. degree in the area of **Design Process in Architecture.** My thesis investigates "Appropriate Model of Pedagogic Methodology of Architectural Design, Prioritizing Design Factors in Education".

In order for me to proceed with my research theory, I need to collect some initial data from scholars here in the UK. Therefore, I would appreciate it if you would pass this enquiry to one of your senior Design scholars who you feel is appropriate and is interested in the subject of Architectural Design and/or Architectural Theory.

The objective of this data enquiry is to obtain some professional responses from the UK architecture educators in regards to the issue of design methodology and design factors influencing students' architectural solutions. I hope to be able to collect your views on the subject and reflect them in my research. All contributions will be formally acknowledged.

Upon your completion of the questionnaire, or shall you require any further information, please contact Mrs. Dorothy A.Carr, the postgraduate secretary at (0113) 233-2265.

I am grateful for your time and assistance.

Yours faithfully,

Amir S. Mahmoodi

Ph.D. student
Cenasm@leeds.ac.uk

Civil Engineering
Research Institute
School of Civil
Engineering
University of Leeds
Leeds LS2 9JT

INITIAL DATA CAPTURE

Name:.. Male/Female:...... Date:...................

Institution/University:..

Position/Title:...

Qualifications/Degrees:..

What Design level/s do you teach? Please identify in terms of students' level of education. (e.g. 3rd year Design)..

What type of Design environment do you work in?

☐ Studio ☐ Class room ☐ Other (describe).......................

1- **Please write your thoughts about the subject of the design process in architecture.** What model do you use? What are the major stages of design in your model?

....

....

....

....

....

....

Please write a comprehensive list of design issues which influence architectural design and you feel students need to respond to them in different stages of their architectural education. (Please specify the most effective design issues in terms of educational year, i.e. 3rd Year)

3- **What design methodology do you suggest that would help students of design in their projects?** Should Design instructors give a framework of design activities to students to follow?

Thank you for your time and participation. Please return the responses to:
Postgraduate Secretary, School of Civil Engineering, University of Leeds, LS2 9JT.

Head of the Department of Architecture
School of Architecture
University of Constantine
Constantine, ALGERIA

Head of the Department of Architecture
School of Architecture
University of Buenos Aires
Buenos Aires, ARGENTINA

Head of the Department of Architecture
School of Built Environment
University of Sydney
Sydney, AUSTRALIA

Head of the Department of Architecture
School of Architecture
Federal University of Rio De Janeiro
Rio de Janeiro, BRAZIL

Head of the Department of Architecture
School of Architecture
The University of British Columbia
Vancouver, BC, CANADA

Head of the Department of Architecture
Institute of Architectural Design
University of Architecture and technology
Shaanxi Province, CHINA

Head of the Department of Architecture
School of Architecture
National University of Bogota
Bogota, COLOMBIA

Head of the Department of Architecture
School of Architecture
The Royal Danish Academy of Fine Arts
Kobenhavn, DENMARK

Head of the Department of Architecture
Faculty of Engineering
Cairo University
Cairo, EGYPT

Head of the Department of Architecture
School of Architecture
Helsinki University of Technology,
FINLAND

Head of the Department of Architecture
School of Architecture
University of Vencennes Saint-Denis
(Paris VIII) FRANCE

Head of the Department of Architecture
School of Architecture
Aachen University of Technology
Aachen, GERMANY

Head of the Department of Architecture
School of Architecture
National Technical University of Athens
Athinai, GREECE

Head of the Department of Architecture
School of Architecture
Technical University of Budapest
Budapest, HUNGARY

Head of the Department of Architecture
School of Architecture
Aligarh Muslim University
Uttar Pradesh, INDIA

Head of the Department of Architecture
School of Fine Arts
University of Tehran
Tehran, IRAN

Head of the Department of Architecture
Department of Architectural Engineering
University of Technology Baghdad
Baghdad, IRAQ

Head of the Department of Architecture
Faculty of Engineering
The University of Tokyo
Tokyo, JAPAN

Head of the Department of Architecture
Faculty of Architectural Engineering
The University of Jordan
Amman, JORDAN

l of the Department of Architecture
artment of Architecture
il National University
Seoul, SOUTH KOREA

Head of the Department of Architecture
Department of Architecture
University of Malaya
Kuala Lumpur, MALAYSIA

Head of the Department of Architecture
School of Architecture
University of Guanajuato
Guanajuato, MEXICO

Head of the Department of Architecture
Faculty of Architecture
University of Nigeria
Enugu State, NIGERIA

Head of the Department of Architecture
Oslo School of Architecture
Oslo, NORWAY

Head of the Department of Architecture
School of Architecture
University of Engineering and Technology
Lahore, PAKISTAN

Head of the Department of Architecture
College of Architecture
Adamson University
Malina, PHILIPPINES

Head of the Department of Architecture
Faculty of Architecture
Technology University of Lisbon
Lisbon, PORTUGAL

Head of the Department of Architecture
Department of Architecture
Moscow Architectural Institute
Moscow, RUSSIAN FEDERATION

Head of the Department of Architecture
College of Architecture
King Faisal University
Al-Hasa, SAUDI ARABIA

Head of the Department of Architecture
Faculty of Architecture
University of Cape Town
Cape Town, SOUTH AFRICA

Head of the Department of Architecture
School of Architecture
Polytechnic University of Madrid
Madrid, SPAIN

Head of the Department of Architecture
Faculty of Architecture
University of Damascus
Damascus, SYRIA

Head of the Department of Architecture
Faculty of Architecture
Istanbul Technology University
Istanbul, TURKEY

Head of the Department of Architecture
Faculty of Architecture
Swiss Federal Institute of Technology
Zurich, SWITZERLAND

Head of the Department of Architecture
Department of Architecture
The University of Edinburgh
Edinburgh, EH1 1JZ, UK

Head of the Department of Architecture
School of Architecture
Architectural Association
London, WC1B 3ES, UK

Head of the Department of Architecture
School of Architecture
University College Dublin
Dublin, UK

Head of the Department of Architecture
School of Architecture
Columbia University
NY, USA

Head of the Department of Architecture
School of Architecture
Ohio State University
Ohio, USA

Head of the Department of Architecture
School of Architecture
University of Miami
Florida, USA

Head of the Department of Architecture
School of Architecture
University of Illinois at Chicago
Ill. USA

1 of the Department of Architecture
›ol of Architecture
/ersity of Houston
TX, USA

Head of the Department of Architecture
School of Architecture
California Polytechnic State University
CA. USA

Head of the Department of Architecture
School of Architecture
University of California, Berkeley
CA. USA

Head of the Department of Architecture
School of Architecture
Washington State University, Pullman
WA. USA

1st December, 1999

Head of the Department of Architecture
School of Architecture
Washington State University, Pullman
WA. USA

Enquiry: Architectural Education Research

Dear Head,

I am a faculty member of the Department of Architecture at the University of Tehran who am also a postgraduate student at the University of Leeds. I am working on an architectural research programme toward my Ph.D. degree in the area of **Design Process in Architecture.** My thesis investigates "Appropriate Models of Pedagogic Methodology of Architectural Design, Prioritizing Design Factors in Education".

In order for me to support my research theory, I need some constructive assistance from my colleagues throughout the world. However, due to the large number of educators and universities, I had to select only one university from each country/region. Your university is selected as a more reputable school in the areas of architectural education and/or architectural design. Therefore, I am appealing for your assistance to ask one of your Design educators whom you feel is most appropriate to fill this questionnaire and return it to me as soon as possible, please.

The objective of this questionnaire is to obtain some professional responses from various architecture educators worldwide to analyse their views and experiences on the issue of "Design Process in Architecture". I hope to be able to collect your views on the subject and reflect them in my research. All contributions will be formally acknowledged.

Upon your completion of the questionnaire, or shall you require any further information, please contact Mrs. Dorothy A.Carr, the postgraduate secretary at ++(0113) 233-2263.

I am grateful for your time and assistance.

Yours faithfully,

Amir S. Mahmoodi
Ph.D. student
UK Email: cenasm@leeds.ac.uk IRAN Email: amahmoud@ut.ac.ir

Civil Engineering Research Institute
University of Leeds
Leeds LS2 9JT

QUESTIONNAIRE

Name:.. Male/Female:......

Date:....................

Institution/University:..

Position/Title:...

What Design level do you teach? Please identify in terms of students' level of education. (e.g. 3rd year Design)*...

What Design courses/levels have you taught before?.................................

What type of Design environment do you work in?

☐ Studio ☐ Class room ☐ Other (describe)...............................

What type of academic calendar are your design courses based on?

☐ Yearly ☐ Semester ☐ Quarter ☐ Other (describe)...................

How many architectural design students do you work with during each term?......

*Note: Although you may teach different Design levels, your responses to the following questionnaire will be classified based on the Design level you prefer to identify your teaching with. Therefore, by the term "student" in this questionnaire, it is meant those students who are in your preferred Design level.

SECTION 1- Architectural Design Education

1- In the following spectrum, where do you like to define the subject of Architectural Design? Do you define it more related to "technical/scientific" issues, or do you define it more related to "artistic/creative" issues? (Mark 'X' a location)

Technical/Scientific ◄———————► **Artistic/Creative**

☐	☐	☐	☐	☐
a	b	c	d	e

2- How influential do you consider the following issues in developing a "successful" architectural education system in general? (Rank them on a scale of 1-4, where "1" is the most influential issue)

Student's characteristics (e.g. motivation, qualification,...)	
Educational programmes (e.g. curriculum, continuity,...)	
Instructor's characteristics (e.g. delivery method, availability,...)	
School's facilities (e.g. libraries, equipment, space, ...)	

3- How effective do you find the following issues in the progress of an architecture student in design courses? (Rank them on a scale of 1-4, where "1" is the most effective issue in your opinion)

Student's ability to communicate	
Student's level of creativity	
Student's willingness to work hard	
Student's level of intelligence	

4- How effective do you find the following issues in regards to the instructors of Architectural Design in the progress of the students of design? (Rank them on a scale of 1-4, where "1" is the most effective issue)

Instructors who have a good rapport with students and encourage students to express new design ideas	
Instructors who have a clear design methodology and expect specific exercises to be experienced by all students	
Instructors who are not set on any particular methodology in design and deal with students independently	
Instructors who spend more time with students and expect students to spend a lot of time as well	

SECTION 2- Design Methodology and Design Process in Architecture

5- How effective do you consider the following teaching methods in assisting design students in their design process?

	Less Effective	Effective	Very Effective
Saying the least and letting students to find their own way through design	☐	☐	☐
Giving a framework of design activities to students and directing them in their search for solution	☐	☐	☐

6- Many design students use architectural journals during their design studies, however, there is a mixed reaction from instructors about the time of referring to library for assistance. In directing design students, do you think it is appropriate for students to use library material, particularly architectural periodicals, in their design activities?

☐ **No**, If you don't think using journals is appropriate for design students in your course.(skip to Question 7)

☐ **Yes**, If you think using journals is ok, please respond to the appropriateness of the following stages.

	Not Appropriate	Appropriate	Very Appropriate
When students are given a project and they need to become familiar with the subject (eg. precedence study)	☐	☐	☐
When students are stuck and can not develop any ideas	☐	☐	☐
When students use journals for technical purposes and not necessarily for copying ideas	☐	☐	☐

Other (please explain) ....

7- The term "design process", has been used in most architectural academic institutions by students and educators of architecture. Does your methodology of teaching include discussing about the design process with students?

☐ **Yes**, if yes, please explain your description of design process, what are the major stages in that process?

....

☐ **No**, if no, please explain why not and how do you describe design activities to your students?

....

8- In each of the following design activities, which communication tool do you consider most effective for your students to use? (Mark 'X' only one tool for each design activity)

	Collage of pictures & forms	Computer Graphics	Model Making	Pen/Pencil Drawing
Conceptual Design				
Design Development				
Architectural Presentations				

SECTION 3- Design Factors Influencing Architecture

9- Throughout his research, the author has come across many factors influencing design solution in architecture. The following list is a random representation of different design issues categorised under ten major design factors.
Would you choose the effectiveness of each factor in your design course? Also, please add any other factors which you feel are appropriate to be discussed with students and are left out from this list.

	Less Effective	Effective	Very Effective
TIME AND BUDGET (e.g. Investments, Interest rates, Development opportunities, Seasons, Work hours, ...)	☐	☐	☐
USE OF SPACE (e.g. Organization and Circulation of Space, Client and/or User's wants and needs, User types,...)	☐	☐	☐
CLIMATE AND NATURAL FORCES (e.g. Sun angles, Temperature, Precipitation, Winds, Earthquake, Tornado, Hurricane, Flood, ...)	☐	☐	☐
SOCIAL AND CULTURAL INFLUENCES (e.g. History, Religion, Culture, Arts, Aesthetics, Thoughts, Designer preferences/values ...)	☐	☐	☐
MATERIAL AND CONSTRUCTION (e.g. Availability, Durability, Reliability, Skills, Knowledge, ...)	☐	☐	☐
NATURAL ENVIRONMENT (e.g. Geography, Topography, Soil, Vegetation, ...)	☐	☐	☐
BUILT ENVIRONMENT (e.g. Neighborhood, Architectural characteristics, Roads and access, Utilities and Infrastructures, ...)	☐	☐	☐
BUILDING SYSTEMS (e.g. Structural, Mechanical, Electrical, ...)	☐	☐	☐
SENSORY SYSTEMS (e.g. Views, Noise, Feelings, ...)	☐	☐	☐
RULES AND REGULATIONS (e.g. Country/State/City/Building regulations)	☐	☐	☐

Other factors:

10- Using the descriptions from the previous question in regards to the architectural design factors, which factors do you suggest should make the major theme of design projects during each level of architectural education? You may add as many as three other design factors which may be left out of the following list. (Mark 'X' as many factors as you consider are appropriate for selecting design projects in each educational level)

	Time & Budget	Use of Space	Climate	Social, Cultural	Material	Natural Environ.	Built Environ.	Building Systems	Sensory Systems	Rules & Regulat.			
Year-1													
Year-2													
Year-3													
Year-4													
Year-5													

11- Please write your general comments in relation to the subjects of "design process", "design methodology", and/or "design factors" in architectural design.

....

....

....

....

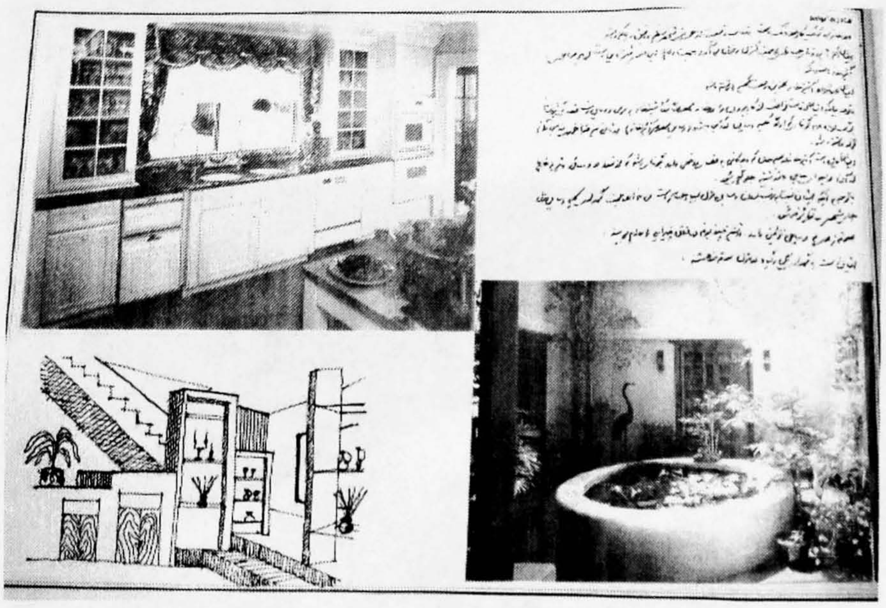
....

....

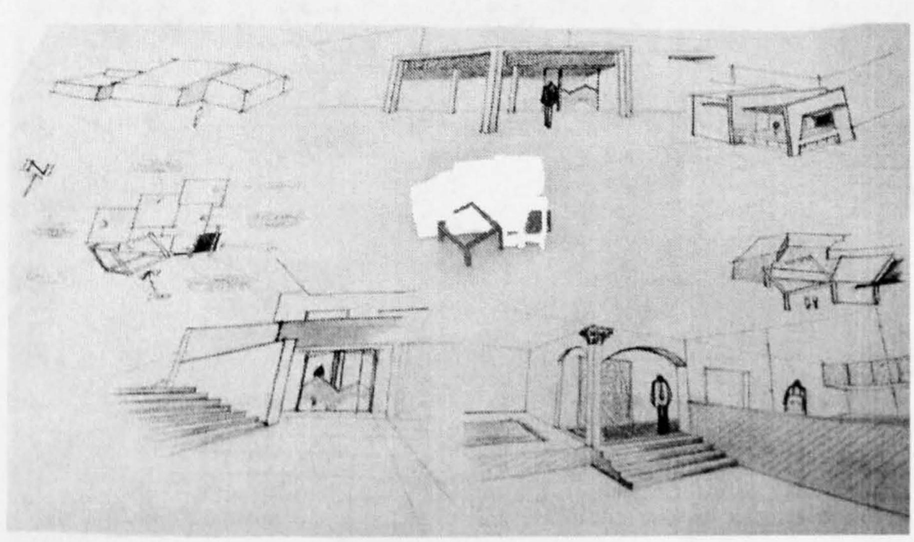
....

Thank you for your time and participation. Please return the responses to:
Postgraduate Secretary, School of Civil Engineering, University of Leeds, LS2 9JT, UK.

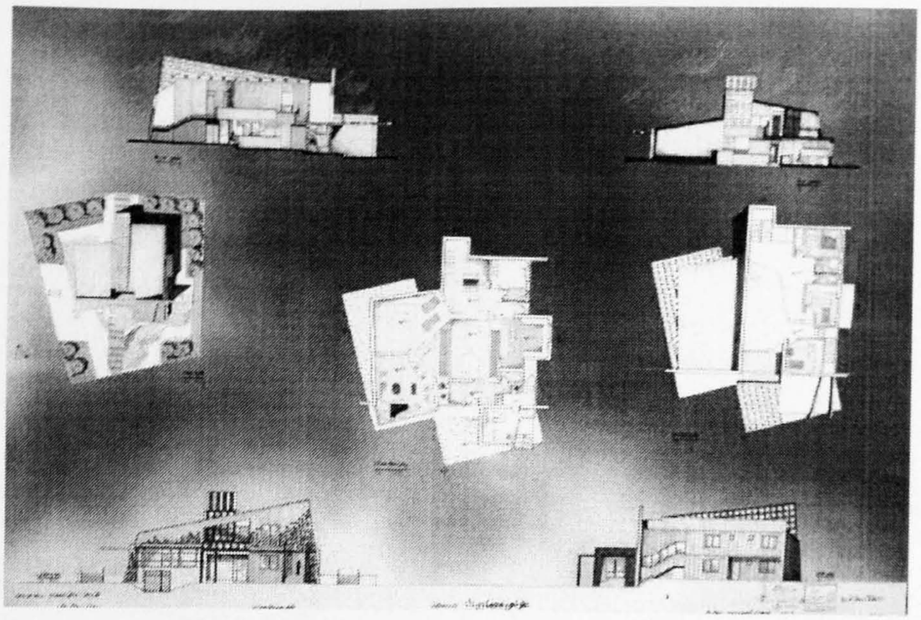
Design of a house for an architect in the cold and dry climate of Tabriz in Northern Iran. Drawing belong to the design process conducted by Fouad Khorami, a student of Architectural Design I, at the Department of Architecture, School of Islamic Arts, in Tabriz, Iran.

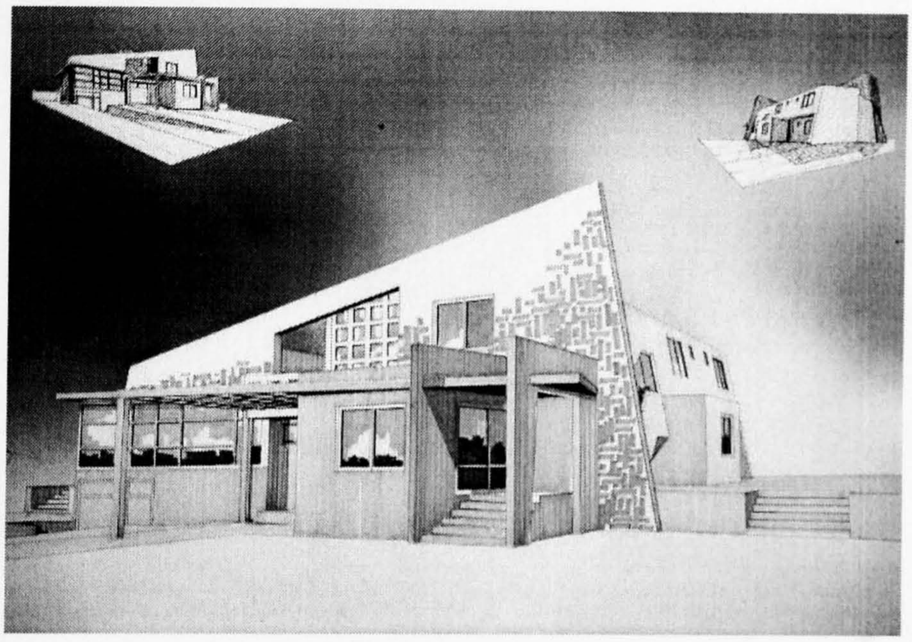


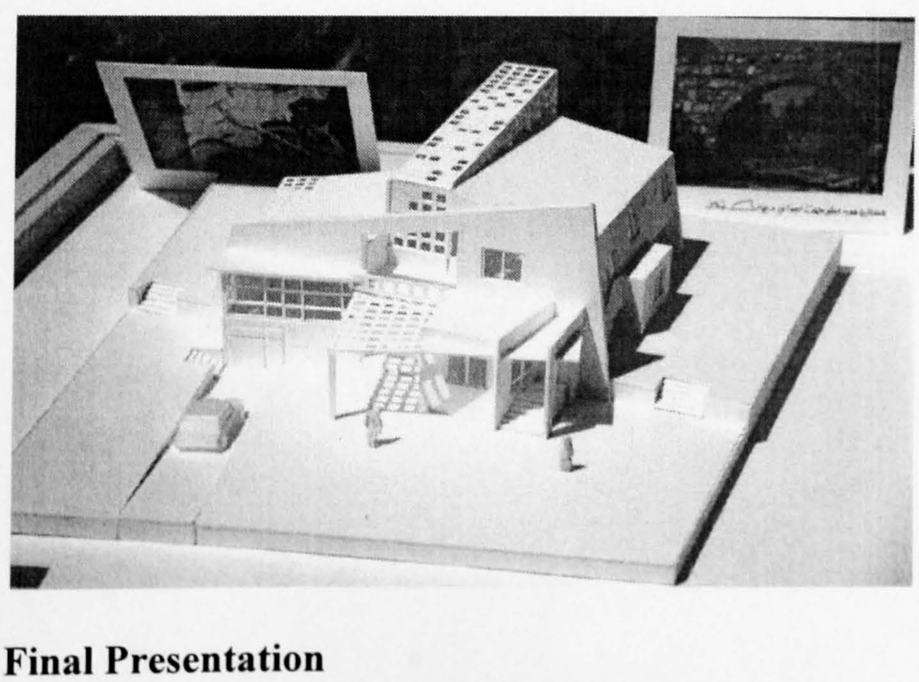
Writing Scenario
In this page, the student is illustrating two photographs of different spaces, in this case one from a kitchen and one from a courtyard. He has also drawn a sketch from the living room with the stairs in the background. In his scenario, the student has described an open plan and he prefers to use wood finishes for the inside and stone for the outside surfaces.



Design Factors and One-day Esquisses
The student has put together his thoughts about the character of the interior spaces as well as some studies in relation to the zoning, relation between adjacent spaces, and a mass model of his residential design.







Final Presentation

The student has stayed loyal to his initial scenario in many ways, i.e., the use of building materials, the use of an open plan, and a maximum use of sun in the southern front.