AN APPROACH TO INTEGRATE LIGHTING CONCEPTS INTO INTERIOR DESIGN STUDIOS: A CONSTRUCTIVIST EDUCATIONAL FRAMEWORK

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FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN ART, DESIGN, AND ARCHITECTURE

By
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January 2006

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ABSTRACT

AN APPROACH TO INTEGRATE LIGHTING CONCEPTS INTO INTERIOR DESIGN STUDIOS: A CONSTRUCTIVIST EDUCATIONAL FRAMEWORK

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Ph.D. in Art, Design, and Architecture

Supervisor: Assoc. Prof. Dr. Cengiz Yener

January 2006

Originating from the inadequacy of teaching and learning frameworks in interior design education and the gap between design studio and supportive courses in design curricula, this study suggests a pedagogical approach for design studios to overcome the disentanglement in interior design education. Within this context, the study introduces a 'constructivist framework' as the foundation of an instructional method to recall knowledge from lighting-related courses into the design studio. Constructivism, taking knowledge as temporary, developmental, nonobjective, internally constructed, and socially and culturally mediated, is discussed as one of the most suitable epistemological stances for design education with regards to its problem-based studio education. In order to examine the appropriateness of the suggested approach for integration, students in one of the two design studio sections were given lighting design exercises prepared with reference to constructivist premises, and received constructive feedbacks for their lighting design proposals during the semester, while the other section had no extra exercises and critiques on lighting design. The effectiveness of the approach was evaluated using quantitative data analysis techniques. The findings demonstrated that incorporation of the constructivist instructional strategies improved the success of students in studio projects in terms of lighting design requirements. Additionally, final jury sessions were recorded and analyzed in relation to the discussions and questions about lighting design dimensions of the projects, with regards to the nature and content of the questions and faculty-related barriers against the integration of lighting concepts. The study is considered also significant for the potential applicability of the proposed educational approach to integrate the other design knowledge areas into design studio for a more comprehensive interior design education.

Keywords: Interior Design Education, Lighting Education, Constructivism.

ÖZET

AYDINLATMA TASARIMI KAVRAMLARININ İÇ MİMARLIK TASARIM STÜDYOLARINA AKTARIMI İÇİN BİR ÖNERİ: KONSTRÜKTİVİST EĞİTİM YÖNTEMİ

Mehmedalp Tural

Güzel Sanatlar, Tasarım ve Mimarlık Fakültesi

Doktora

Tez Yöneticisi: Doç. Dr. Cengiz Yener

Ocak 2006

Bu çalışma, iç mimarlık eğitiminin kendine ait öğretim ve öğrenim kuramlarının yetersizliğinden ve de tasarım stüdyoları ile diğer dersler arasındaki kopukluklardan yola çıkarak, bu sorunların çözümüne katkıda bulunmak amacıyla tasarım stüdyoları için yeni bir pedagojik yaklaşım önermektedir. Bu bağlamda, önceki aydınlatma tasarımı içerikli derslerde edinilen bilginin tasarım stüdyo projelerine aktarımını sağlamak üzere, konstrüktivizm bir öğretim yöntemi olarak önerilmiştir. Konstrüktivist yaklaşımlar için bilgi, geçici ve özneldir; kişisel, sosyal ve kültürel bağlamların etkisiyle şekillenir ve değişkendir. Bu özellikler, tasarım problemlerini çözmeye yönelik ve tek bir doğrusu olmayan stüdyo eğitimi ile paralellik gösterir. Bu önerinin uygunluğunu araştırmak için iki şubeden oluşan 4. sınıf tasarım stüdyolarından birinde konstrüktivist ilkelere göre hazırlanmış aydınlatma ödevleri verilmiş, öğrenciler bu ödevler çerçevesinde aydınlatma tasarımları için yapıcı eleştiriler almışlardır. Diğer şubede ise aydınlatma tasarımları için fazladan bir ödev veya eleştiri almamışlardır. Değerlendirme sonuçları önerilen eğitim yaklaşımı uygulandığında, öğrencilerin dönem sonu projelerinde aydınlatma tasarım kriterleri bakımından diğer öğrencilere göre daha başarılı olduğunu göstermiştir. Buna ek olarak, dönem sonu tasarım jürileri kaydedilmiş, eğitimci ve öğrencilerin projelerdeki aydınlatma tasarımı öğelerine karşı tutumları belirlenmeye çalışılmış, aydınlatma bilgisinin projelerde uygulanmasına engel oluşturabilecek etkenler saptanmıştır. Bu çalışmanın bulguları, aydınlatma alanı dışındaki diğer tasarım bilgisi alanlarının da stüdyo eğitimine dahil edilebilmesi açısından da önem taşımaktadır.

Anahtar Kelimeler: İç Mimarlık Eğitimi, Aydınlatma Eğitimi, Konstrüktivizm.

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LIST OF ABBREVIATIONS

AIID	Foundation of the American Institute of Interior Decorators
BIG	Beyond the information given
CAD	Computer aided design
CIE	International Commission on Illumination
FIDER	Foundation for Interior Design Education Research
IAED	Department of Interior Architecture and Environmental Design (Bilkent University)
IALD	International Association of Lighting Designers
IDEC	Interior Design Educators Council
IESNA	Illuminating Engineering Society of North America
LED	Light-emitting-diode
NCIDQ	National Council for Interior Design Qualification
NSID	National Society for Interior Designers
PBL	Problem based learning
SPSS	Statistical Package for Social Sciences
UIA	International Union of Architects
WIG	Without the information given
VDT	Visual display terminal
YÖK	Yüksek Öğretim Kurumu – Council of Higher Education
ZPD	Zone of proximal development

Statistical Abbreviations and Symbols (derived from the Publication Manual of the American Psychological Association, 2001)

B	multiple regression coefficient
CI	confidence interval
df	degree of freedom
F	Fisher's F ratio
M	mean (arithmetic average)

N	total number in a sample
p	probability
r	Pearson product – moment correlation
R^2	multiple correlation squared; measure of strength of relationship
SD	standard deviation
SE	standard error (of measurement)
t	computed value of t test
α	Alpha; probability of a Type I error
β	standardized multiple regression coefficient

1. INTRODUCTION

1.1 Problem definition

Interior design is a profession which is still continuously evolving to better define its disciplinary boundaries and construct its knowledge base, as well as to generate its own educational theories and practices. This study originates from the insufficiency of teaching and learning frameworks in interior design education, and the gap between design studio and supportive courses in design curricula. The unique nature of design education structured around design studios as problem-based learning environments usually underestimates the significance of other courses in curricula, and studios prioritizing creativity and originality in projects remain the prevailing aspect of teaching and learning design.

As the other design knowledge areas, lighting design knowledge is given as a supportive course and remains as a disintegrated dimension of student projects. The problem of disintegration in the existing education system is elaborated in further detail in this study, in terms of curricular and instructional problems as well as barriers intrinsic to teachers and students themselves. As a result, even though learners have the information on lighting, available in their memory, they never recognize when to use it since the topic is isolated from the context of designing.

Besides, as it will be discussed in more detail in the following chapters, present design education in interior design schools does not provide competent

knowledge on lighting. Based more on technical information, programs miss providing an aesthetic understanding.

This necessity of developing a well defined lighting pedagogy and establishing a multi-leveled approach in teaching (with regards to inter-, multi-, and trans-disciplinary levels), and integrating qualitative and quantitative aspects of lighting within the core design curricula constitute the basis of this study.

The research problem is grounded in the professional responsibilities of interior designers with respect to the design levels they are to operate, the current situation of design education as fragmented teaching and learning practices that do not give students the chance of incorporating all knowledge into their design projects, and the lack of sufficient lighting instruction in design schools. This multi-faceted problem is explored in detail to provide a research framework basing mainly on the literature review, and also the author's observations and experiences as a design student, teaching assistant and studio instructor; and elucidated further in the following three chapters as the foundation of the research.

1.2 Aim and scope

Within this context, the study introduces 'constructivist framework' as the foundation of an instructional method to recall knowledge from all courses in design curricula into the design studio, particularly bridging the gap between lighting-related courses and design projects. Constructivism, taking knowledge as temporary, developmental, nonobjective, internally constructed, and socially and culturally mediated, is discussed as one of the most suitable epistemological stances for design education with regards to its problem-based studio education.

The study deals with the epistemological bases of constructivism and introduces the key conceptions inherent to the constructivist theory to show the aptness of employing its notions to design studio education. Exemplified constructs and the framework of constructivism are utilized to develop a research design, and adapted to the body of interior design studio. The aim is to analyze the effectiveness of constructivist learning in studio environment by experimenting it as a tool for integrating lighting knowledge to studio projects.

In order to examine the appropriateness of the suggested approach, students in one of the two fourth-year interior design studio sections were given lighting design exercises prepared with reference to constructivist premises, and received constructive feedbacks for their lighting design proposals during the semester, while the other section had no extra exercises and critiques on lighting design.

Additionally, final jury sessions were recorded and analyzed in relation to the discussions and questions about lighting design dimensions of the projects, with regards to the nature and content of the questions and faculty-related barriers against the integration of lighting concepts.

The study is also significant for the potential applicability of the proposal educational approach to integrate the other knowledge areas of interior design into design studio on for a more comprehensive, rather than fragmented, interior design education.

1.3 Outline of the study

This very first chapter of the study introduces the research problem. It refers to the broader context of interior design education and the nature of design

studios as the origin of this study. The ongoing debates on the unclear disciplinary boundaries and responsibilities of the profession and the gap between design studios and the other – supportive – courses in design curricula are defined as the roots of the problem. The primary focus of the study is explained as the attempt to integrate lighting design concepts to studio education, and constructivist framework is suggested as an approach to overcome this disintegration problem within the context of lighting design issues. The research methods and strategies utilized in the study are briefly mentioned.

The second chapter aims at describing the broad context of the research. The current definition of the interior design is given in order to clarify the present situation of the profession along with the duties and responsibilities of interior designers. The existing situation of interior design within the Turkish context is also explored. This chapter is important for understanding why lighting design is/needs to be an integral part of the profession.

The third chapter is structured around the existing nature of interior design education, and design schools in the Turkish context. Design studio is discussed as the core of education. The intrinsic properties of the studio environment and its unique pedagogy are explained to constitute the initial basis for the appropriateness of constructivist approach in design education. This chapter also defines the current status of lighting education within design schools as an undervalued dimension, and emphasizes the need for lighting design knowledge for interior designers. The existing barriers to integrate lighting design aspects to interior design education are defined for three major contexts of education as curricular (content-based), instructor-based, and learner-based problems.

In the fourth chapter, constructivist learning framework is proposed as an approach to overcome the disintegration problem in interior design curricula in general, and to integrate lighting issues to design studio in particular. The aptness of constructivist pedagogies for studio education is demonstrated with reference to the specific attributes of studio teaching and learning processes.

The fifth chapter is the elucidation of the research methodology in terms of data gathering and analysis strategies in order to test the effectiveness of the proposed framework. One of the two main stages of the research is explained as the evaluation of the lighting exercises and final lighting design proposals of students for the section where constructivist instructional approaches are applied, and its comparison to the final lighting design proposals of the students who did not complete any lighting exercises and receive any prior feedback on their lighting designs. The second stage is the assessment of the jury recordings of both studio sections to clarify the instructors' and students' perspectives on lighting design within the context of studio projects and to understand the nature of the jury dialogues with respect to lighting design aspects.

The last chapter consists of the discussions and conclusions about the findings of the study. In addition to providing pedagogical suggestions for studio instruction, the chapter underlines the significance of the research for interior design education, and defines further research directions.

2. INTERIOR DESIGN AS A PROFESSION

To conceptualize interior design education and trace the subject of lighting within its body of knowledge primarily it is essential to define what interior design is, and then outline the boundaries of profession, and elucidate the duties of an interior architect/ designer.

2.1 Definition as a profession

The definition of an interior designer which was formulated by Foundation for Interior Design Education Research (FIDER), the National Council for Interior Design Qualification (NCIDQ) and major interior design associations of North America[1], has been endorsed by the programs of interior design. FIDER defines an interior designer as the professional who is qualified by education, experience, and examination to enhance the function and quality of interior spaces for the purpose of improving the quality of life, increasing productivity, and protecting the health, safety, and welfare of the public (Definition of an interior designer, n.d.).

The definition has been modified slightly in time and NCIDQ's definition, created in 1990 has been the standard for the interior design profession and was adapted across professional organizations and by the FIDER. The last revision completed in 2004 stands as follows:

> "Interior design is a multi-faceted profession in which creative and technical solutions are applied within a structure to achieve a built interior environment. These solutions are functional, enhance the quality of life

[1] The foundation of the American Institute of Interior Decorators (AIID), National Society for Interior Designers (NSID), Interior Design Educators Council (IDEC).

> and culture of occupants, and are aesthetically attractive…"(American Society of Interior Designers, n.d.).

In line with the above definition, interior designer's scope of services (American Society of Interior Designers, n.d.) was presented mainly as programming, conceptual design, design development, contract administration and evaluation.

The scope of services includes particular references that indicate lighting design as a practice service and an important facet for an interior designer (Appendix A). Accordingly, an interior designer deals with the preparation of reflected ceiling plans, lighting design while selecting colors, materials and finishes and equipment -in compliance with universal accessibility guidelines and all applicable codes- in order to appropriately convey the design concept and to meet the needs of human.

In Turkey, the definition and the scope of services have been adapted by the programs of interior design. However, instead of the term interior design, most programs refer to the discipline as interior architecture, referring to the emergence of the profession as a sub-discipline of architecture. The terms of interior architect and interior architecture have been defined as: Artist working in the branch of interior architecture, decorator and the artistry of shaping a structure's finishing and furnishing work respectively (Hasol, 1993).

Within the scope of this study the profession will be referred as interior design.

2.2 Interior Design within the Turkish Context

Although the establishment of the Chamber of Interior Architects in Turkey dates back to the 1970s, and the first education in interior architecture had started in 1925, in Mimar Sinan University, people have been encountered with the expression of 'interior architecture' as a profession beginning with late 1980s, due to the proliferation of interior design schools that are especially constituted within the privately founded universities (Demirbas, 2001; Kaptan, 2003).

The number of interior design schools by 2005 has increased to 21, a totaled number regarding Turkey and the Turkish Republic of Northern Cyprus. Along with this rapid increase, the debates, regarding the structure of the discipline, the quality of its education and the necessity of interior architecture as a profession, along with legislative and jurisdictional problems were introduced in academic discourses. The indefinite and undetermined boundary of the profession in practice alongside with the unset accreditation standards of the departments offering interior design programs leads to the uncertainty in most curricula content, to inconsistency in education considering the instruction and evaluation criterion and defines a vulnerable area of expertise for the graduates. "The scope of responsibilities, the tasks performed, and the specific qualifications required to use the title or practice design are issues that need clarification" (Martin, 1998, p.36).

As mentioned before, interior design has been constituted rather distinctively from architecture starting with early 20th century, in countries like the United States and defined as a separate profession with its own amount and level of experience and education (Nutter, 2001). However, in the case of Turkey the

educational structure and practical realm of interior design cannot be seperated from architecture yet. The profession is still referred to or associated with the term ‘decoration’ and also discussed as a subset of architecture -content and intent wise- as well as architects’ being inquisitive about the need for this profession.

Architecture territorializes within the design realm, and architects in Turkey still hold direct responsibility for creating almost all the facets of architecture and the built environment.

3. INTERIOR DESIGN EDUCATION

There is at present no body of literature that comprises the theory and educational practice of interior design (Loustau, 1988). Although there are quite a number of studies for defining the body of knowledge of interior design, the attempts were not articulated to develop a body of education, but rather were concerned with answering the questions regarding regulation and licensing of the interior design profession (Marshall-Baker, 2005). Starting with the 1980s, interior design especially in the States encountered oppositions questioning the graduates' licensing and the programs' accreditation (Friedmann, 1986).

Studies by Harwood (1991), Friedmann (1986) and Guerin (1992), suggested the necessity for interior design as establishing an educational body of its own. However, current interior design programs still try to establish their educational programs in the roots of traditional origins of interior design discipline; within the fine arts education, home economics and architecture programs (Whited, n.d.).

Kaufmann's and Lee's studies support the arguments that interior design education persists a transitional period in which practitioners and academicians do not reconcile regarding the foundational knowledge for instructional preparation, course types and their contents (cited in Gane, 1984, p.30-31).

Argyris and Schon (1974) identified the problem of design schools as their deficiencies in preparing the students to be competent practitioners and their lack of assistance in acquiring them the skills essential in their practice in the real world.

The problem of uncertain boundary of practice in interior design in Turkey, when combined with similar deficiency in scholastic approaches prevent students from becoming professionals or specialists -in certain fields like lighting design. The reason for this can be grounded again in the educational system, in providing the sufficient knowledge. However, it is not possible to make such clear cuts in interior design discourses like in many fields of design, as the epistemological problems or approaches in curricula are somewhat tentative. “We don’t succeed in helping our students understand that there are various knowledge bases on which they might move…” (Argyris & Schön, 1974, p.142).

In Turkey, the Chamber of Interior Architects is still struggling for legislation of interior design practice as a separate and distinct profession. This goal is directly linked with the recognition and organization of a well-defined body of knowledge and education.

The lack of standards and a systemized body for accreditation of interior design disciplines in Turkey results in polarization in interior design education as well. Each program constructs its curricula by adopting a selected design program and establishes the faculties from the public associations, since there are not enough trained design educators in academia to fulfill the growing demands. This reciprocal relationship within the problematic also affects the educational research negatively.

Although its importance is maintained by the definition of the discipline, it is not possible to ascertain the degree of acknowledgement or the place of lighting design knowledge within such vague educational definitions.

Interior designers are not educated, or trained to be architects; yet, until the reconciliation of disciplinary boundaries and the body of knowledge, the pedagogy

of interior design will be fed by the knowledge areas and the structure of architectural education.

3.1 Interior Design Curricula in Turkey

Each interior design academic program has a different emphasis because of the mission of the institution and department, and the focus of the faculty.

Similarly, the schools of interior design are by no means the same in Turkey, but their curriculum descriptions express similar functions of profession, such as the design of enclosed spaces in buildings (Çankaya University), creation of the environments that human would live in a physically and psychologically satisfied situation (Anadolu University), manipulation of interior spaces with special attention to materials, color and textures (Girne American University), conceiving spaces to enhance the quality of life and to increase productivity and to procure health and safety (İstanbul Technical University), etc[2].

In his study on interior design, Kaptan (2003) analyzed the curricular structure of interior design schools in Turkey examining their course contents and the departments that the programs are being offered. According to the study, 55% of interior design programs are offered by fine art faculties. The second rank was given to art and design faculties and the third to art, design and architecture faculties which comprised 20% and 18% of the offered programs respectively. His results portrayed significant differences for the definitions, teaching and curricular contents in each school.

[2] Complete list of interior design programs in Turkey can be found at the Turkish Chamber of Interior Architects' web-site: http://www.icmimarlar.org

The differences are also significant in their considerations of technical and theoretical knowledge domains. For examining the situation of lighting-related courses within the curricula of interior design schools in Turkey, a similar analysis was conducted. The content search of each curriculum showed that there are great variances between the schools that are offering lighting-related courses. The matter will be introduced within the following sections while describing the current situation of lighting courses in interior design curricula.

3.2 Design Studio as the Core of Interior Design Education

The basic way in which a designer learns to design is by learning how other designers have designed or are designing. Architecture and design educations are dominated by this method of studio teaching which varies between "what educationalists might refer to as tutorial based teaching and apprentice-based teaching or mentor-based teaching" (de Graff & Cowdroy, n.d.). Like in the traditional design pedagogy, design studios maintain their status as being the most significant aspect in interior design education, too.

An interior design studio environment is a place where students acquire design cognition by creating, accumulating and sharing experiences and information of designing. It has its own unique pedagogical approaches to be able to train design students for reconciliation of diverse factors for a consistent and integrated design product. Interior design studio education is conducted following a learning-by-doing process as mentioned. In this sense, it is dependent on what students produce, how they get feedback from their educators, and how they revise their designs in the light of this feedback. Thus, one of the most significant factors

for the success of design studio is the communication between the involved parties. Studio has its own pedagogical strategies to empower this communication: Feedback on student projects are given either in the form of one-to-one "desk crits" as a private conversation between the student and the teacher, or publicly as students' presenting their projects in front of their peers and teachers, being criticized about what they have done so far, and getting advice on how to improve their work, i.e. pin-ups. Pin-ups are also useful for other students listening to the criticisms, in addition to the student who is on the stage. They give a chance to the listeners to more objectively evaluate the teacher comments and their possible applications to their own projects (Tate & Smith, 1986).

Interior design studio setting with multiple sources of information and several modes of representations embedded in social interaction, dialogue and experience has been an arena for many debates comprising issues ranging from the epistemology of design knowledge to the fragmented practices in design activity.

Although recognized by many as the melting pot or the integration core of knowledge (for example: Schon, 1985; Jeng, & Shih, n.d.; Purcell & Sodersten, n.d.), current models of design studio education is characterized by disintegrated teaching, individualized subjects with little connection in between (de Graff & Cowdroy, n.d.; Pultar, n.d.).

Studio pedagogy as mentioned above is constructed on the relationship in between the tutor and the design student. While working on a project, design student is assisted, guided and coached by an authority, a virtuoso as Schon (1985) calls it. "This mentoring process provides the conduit by which good design, while outwardly difficult to describe, is demonstrated, practiced and adapted by the student" (Johnson, n.d.). Disintegration of teaching in this reciprocal relationship

becomes more evident when the mentor is not the same person as the one who teaches in the knowledge areas supporting the studio course (Purcell & Sodersten, n.d.).

There have been numerous accounts on resolving the problematic body of design education, theories and ideologies formulized to bring about an answer to the undertheorized body of design which is generally identified by professionally driven design education.

Schon's studies maintain a significant role in identifying the process of designing and describing knowledge generation in studio environment. The nature of design studio instruction was referred as reflection in action. (Schon, 1985; 1990; Waks, 1999). He tried to describe the nature of design studio with its dynamics, conflicts, pedagogies, etc. reflecting both instructors' and students' perspectives. Basing his theory to the improvisations in jazz, Schon analyzed design studio environment as reflective practicum and the ongoing process as reciprocal reflection in action. He adapted the action theories -which he had developed to analyze professional practice, in terms of effectiveness and organizational learning- to design studio process and described the knowledge construction with regards to reflection in and reflection on action constructs.

Current discussions on active learning, collaborative learning, project and problem based learning approaches are all fed by the action theories of Schon.

However, he overlooks the parameters of disintegration and fragmentation in design knowledge which both create conflicting paradigms in design practice (Schon, 1985; Schon & Wiggins, 1992). Especially in his protocol analyses which were structured around the dialogues between a studio instructor and a design student, he does not deal with the theory of dialoging and social interaction or the

interpersonal and socio-cultural contexts. For instance, the conveyance of technical knowledge being presented in text is an asymmetrical one in terms of dialoguing. The tutor plays a strict authoritative figure in the conversations, decreasing the value of student's active engagement in the interplay (Schon, 1985). Mostly, the student presents a silent gesture, accepting propositions coming from authoritative voice. Therefore, it is doubtful to talk about an effective reflection-on-action from learner's point of view, since she is not given the opportunity to analyze the problem by assistance provided through self reflection.

In addition to action theories, problem based learning (PBL) has particular implications to studio education. The ill-structured problems in studio pedagogy have been related with PBL which is an increasingly used jargon in the educational realm. "PBL is a way of constructing and teaching courses using problems as the stimulus and focus for student activity" (Boud & Feletti, 1997, p. 2). It is not a recently developed or defined concept. Its roots are retrieved from the classical Socratic approach of thinking which opposed teacher dominated approach that is present in most design schools today (Shanley & Kelly, n.d.).

Different than the problem solving activity and ill-structured problems in design process, PBL problems are abstracted from the reality of practice. Therefore, solving the problems in the project is not the point in knowledge construction, but rather each problem serves as a generic problem and learning about problems and solutions to it are the salient educational agenda (de Graff, Cowdroy, n.d.).

The reflection action theories and Schon's attempt in defining the nature of design process with PBL approaches constitute the foundation of arguments on

lighting education and constructivist framework that will be presented in the following sections of this study.

3.3 Nature of Lighting Education

3.3.1 Need for Lighting Education

It is with no doubt that light is the strongest "catalyst"[3] uniting us with our environment. It is needed for many purposes central to vision, and required to fulfill a large number of activities arising from human needs. It is vital for various task performances, visual comfort, aesthetic judgment, mood and atmosphere, and social communication (Rea, 2000).

Over the past twenty years there has been a movement in lighting practice from illuminating engineering to lighting design, a movement from calculations of illuminance to judgments of aesthetics, a movement from quantity to quality (Rea, 2000). The movement has been assisted by the progression in lighting technology, which allows designers to propose new solutions on existing situations, and work on new and innovative fields with an extending variety of lamp and luminaire types (Tural, 2001). Regarding natural lighting, inventive solutions are expanding in terms of fenestration systems, and glazing types with various possibilities of shades and control devices that all merge with artificial illumination and control practices. Lighting design has become more significant.

From layman point of view, every single individual has adapted to this inordinate alteration in their life-time cycle –a shift toward nights- and found more possibilities in terms of lighting design products. With disperse of lighting

[3] Erhardt (1985) used the term "catalyst" in defining people and environment relationship.

technology and its application to consumer level, the number of available light sources in the marketplace have increased, and nights have become days.

However with the increase in people's interest in more and more brilliant days and nights, particular problems pertaining to energy use and production has thriven. After 1990s, the increasing trend in exterior lighting applications (cited in Tural, 2001), and lighting-related product consumption patterns among societies brought about concerns pertaining to sustainable use of resources. Jung, Gross and Yi-Luen (n.d.) underline the energy crisis in 2001 as a turning point towards sustainable use of electricity, and lighting design has gained more importance since then; with particular attempts to increase public awareness on codes and guidelines for more economical and efficient utilization of lighting systems. Much work has been done by adopting more efficient lamps to the existing applications. In author's country, similar attempts can be observed in terms of selection and use of compact fluorescent lamps –although the function of space, luminary design etc. is mostly disregarded - as a remedy for energy consumption.

The continuous and accelerating evolution of human kind have found its implications in the formation of built-environment. There are about one to two billion buildings (Davis, 1999, p.3) on the earth being lit by simplistic to extravagant solutions of lighting design. From incandescent lamps dangling down the ceiling to sophisticated facades illuminated with computer assisted light emitting diodes, lighting became an indisputable feature of individual and social life.

Within this context, along with the many currently emerging specialization fields, lighting design has gained more significance as an indispensable component in the design of built environment.

While man-made environments continue to enhance in size and extent, vary and alter in terms of function and use, artificial lighting and daylighting design acquire great importance, and demand new understanding and development. Research and collection of data, technology transfer from optics and engineering fields, and accumulated knowledge resulting from its close connection to building sciences have constructed a foundation for the appreciation of the necessity of lighting design as an educational field and as a professional practice.

Therefore design and application in the fields of lighting calls for academicians, professionals and experts those qualified with qualitative and quantitative aspects of illumination, and skilled to resolve a variety of tasks demanding comprehensive knowledge on lighting notion.

However, current situation in lighting design body does not present an established model in academic and practice realms to meet educational and practical demands. “In a world, dominated by light and dependent on light, there is surprisingly almost no lighting education” (Warren, 2002, p.156).

It is difficult to restrain lighting to a specific field of expertise. As an interdisciplinary subject, lighting appears in the territories of electrical and lighting engineers, architects, architectural engineers, interior architects, and landscape architects which all use its technics and knowledge to produce various levels of visual comfort and spatial character. Questioning the existence of interdisciplinary cooperation and the level of interaction is subject of another research necessitating an in-depth analysis. The study rather inquires disciplinary actions to further discuss the generation and dissemination of lighting knowledge.

Although lighting design sustains its emergence in various territories and its provision is usually performed by unspecialized people (Warren, 2002), more

architecture professionals and academic institutions have begun to recognize lighting design as a valid, discrete discipline, not simply a service enhancing the grand design (Calhoun, 2003).

Besides, in many countries, one of which is Turkey, disciplines that comprise and recognize lighting design do not exist yet. As an example, neither lighting design nor lighting engineering has been established as a discipline so far. The absence of such disciplines and fields of expertise, especially in design professions, monopolizes the formation, utilization, and use of lighting knowledge within the district of electrical engineers. Jargonizing the subject of lighting in these fields, result in particular problems pertaining to educational premises as well.

3.3.2 State-of-the-art Lighting Education in Design Disciplines

Education, maintains a great variety of debates and discussions comprising its whys, ways, and tactics in almost all the fields of sciences and application. Although we are not thought like the way our parents were, current system relies on previous theories promoting teacher centered strategies. However, there are numerous attempts to develop instructional design and teaching methods such as active and collaborative learning in order to enhance effectiveness in pedagogical terms.

In addition to the attempts to change instruction, availability of technical tools and aids to teach as well as to disseminate information has been accelerating greatly. Design professions, encompassing theory and practice, are still holding similar concerns in curricular structure and pedagogy, and continually try to devise their educational theories in terms of undergraduate, graduate and continuing

education. Interest in lighting design and technology within design disciplines and academia brought more questions towards teaching of design, and in particular, how to teach lighting subjects.

Although becoming a more recognized issue in design-based curricula with standards and certain conventions, a consistent method for teaching lighting has not been codified yet. In many degrees and programs, emphasis is not adequate, and mostly externalized with surface approach to learning and teaching[4]. The subject has too often been overlooked in both interior design and architectural education programs (Brent, 1985). Its importance as an integral element of a design solution is unfortunately not sufficiently stressed in design studio projects.

Within this respect, the notion of lighting, being one of the predominant subjects of building physics and having close relationship with science, art and application, needs a comprehensive approach regarding its educational methods.

Dombroski, maintaining engineering schools and design schools as two areas concerned with lighting, feels that lighting design part of the education in both ends are inadequate and disorganized (Ruffett, 1985).

Current approaches in education and practice demonstrate the continuation of such problematic, since the issue of lighting and its design is misconceived by many as selecting lamps and installing luminaries. Defining the matter within such boundary is an opposition to its absolute place in human life and a pure overlook to its role in shaping our life-cycle. Lighting cannot be isolated from the matters concerning environmental protection, energy efficiency, urban design objectives, technical performance, and statutory requirements (Warren, 2002). Being related

[4] Ramsden (1992) uses the term 'surface approach' to emphasize memorized information, unreflectively associated facts and concepts etc. in teaching and learning approach.

with human needs like vision, perception and psychology, it encompasses a vast range of mutual relations that form its versatile body.

Attitudes towards Lighting Education

State-of-the-art lighting education is determined and necessarily be weighed by several factors including curriculum in various disciplines, faculty, instruction, graduate studies, facilities and teaching resources.

Detailed analyses, information and literature survey about the current state of lighting education are not readily available. Studies listed below discuss the importance as well as the underestimation of lighting as a design tool, and stress its ignorance in design-based curricula.

Ginthner points out that there had been a major change in lighting education in 1980s, stating that in early 1980s, it was not possible to trace any approach regarding lighting education, and the only courses that contain lighting notion could be found in engineering departments (Ruffett, 1985, p.31).

According to Benya, the increased awareness towards lighting design and lighting design education came from the technological advancement (Ruffett, 1985, p. 33). In terms of lighting technology, both equipment and technique of application has altered, proposing more and more solutions to the experts, and professionals in the design fields. There were more glittering times in America till the energy crisis in early 70s. Many systems have been developed as a response to the energy crisis (Rey-Barreau, 1983). Ginthner tells that after the crisis the way people use lighting sources and equipments changed (Ruffett, 1985, p.33).

Being aware of the importance in proposing economical and functional solutions, designers searched upon ways to incorporate aesthetics into the projects.

Ruffett's study (1985) discreetly comprises facts on the spread of this awareness into the academic area. Educators talking about lighting issues in his survey demonstrated this awakening in terms of their experiences in lighting design courses and instructional design, and emphasized the methods and tactics they planed and studied.

Dombroski sees the suddenly developed interest in lighting subjects in the States in early 1990s, as a result of increase in the number of interior design schools. He believes that interior design field is the fastest growing professional art program, and most schools incorporate lighting design to their curricula, realizing that they cannot teach interior design without teaching lighting. "Because lighting controls so many aspects of a space, you cannot design that space properly without designing the lighting for it, too" (qtd. in Ruffett, 1985, p.32).

Before the proliferation of interior design schools, fields of theatre and performance arts supplied great accounts for lighting design, by manipulating light to create special effects of mood, illusion and drama (Hegde-Niezgoda, 1991).

One other point discussed by Meden is the fact of increasing interest on specialization in design fields, which influenced the idea of lighting design instruction in various curricula (Ruffett, 1985). It was early 1980s when lighting design became legitimized as a profession, and got recognized in the States. Parsons School of Design in New York and Rensselaer Polytechnic Institute in Troy, New York, are stressed as having leading roles in lighting design instruction. While the former emphasizes history, aesthetics and psychology of lighting by stressing its critical role in social formation, and in qualification of built environment, the latter concentrates on the technology of lighting proposing research opportunities and facilities (Calhoun, 2003).

Whereas as discussed before, in Turkey, such specialization and professionalization of lighting design as a discipline has not been established. Looking at the current situation, it is possible to state that both interior and exterior lighting projects of a building are managed by the electrical engineers in Turkey. In line with the functional necessities of the space, they calculate the required level of illumination, and find the number and locations of luminaries accordingly. The aptness of the projected lighting scheme is therefore questionable as their selection criteria relies purely upon calculation of required illumination levels.

Kesner's study in late 1980s is another example illustrating the development in lighting education, pointing out interior design as the most lighting course-supported major (Kesner, 1987). Besides, Kesner draws attention to the importance of supplying adequate resources for teaching lighting courses effectively in design based curricula, and underlines demonstration aids and laboratory support as major factors in enhancing lighting education quality. Survey results demonstrated model making/testing facilities, and measurement equipments as the areas of greatest need, and pointed out library references as of least needed resources.

Dombrowski also mentioned the deficiency in supplying aids and facilities, audiovisual and printed in particular, which would be used to demonstrate "quality lighting" to students (Ruffett, 1985, p42). Butler feels that lecturing students on the effects of lighting from a textbook without taking them to installations where they observe in a practical sense is nonsense and useless (Ruffett, 1985).

However, about twenty years after the study of Kesner, and Ruffet, Anderson (1999), a lighting designer from Norway, still maintains the necessity of lighting literature and references besides problems pertaining to research facilities.

He states that there is still very little serious and comprehensive literature about lighting education issues and lighting related sources are mostly the coffee table books with mere illustrations of producer's catalogues or price winning luminaries (Anderson, 1999).

Adequate resource supply to interior design or architecture majors in Turkey is also still in its infancy even within privately founded universities. Although the universities in Turkey seem to have autonomy in terms of administrative and financial structure, they have liability to the Council of Higher Education (YÖK) "which steers important activities of higher education institutions, i.e., planning, organization, governance, instruction and research" (*Outline of the Turkish Education System*, n.d.). Especially in foundation universities, design-based programs are seen as income services, while engineering majors having greater allowances from funding. Thus, design-based majors - established with less investment compared to engineering departments and believed to sustain their academic life within studios or ateliers- lack in research facilities, and artificial and daylighting laboratories to acquire, manipulate and expand lighting knowledge.

Beyond the university realm, manufacturers present in-house or on-site training for professionals and students (Calhoun, 2003). Web-based courses and programs are sponsored by various institutions and associations like the Illuminating Engineering Society of North America (IESNA) and the International Association of Lighting Designers (IALD) to increase awareness and provide training to practice lighting design.

Hegde-Niezgoda (2001), studying on the perceptions of lighting educators and professionals regarding lighting concepts, found out that interior designers

tend to value the acquisition of lighting knowledge through continuing education, workshops, visits to demonstrations and testing laboratories as significantly higher than architects and lighting professionals (p.69). They tend to utilize the resources supplied and sponsored by institutions after graduation. Although for interior designers, the scores for acquiring lighting knowledge through formal education were higher than architects, and other lighting professionals (indicating the importance of lighting issues in their profession) (Hegde-Niezgoda, 2001, p.76), the study does not explain whether and/or how they had acquired their lighting knowledge before they pursued professional or post-graduate studies.

Curricular Aspects – What to teach?

According to Rey-Barreau (1983), most of the existing methods in lighting education were restricted in their approaches to scientific and aesthetic matters. Emphasis was placed either on scientific approach, e.g. to task lighting, or on an artistic viewpoint concerned primarily with perceptual considerations.

The emphasis actually varies in different design disciplines and in each design curricula. For some architectural schools whose curricula is directed more towards practice than theory, lighting-related courses embody more calculation based technical knowledge, giving less weight to quality. It is possible to see more accents on quality issues in theater, interior design, retailing and home economics programs, where lighting component is seen as a stronger support for practice and spatial perception.

To clarify aspects to be taught for each design discipline, and to make praised statements for curricular discussions, primarily it is essential to analyze

each profession –interior design in this study- in terms of the operations they ascertain in practical life.

- Is it possible to classify particular variables of lighting for different design professions? e.g.: For an interior architect what are the most important issues in lighting design?
- What kinds of responsibilities an interior architect would undertake in practice?
- Is he/she going to deal with daylighting? If yes, to what extent?
- Is he/she going to collaborate with an electrical engineer and/or architect? If yes, which aspects of daylighting they should be learning during their undergraduate studies?
- Is it apt to ascribe certain issues within those aspects to particular professions? e.g.: quantitative aspects to engineers, quality issues to interior designers etc.

It is difficult to answer such questions with clear-cut statements since the philosophy of design makes it difficult to define boundaries. An interior architect may participate in inter-, multi- or trans-disciplinary design teams working on solar shading devices. Such circumstances may not necessitate him/her to know and use quantitative aspects of daylighting, but may call for fundamental knowledge on the relation between daylight and human factors, to communicate and perform effectively as a design team member.

Besides disciplinary context, subject matter to be covered in lighting courses is also related with the extent of course load in the curricula. "Within many programs in interior design or architecture, a single requisite course in lighting is taught," DiLaura says, "To get serious about lighting, there must be a sequence that lasts several years at least" (Calhoun, 2003, p.196).

Similarly, lighting-related courses in undergraduate programs offered in several interior design schools in Turkey have single requisite course format except Maltepe University (which offers two successive courses at graduation year). They are suggested at different levels –from 3rd semester (sophomore year) (e.g., Beykent University, Bahçeşehir University) to 8th semester (senior year) (e.g., Maltepe University, Çankaya University) and with different number of course hours (e.g. from two hours, at Karadeniz Technical University to five hours at Çankaya University), with changing course credits (two to five credits). There are also programs without any offerings on lighting in their interior design programs (e.g., Hacettepe University, Marmara University, Girne American, Cyprus International University). [5] In some instances, whole semester load for the particular light-related course is not fully dedicated to lighting subjects, but includes other factors of building physics, and also environmental control topics (e.g., Environmental control courses at Eastern Mediterranean University and Çankaya University). Except Çankaya University which offers the light-related course (Environmental Control including climatic control, thermal comfort, daylighting, theory of sound etc.) at the last semester of education, none of the universities provides practice-oriented and/or laboratory sessions.

Differing lecture hours with distinct topic coverage shows substandard state of lighting courses, and maintains the following questions pertaining to course content and curricular discussions: Throughout their undergraduate training, is it possible for candidates of interior architects to apprehend sufficient lighting knowledge to utilize in creating the essence and character of space? To make

[5] Curricular information and course descriptions were retrieved from universities web-pages. Complete list for Interior Design Schools in Turkey can be found at official page of Chamber of Interior Architects of Turkey <http://www.icmimarlar.org> and Chamber of Interior Architects of Turkey Istanbul Division <http://www.icmimarlarodasi.com>.

accurate selections in the wide range of lighting products, do they acquire adequate awareness on lighting topics? After graduation, are they well equipped or become ready to encounter with design and application process for different projects? If the aim is to define lighting as an integral part of the design process, is it relevant to suggest these courses at junior or even at senior class levels? These questions call for content analyses in the ongoing lighting education with regards to lighting and lighting-related courses in departments of interior design.

Qualitative aspects of lighting can be considered as having great importance for an interior architect, since the profession[6] deals with the enhancement of environmental atmosphere and acts as a definer of human behavior and moods. In her survey, Hedge-Niezgoda (1991) who studied the importance of inclusion of lighting concepts in interior design curricula, found out that lighting educators from architecture and interior design departments emphasized qualitative aspects of lighting as the most important factors to be included in the curricula (quality of light and color of light having the greatest mean scores, 4.572 and 4.681 respectively, out of 5.000). However, the way qualitative aspects are introduced to the subjects in the survey is doubtful in its essence, since the clarity of the category differentiations and how they are explained to the survey respondents is debatable.

Lighting educators, who speak out on the state of education in lighting, in an interview, underlined a similar stance, maintaining quality aspects as significant constituents in their teaching methodologies in opposition to the quantifiable ones (Ruffett, 1985):

[6] See Chapter 2 for FIDER's definition of interior design.

> Dombroski: "The student should be taught to design for what the mind sees or interprets and not just what the eye sees. That's the most important thing in teaching lighting design" (p. 34).
>
> Butler: "We do have the mechanical and mathematical sides to lighting, but we're bound to forget the aesthetic side…" (p. 36).

However, in the author's country, lighting education and related courses are generally based on pure calculations. Illuminance is not the most important element in lighting design but unfortunately it happens to be the easiest lighting metric to calculate and measure, as Steffy (1990) denotes.

Talking about a student who has taken such lighting course dealing with formulas and calculations, it is possible to state that he/she would possibly learn to compute the required illuminance level by dividing the luminous flux to the unit area that is to be illuminated, and would know that he/she can find the necessary illuminance levels for different functions from relevant standards, charts and tables. (Nowadays such calculations are made by various software, distributed, free of charge, by several commercial companies that have affairs in different parts of lighting industry). But after graduation that would be the electrical engineer handling those issues instead. If the lighting designer –the electrical engineer rather than an interior architect in many cases– does not hold an artistic notion or conception on psychological effects, and particular techniques that would all help him/her in attaining the desired space atmosphere, and/or does not consider them of necessity in his/her approaches, the outcome would be not satisfactory.

The International Commission on Illumination's (CIE) study on lighting education[7] indicates that lighting in most of the countries is acknowledged by architects and electrical engineers or technicians (CIE, 1992). However, it was

[7] CIE has received answers from 14 countries and on the basis of the responds prepared a report on Lighting Education.

realized that there are very few lighting engineers as experts in the lighting design field.

> Most of the lighting designers today come from an interior design or an architectural program. Some are from the theater and a few from engineering. That diversity has pluses and minuses. Lighting design education varies from discipline and from place to place, but if a good job is being done, both the art and the science of illumination are included. The third factor that some institutions miss is the human element (Ginther, qtd. in Ruffett, 1985, p.31).

Benya underlines the opposition between designers and engineers as a major problem that started in 70s and carried to 80s, and also states that "engineers place too much emphasis on calculating footcandles, while designers tend to mystify lighting" (Ruffett, 1985, p.36). Such suggestions and statements urging that 'lighting is an art as well as a science', such as by Erhardt (1985) does not propose a patch for current teaching approaches, but stresses the fact that it should not be bounded within engineering fields.

Pedagogical Aspects – How to teach?

- How do students acquire knowledge at studio, how do they learn, what motivates them to learn?
- What types of learning styles do they characterize through learning by doing activity?
- What are the strategies to incorporate lighting knowledge into the design realm?
- What (if anything) is different about interior design students that would affect the way they are taught lighting concepts?
- What are the methods for teaching quantitative and qualitative aspects of lighting?

As summarized in the preceding sections, lighting design is currently a tacit component in interior design profession. An accredited and competent degree in the discipline should underline the significance of lighting as an integral part in interior design profession, and formulate its curricula to reveal both issues of theory and practice in lighting.

CIE's survey for bringing up the matter of educational state in lighting points out the level of education as insufficient according to the comments and judgments received from the teachers in electrical engineering, lighting engineering and architecture. They are not happy with the ongoing teaching methodology based on technical aspects; rather they search for a method, based on the visual aspects and aesthetics of light (CIE, 1992). According to the report, the situation of architects regarding the acquisition of lighting knowledge is more problematic, since only a few of countries and institutions convey a well-grounded theory of lighting in design curricula.

Current studies on lighting in Turkey also lack in developing pedagogical aspects, resulting methodological poverty in learning and teaching of lighting subjects. CIE's study reflects a similar discouraging stance. Demonstrated results on the number of published articles about lighting education (4 to 30 - per country on a yearly basis) indicated insufficiency when compared with other fields of education (CIE, 1992).

One barrier against developing the theoretical framework for teaching lighting is the un-theorized body of the interior design itself. As discussed in Chapter 2, there is still an ongoing debate on interior design profession –with arguments on its accreditation to its necessity as a design practice- nurtured through debates on theories of architecture and of its education. The debates on

architectural education in Turkey comprise a series of discussions that aim at expressing the former issue of bridging the gap in between architectural theory and practice, through which it is not possible to find particular approaches or proposed frameworks that involve lighting education (Çağlar, 2001).

Integrating computer-aided design (CAD) and its software on lighting into architectural education is an illustrative situation among those debates. Although CAD offers extensive opportunities for the studio environment to improve the projects in terms of lighting design, in most design schools in Turkey, there is a gap in between the theory of design and CAD practice (Taşlı, 2001). Besides deficiency in facilities, like unavailability of digital studios because of financial constraints and pedagogical considerations, design computing is not valued among studio instructors, who are unaware of the extent of possibilities to solve design problems computationally (Taşlı, 2001).

Although current lighting software's rendering abilities are debatable in terms of realistic natural and artificial lighting conditions (Jung, et al., n.d.), they still maintain certain advantages like helping to visualize space under changing lighting schemes. Lighting educators in Ruffet's study in 1985 had foreseen the impact of computers on teaching lighting, and discussed how computers might influence lighting design in terms of technical performance, and how software might facilitate the access to information about lighting. "Practically the whole process of lighting application can be taught on the computer" (Dombroski, qtd. in Ruffett, 1985, p.34). It is important to stay abreast of technology in the field of lighting to provide insights into emerging technologies and trends in the field of lighting.

Previous section aimed at demonstrating curricular information and discussed the content issue of the lighting courses in interior design schools in Turkey. From the portrayal, it can be argued that departments tend to formulate the courses around lecture format, primarily as a result of the resource constraints. Secondly, what is more important is the fact that educators have limited knowledge on how to construct their teaching methodology for lighting. Only sources for adapting a methodology for teaching lighting are precedent lighting courses in design-based or performing arts curricula. However, each discipline, as discussed before, has its own professional boundaries somewhat defining the content of the courses.

> There are not enough qualified academic people who can go out and teach lighting. Every academic person who approaches the subject brings into the prejudice of the academic field in which he or she teaches. If the individual is professor of architecture, architectural engineering, electrical engineering, or interior design, they bring with them the shortcomings of that profession, because lighting design is none of those, but rather, lighting design, as a profession, is all of those (Benya, qtd. in Ruffett, 1985, p. 39).

Additionally they have not been taught to teach, but rather acquired their teaching skills like they acquired their design expertise, through normative theories of their tutors. Since teaching lighting is comparatively a new challenge in interior design education, it is difficult to employ academicians qualified in this field. "Most of my colleagues have no background in education" (Long, qtd. in Ruffett, 1985, p. 38). "They have never been taught to teach. One has to discover how people learn before one can be a teacher. A good designer is … not necessarily a good teacher" (DiLaura, qtd. in Ruffett, 1985, p.40).

Alternatively, many departments tend to hire practitioners to bridge the gap between theory and application, and to offer a more practice-based approach in their programs.

> The teaching of lighting is extremely immature as a profession and as an educational curriculum. As the schools begin to recognize that they want to offer such a curriculum it's difficult to find the skills and the knowledge to do this in current members of the faculty,… [M]any schools revert to the professional community (Benya, qtd. in Ruffett, 1985, p.37).

Employing practitioners may raise problems in developing a systematic course content and pedagogy for the particular department, if the practitioner has little experience in teaching. It would be ideal to call for the ones who have experience both in teaching and lighting design and application.

> The ideal situation is a person who has the educational background and also has real lighting design experience. … [P]eople who do not have the real experience are not teaching the realistic day-to-day activity… They know the teaching methodology, but they don't know the best things to teach (Dombroski, qtd. in Ruffett, 1985, p. 38).

Before going deeper into the practitioner versus academician issues, it is necessary to underline the limited number of positions available for lighting educators in the current curricula in interior design schools in Turkey. The chart in figure 3.1 illustrates the interdependency of the relationships between system of education, administration, teachers, students and facilities, and describes the reciprocal connection in between those entities.

To achieve success in a program in terms of lighting education, departments seek qualified academicians. As Israel underlines, it is not possible to have good programs unless there are good teachers (Calhoun, 2003). The assertion can be discussed in terms of the aforementioned context of practitioner vs. academician, but the aim is to emphasize the need for increased number of graduates interested in lighting design and its education. Both practitioners and academicians should be appreciated by administrative authorities in order to develop the programs in terms of lighting concerns. As in programs like in the United States, where tenure-track systems involved in higher education system, it

gets more difficult to locate academicians with on site experience in lighting (Calhoun, 2003). Although that would develop other concerns about the level of relationship between instruction and practice, it would be possible to introduce lighting courses involving practitioners and academicians together as a team. "It's difficult to tell whether it's the schools that are affecting practice or practice affecting schools, … practice seems to be little ahead" (Long, qtd. in Ruffett, 1985, p.32).

The success of a program in terms of lighting education would increase the interest of prospective students, particularly in lighting design, and that would have a positive impact on the number of students searching for specialization opportunities in lighting design and education after graduation.

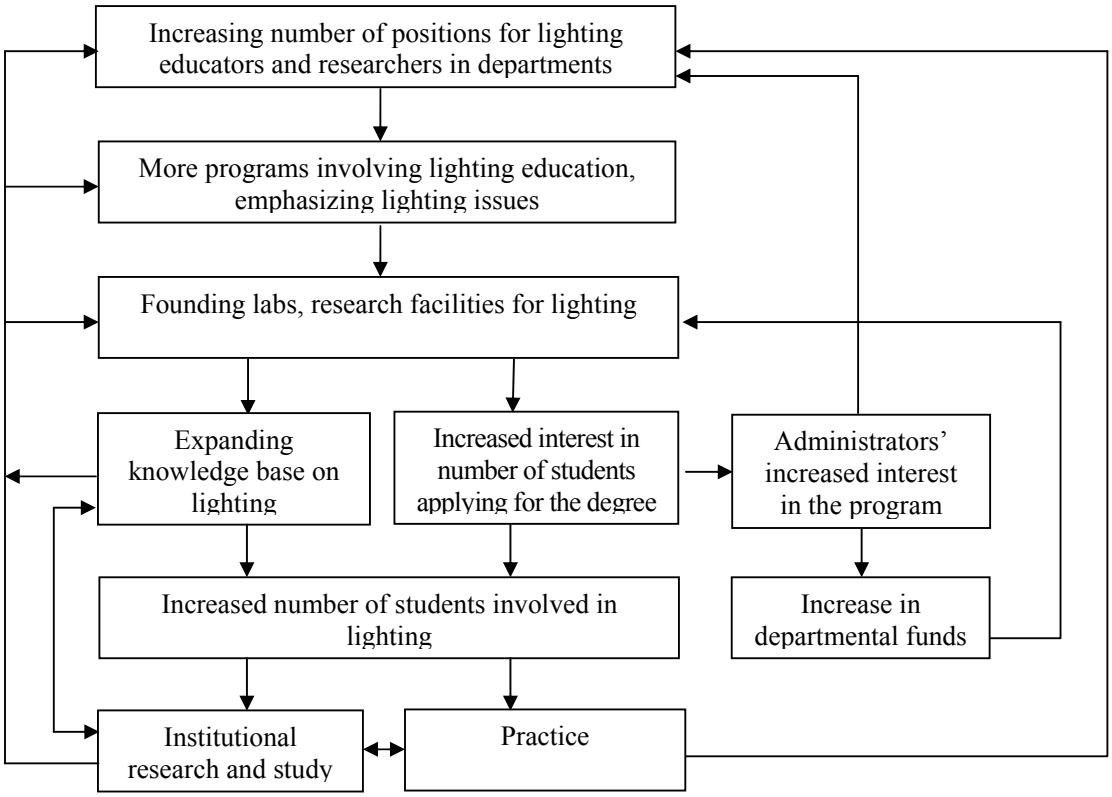

Figure 3.1. Interdependency map for emphasizing lighting education in design curricula.

Programs offering several lighting laboratories and research facilities will also have an intrinsic effect on design students' interest in lighting and those particular interests will aid in developing the knowledge base for lighting education. Additionally, students of interior design schools should be informed about the employment opportunities in lighting design. They should be offered paths of specialization in lighting to increase the number of ranks for professionals of lighting design as well as education.

> The International Association of Lighting Designers' (IALD) emphasis is to make students aware of the professional field of architectural lighting design. Lighting consultants may work on 5 percent of all architectural projects. Let's say we could double that to 10 percent. We don't have the depth of ranks to accomplish that. Where would we get all those designers to double our field? Clearly, there is a huge need for better lighting education (Calhoun, 2003, p. 194).

Another approach underlined by CIE for developing lighting educational methods is professional training options that are provided in some countries after graduation as post-graduate studies or particular training programs specified by institutions. More than an alternative approach, the Commission identifies post-graduate education as the easiest way of disseminating lighting knowledge:

> The attention of the National Committees should be drawn to the importance of post-graduate education. (Lighting education in many places cannot be included in normal hours of lectures and therefore it is easier to get into the universities and institutes in this way –like the Greeks in the wooden horse of Troy) (CIE, 1992).

Ideally, design disciplines require a knowledge base and skills from a wide range of areas, but also the ability to combine these diverse fields in a single project. As a result, design education covers a lot of knowledge fields in its curricula, mostly in an incoherent way. This divergence is also observed in design research. Additionally, especially in the last few decades, the increasing fragmentation in the design professions and numerous specializations within

design disciplines caused more interconnectedness in design curricula and among faculty and professions belonging to these specific areas. Specialization and fragmentation of design knowledge resulting in decreased communicative abilities between parties has its implications in lighting education, too. As stated by Pultar (1998) within the context of building sciences, having such different worldviews and value judgments, professionals have a distorted conception of the importance of their own field within building (p.157). As Calhoun (2003) argues, cultural perceptions and misconceptions persist, particularly in high levels of architecture; architects tend to think of lighting designers as technicians, taking lighting as a service discipline.

Within such indecisiveness offering lighting education as post-graduate studies may intensify the issue of fragmentation, (with each discipline offering a master's degree on lighting e.g.: Master's degree in interior design with concentration on lighting, master's degree in architectural lighting, master of fine arts degree in lighting design etc.) unless building the professional level on a general lighting design knowledge that is provided in undergraduate studies. Furthermore, graduate studies should be formulated to have a strong relation with undergraduate studies. Graduate seminars and presentations should foster audience from all levels in the program.

In the previous section, qualitative aspects of lighting were underlined as having utmost concern for interior design students. However, they still need to acknowledge basic information on quantitative issues. Since they will only be dealing with preliminary calculations to have an awareness on the quantity of lamps and understanding of fixture locations, quantitative aspects might be taught using rules of thumbs -without extracting formulas but rather simplifying them. As

an example, for an interior designer it would be sufficient to know that as a rule of thumb, the distance of a light source from the ceiling, for uniform cove lighting application should not be less than 50 cm.

For qualitative aspects, it is important to provide case studies besides rules of thumbs, for making students understand, analyze and reflect on the applications in spaces they perceive. Case study method has been utilized in many disciplines of design as a tool to help students understand the underlying principles and also processes (Akın, 1997, n.d.; Koti, 1997; Cook & O'Neill, 2003). Trial and error, experience and common sense are other crucial factors that take a major part during a design process (Rey-Barreau, 1983). Pedagogical wise, students would feel more comfortable to learn from the mistakes of others by observing as many cases and examples as possible. The case of case studying will be elaborated in the following chapter to discuss its function for integrating lighting subjects into the studio projects.

In schools having limited resources for demonstration facilities, quantitative information can be communicated through physical models and mock-ups. By experiencing the visual data, students will be able to have immediate conception on the lighting qualities of the spaces they are designing.

3.3.3 Discussion

The aim in the previous sections is to present the necessity for developing a well defined lighting pedagogy, and to discuss the reasons for establishing a multi-leveled approach in teaching (with regards to inter-, multi-, and trans-disciplinary levels), structured to integrate qualitative and quantitative aspects of lighting within the core design curricula.

Rather than proposing an explicit list of tactics, the purpose is to develop a framework to discourse what kind of information to include in teaching, and make arguments on pedagogical premises on how to convey those notions to students. The arguments have not been necessarily put to resolve the problem of how to teach lighting, but rather to emphasize the inevitability of teaching and learning lighting.

The discussions underlined the fact that present design education in interior design schools does not provide competent knowledge on lighting. Based more on technical information, programs miss providing an aesthetic understanding.

The problem is identified by defining an interdependency map –a causal chain- for reasoning the inferior position of lighting in design education, taking students, teachers, curricula and administration into account. A holistically planned philosophical approach, uniting artistry and technical concerns, with physical and psychological factors that affect human-environment relationship is essential to reveal lighting education in design-based programs.

Interior designers may not be experts in the field of lighting design, but in order to resolve problems related to lifetime activities of individuals and create such spaces of living, in other words to perform well in their profession, they need to reflect a kind of competency, integrating quantitative and qualitative lighting aspects humanistically.

In order to propose a comprehensive lighting education for interior design schools the problem of disintegration in the existing education system will be elaborated in further detail in the following sections in terms of curricular and instructional problems as well as barriers intrinsic to teachers and students themselves.

3.4 Barriers to Integrate Lighting Concepts to Studio Instruction

In undergraduate curricula of design schools, students are offered a variety of courses along with their primary concern, the studio as the core of their education. All these courses are assumed as design supportive and complement the studio project, while some are theory based and some are more directed to practice and application. The major criticism pointed out by instructors is students' failure in making relevant connections in between these courses and the studio project regarding their contents.

Instructors especially the ones who teach building physics courses feel discontented when they attend in the fourth year graduation juries, and are dissatisfied when they observe the graduation projects as students have significant problems in appraising and reflecting on to the lighting knowledge they acquired in sophomore and junior years. If the student cannot reflect his/her awareness, understanding and/or competence even at the final stage of his/her educational life, where can the reasons for the situation be traced?

As a continuum to previous section of the current study which defined the necessity of incorporating lighting education in design curricula, and dealt with the current situation of lighting education, the following section will elaborate those particular reasons for the disintegration of lighting notions in studio education and in design process.

The reasons for disintegration are grouped in three topics and claimed as barriers preventing the acquisition and generation of lighting knowledge within design studios. The claimed barriers were devised from the author's background and experiences as being a design student, as a design studio teaching assistant and

as an instructor of fourth year design studio. They represent the compilation of observations from critique sessions, pre-juries and final juries.

Taking its roots from ethnographic research, the observational accounts – notes gathered during juries and from critique dialoging, photographed and analyzed student projects- constituted the basis for defining the problem in this study as procedural, methodical and interpersonal misfits between lighting notions and studio instruction. Interpersonal context of the problem is analyzed in terms of instructors' and students' roles in design studio referring to their reflections on design activity, while curricular barriers comprise the status of lighting knowledge and its acquisition methods in interior design. Although the problem is broken down into three major topics, they maintain a strong correlation and interdependency.

The participant observation tactics also act as preliminary stages of the proposed research design and the adopted theory for integration, which will be introduced in Chapter 4.

3.4.1 Instructor-based Problems

There is inadequate research and documentation about how design instructors acquire their design teaching knowledge. Design schools add more questions onto the vague methodology in teaching design, by sustaining weak linkage between research in design and its instruction. It is with no doubt true that the "experience of design studio education as a student is necessary to becoming an effective design studio instructor, but is it sufficient?" (Ochsner, 2000, p. 194). In other words, in pedagogical terms, is experience as a design student the only pedagogical model for teaching design? If so, are these experiences adequate to

sustain the faculty's teaching methods during their instructional career? What other sources of information might be considered while trying to define the context and content of interaction between the instructor and the design student (Ochsner, 2000)?

Knowledge-based barriers

Since the scope of this study entails lighting knowledge, the questions above will be rephrased to provoke discussions about design faculty's methods and ways of acquisition of information on lighting subjects. How did the instructors of design acquire their lighting knowledge (Hegde-Niezgoda, 1991)? How valuable is it to their instruction? What resources do they acknowledge as significant for such acquisition? What was their design instructors' approach in teaching design and lighting knowledge when they were once students of design? How do they use their experiential knowledge in teaching lighting? Since designing is knowledge intensive (Friedman, n.d.), and a complex practice comprising technical and aesthetical inquiry, how can it generate a theoretical body of education if precedents and experience are only tacit sources (Fosnot, 1996b; Akin, n.d.; Ochsner, 2000; Erkip, Demirkan, and Pultar, 1997) for its cognizance?

It is not the intent of this study to scapegoat design instructors as unaware, ignorant or unknowledgeable about lighting. Yet, their knowledge and level of acquisition of lighting notions are still subject to debate.

Throughout the juries and critiques that the author has attended in design studios of third and fourth year, it has been observed that there are particular problems and misconceptions in the way the instructors used lighting related terminology and concepts.

In the 2003 Fall Semester third-year interior design studio in the Department of Interior Architecture and Environmental Design, in Bilkent University, students, being asked to represent two of the four seasons in the "pre-constructed" space using the given six light sources, proposed particular space designs using particular design elements specifically dealing with colors of materials, by sticking colored plastics and louvers in front of sources to change their apparent color and manipulate lighting direction.

Figure 3.2 shows an example from final presentation phases of a student group project in which the transition between spring to summer is emphasized using color shifts with an abstract depiction of the growth of seeds. The students explained their approaches for using particular colors as follows: "The change from cold to hot/warm colors represents the change of seasons. Therefore, as summer is a hot season, we used warm colors like orange and red". This preconception about the selection and the use of color schemes comes from the misconception of their instructors on light and color related issues as well as students' previous knowledge on design and color theory. Through the critiques they were either not reminded or informed about the distinction between surface (pigment) colors and the color of light or did not acquired substantial information from their experiential design knowledge to construct an understanding of the distinction between the two terminologies. Although a blue analogous scheme can represent the clear sky of a pure hot summer day, almost all the students used blue as an attribute of cold temperature. The remark of an instructor portrays the significance of the problem with regards to his/her acquisition of lighting knowledge: "We are learning numerous facts on lighting while looking at the projects".

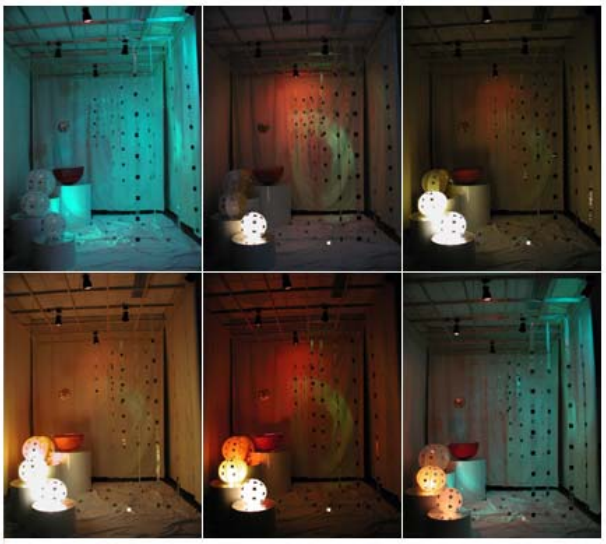

Figure 3.2. Conceptualizing seasons with light and color

Value-based barriers

Every instructor wants to look confident in the class or in the studio in front of the students that he/she instructs. "[W]e fear that they may see behind the mask and that they might recognize that every time we teach design studio our own identification with the students we teach may re-energize all those old emotions (the ones we ourselves experienced as students in studio) that we had thought we had left behind" (Ochsner, 2000, p. 194).

That kind of stances can be described as the milieu of interpersonal contexts in designing, and identified by the individual differences among students and teachers themselves, and between the two groups. They may originate from different sources and can cause significant problems in the process of design with regards to content of dialoguing (lighting notions in our case) as well as the outcome of project to be evaluated in juries. The gaps in psychological states, expectations, and preferences of instructors with regards to design and their

acquired knowledge about its process, can be rooted in the self-definitions of the individuals regarding their background, belongingness and attachment to certain subcultures, and their previous experiences.

Certain psychological states of design instructors are also a very counterproductive aspect for design process. One of the reasons of this negative aspect is explained as "countertransference" where the educator feels the necessity of repeating his/her bad, abusive and destructive design experiences (particularly related to critiques and juries) on his/her students, justifying this as a requirement for a good design education to himself/herself (Ochsner, 2000).

The tendency towards being the authoritative figure in design studio brings about situations where the instructor implicitly hinders his/her particular deficiency in areas -other than his/her focus of interest- either by drawing the contours of dialogue (Gergen, 1995) by directing the content to the area of expertise or terminating the sub-discussion with another issue of concern.

Although there are considerable focus in literature on expert knowledge and the representation and retrieval of expert knowledge, "what has not been addressed is whether or not an expert represents, accesses and utilizes all knowledge equivalently" (Purcell and Gero, 1992, p.82).

It is naturally not possible for an instructor to have extensive knowledge covering all areas of design (content of the content[8]) however, substantial information is essential to sustain studio culture and knowledge transference. As described in the previous chapter, current methodologies in design studio give little importance to teaching lighting since it is not possible to find instructors with competent lighting knowledge.

[8] Term is introduced by Teymur (1992) as content of the curriculum, syllabus, activities within and outside studio, content of cultural, physical, social, historical contexts, educational discourses etc.

Following conversation[9] illustrates the discussed dynamic, through which the juror (a guest design instructor) tries to screen the extent of her/his knowledge on lighting. Although being curious about the state of lighting in studio projects, the juror, by directing the subject matter to a blurry experience, terminates the inquiry as well as the criticism to be proposed. The primary question is answered by one of the studio instructors who acts with a self-protective gesture to maintain the shape of conversation within that particular student project, and also to defend his/her image of authority and success.

> Juror: We do not see too much about artificial lighting in the projects. Maybe that is because it is completely a complex subject in a project.
>
> Studio Instructor 1: Actually yesterday we had more examples. (Defensive gesture against the implicit inquiry of the juror who tries to understand students' general tendency towards incorporating lighting subjects into their projects)
>
> Juror: I think we need to see more individual… well
>
> Studio Instructor 2: Task lighting?
>
> Juror: Yes, task lighting. Overall general lighting, maybe ambience. And there was one more… (Tries to define lighting categories) General, ambience, and the third… What was it? (No reply from other voices) Well, I'd like to see task lighting in here. I really imagine of them. I remember a library having similar study areas, I remember its task lighting now. It was somewhere around … Washington maybe…
>
> …
>
> Other jurors did not comment on or complement to the inquiry on lighting and the content of discussion changes.

Instructors' stances in studio (authoritative, collaborative, supportive, destructive, etc.) and their actions during dialoguing (insecureness about particular design domains) can be related with their design value system –a collection of their value judgments on designing through their experience in the culture of

[9] Presented excerpt was recorded during the final jury presentations of senior students of 2004-2005 Fall Semester, at the Department of Interior Architecture and Environmental Design at Bilkent University, in Ankara, in Turkey. Methods of collecting the data and related inference will be discussed in the following chapters of this study.

design they belong and design education they acquired. Defined in particular by their 'socio-cultural' and 'percepto-cognitional' values (Pultar, 2000), instructors possess certain priorities in the process of design, advocating certain knowledge fields of greater importance than others. Uluoglu (1990) suggested four-fold approach to define design instructors' subjective domain of design knowledge which should be elaborated in terms of their value systems: Instructor's approaches to the philosophy of architecture, to the philosophy of design, to the philosophy of education and to the philosophy of communication. Each believed to be characterized by instructor's experience and value system on that particular notion.

Figure 3.3 shows the 2001-2002 fall semester fourth-year interior design studio syllabus, in the Department of Interior Architecture and Environmental Design, in Bilkent University. As seen on the weekly scheduled design process in syllabus, lighting subjects are regarded as patches to the design project, to be incorporated at the finalizing stage, at tenth week of the whole design activity. The figure is a significant example illustrating the un-prioritized rank of lighting subjects with other components of building physics like acoustics, heating and ventilation. In a studio with such conception, it is not plausible to expect critiques involving discussions on lighting and not possible to see projects enhanced in their approach to lighting concepts.

Overvaluation of personal design values, priorities and preferences by the design instructors can dominate the criticisms of student projects, resulting in an unacceptable degree of subjectivity in their criticisms and evaluation. Giving their feedback from their own frames of references with no aim to connect their points to students' frames of references is another major reason terminating fruitful

communication. This will also result in discounting students' experiences and subjectivities, or displacing what students find of value and meaning in their lives (Dutton & Willenbrock, 1989, p. 55).

Instructors' un-valued stance towards lighting notions is more evident within their attitude towards computer aided presentations. Even though the developments in computer technology suggest many alternative routes for students in presenting their lighting ideas, there is still some resistance to computer-aided design and drafting from some design faculty in line with their proficiency in computers.

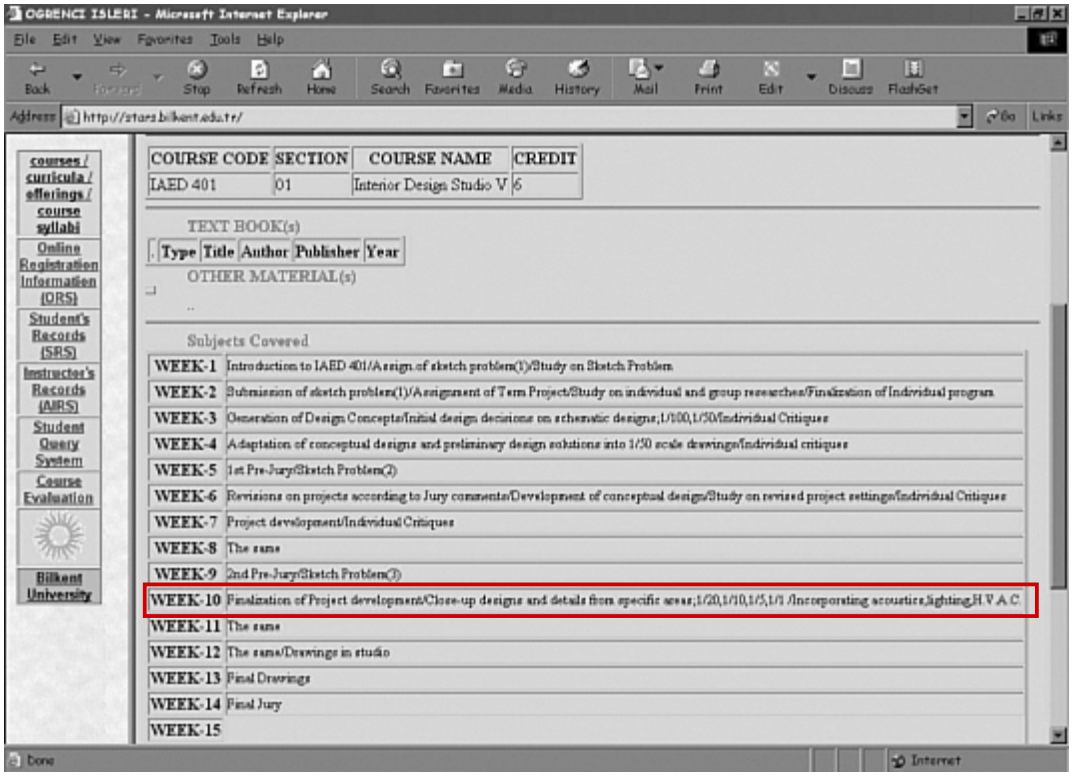

Figure 3.3. Fourth year interior design studio syllabus (Retrieved May 25, 2003 from http://stars.bilkent.edu.tr/)

The roots of the dilemma of manual versus computer-aided drawing in design schools have been dealt by Basa and Senyapili (2005) by examining

attitude differences toward computerized drawings. Defining "loss of author identity, problems of authenticity, and proficiency of the instructors in computers" as the contributing factors, the authors have concluded that the adjustment period for computers has not ended yet. These negative attitudes sometimes direct the process of design jeopardizing the efficiency of knowledge transference through dialogues and in evaluation processes.

"Design inevitably involves subjective value judgement" (Lawson, 1990, p. 89), but the concern would be less problematic if both students and instructors act more explicit in their design decisions.

3.4.2 Learner-based Problems

One other aspect leading to an unproductive communication is related to students' differing responses to criticism. Due to personality or other reasons, while one student is willing to accept criticism, another student may adopt a defensive stance rejecting to get a constructive feedback. The following excerpt[10] is an example for a design student's defensive gesture which almost completely terminates interaction. In the example the student ignored particular question (for three times) about how did he/she illuminated the space, and tried not to get involved in a situation where his/her lighting knowledge will be questioned.

> Juror: I have two questions. Why LED (light-emitting-diode)? Why plexiglas?
>
> Student: I don't want to create glare so I used sand blasted plexiglas. Another reason for using sand blasted plexiglas is making the light source unnoticeable.
>
> Juror: You could have installed another type of source then, why LED?

[10] Presented excerpt was recorded during the final jury presentations of senior students of 2004-2005 Fall Semester, at the Department of Interior Architecture and Environmental Design at Bilkent University, in Ankara, in Turkey. Methods of collecting the data and related inference will be discussed in the following chapters of this study.

Student: Well, I don't know…

Juror: When you are proposing a design idea you have to think about its whys and hows. How do you illuminate history section? Particularly how do you illuminate the aged-books? They are very valuable and important and it is forbidden to touch them, right?

Student: To obstruct the light coming from the skylight I have made a suspended ceiling.

Juror: You know, those writings are very important assets and cannot be restored in case of serious deterioration. What is your solution?

Student: I protected them from sun.

Juror: Ok, but how did you illuminate them artificially?

Student: Walls are bright and there are lights inside the box.

Juror: I am asking again, what are you using to illuminate them? (Inquiry about student's knowledge on lighting technics and technical solutions for the space he/she designed)

Student: I may say LED but I really do not know.

…

Discussion terminates.

The excerpt also portrays a contrary situation to Schon's (1985; 1990) theory of reflection-in-action, which he explains practitioners' skilful responses as their routinized, sometimes spontaneous deliberations, referring to their experiential knowledge and previous trial-by-error actions. However, as seen from the student's explanations, he/she has not developed a relevant conception on why he/she proposed LED's for illumination –through his/her reflective-actions fed by past experiences, cognition and knowledge- but rather developed an uncertain situation with conflicting values, based on the action of transference. Action of transference in our suggestion should not be conceived as the act of conveyance. We suggest its conceptual use referring to psychoanalysis, where it is defined as individual's tendency to repeat, in current setting, the attitudes, impulses and desires experienced or generated in relation to figures in individuals' development (Ochsner, 2000, p. 200). In other words, the student suggests LEDs as a response

to his/her un-cognized action, repeating the light source selection trends of his/her friends in design studio without critical thinking.

Schon (1990) suggests that the only way to help this type student (who enters design process in a defensive position and encounters difficulties in involving in himself/herself in experimentation) as engaging him/her in reflection in action. If the student in the portrayed case had been motivated to search for possible lighting solutions pertaining to the designed space during the process of designing, he/she would have had a basis and a conception to explain the proposed idea even if it was not apt for the space.

Students' lack of interest in making research suggests another barrier to integration problem from learners' side. Franklin and Erickson (1987), underlined the importance of introducing research to the baccalaureate degrees of interior design as an significant component of their design processes and found differences in student reasoning when they were involved and encouraged in making research.

The problem of disintegration originates from sophomore studios of design, and fed by students' lack of research interest on lighting subjects. Figure 3.4 charts a typical cyclic process route for mapping design activity. Although the process is often un-sequential and the phases are overlapping with each other (Eekhout, 1997; Teymur, n.d.; Lawson, 1990), defined processes of design literature employ phases of accumulation, investigation, development and communication (implementation and use phases (Pultar, 2000) are excluded from this discussion). Reasonable information on lighting is not collected through first and second phases, and students continue developing the project with undersupplied solutions for lighting-related problems. Also, as they experiment little about how to present lighting ideas in their drawings, they become accustomed to draw perspectives

with empty ceilings, and draft orthographic presentations that are deficient in lighting accounts, which all can be identified as a problem of communication of the solutions (Phase IV). Following dialogues recorded in the same setting with the previous ones and exemplify instructors' complaints about students' lack of interest in research phase (Phase I).

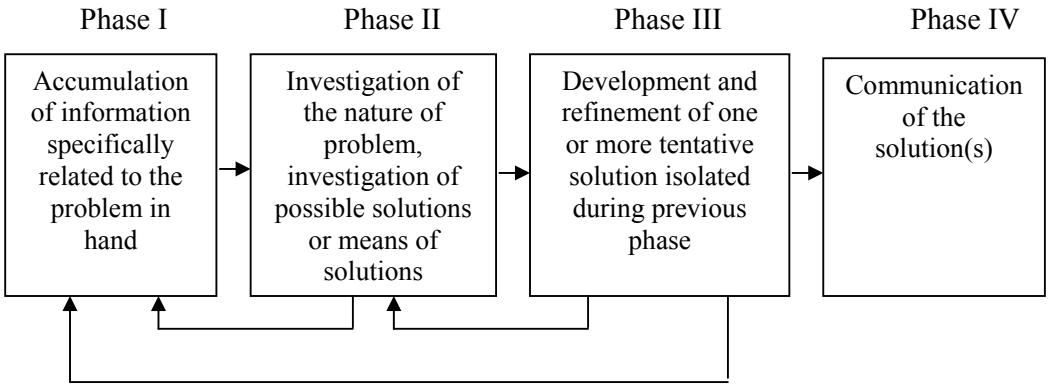

Figure 3.4. Design process work-map adapted from Lawson, 1990

> Student: (while describing the allocation and floor plans) My special section in library is designed for history books (given a public library project, students were expected to propose special collections as well as the main collection).
>
> Juror: We have a similar section in our library, have you seen it?
>
> Student: No.
>
> Juror: Research part of the projects is extremely poor. Don't take it personal, it is a common problem of the whole class.
>
> …
>
> (another evaluation)
>
> Juror 1: In case of a failure how can we change a lamp located at the mid-portion?
>
> Student: I did not consider that.
>
> Juror 2: What about the cables? I guess they will be visible and distort the appearance.
>
> Student: …(Do not answer)
>
> Juror 3: Even if we don't see the cables I think we will perceive luminary's structure.

Student: …(Do not answer)

…

Juror 3: The problem I generally observe is students' lack of interest in making research related with the project.

One of the most observed problems pertaining to graphical representation/communication is students' incompetent and even primitive way of lighting representations (Figure 3.5). Ideas are not conveyed substantially with creative skills of presentation.

Figure 3.5. Fourth-year interior design students' lighting design sketches.

Cutting and pasting luminary photographs from manufacturer catalogues onto material boards for final presentation is a habit that students sustain from the early years of their studio education. The pasted figures do not give any information about photometrical data and properties of the light source, and the selected luminaire usually do not fit to the spatial requirements but rather exist to fulfill the project requirement of 'incorporating lighting into design' (Figure 3.6).

Figure 3.6. Material board with pasted figures from manufacturers' catalogue.

Incompetence in presentations should also be discussed taking drawing courses and their instructional methods into account (curricular and instructional problems) since students learn the basics of graphical communication and also develop their presentation skills through those courses. Because, the program and such courses aim firstly at equipping the students with skills by teaching them a representational language and then training them to select those skills at a defined time related to the type of presentation (Basa and Senyapili, 2005).

Similar to instructors' differences in their value system which defines their prioritizing particular knowledge domains in design process, students of design tend to put their best effort into 'designing' the project, perceiving the supportive courses as providing information which places limitation to their design.

> If one were to poll professors of architectural technology courses, one would find that their most common grievance reflects the fact that in the minds of the students, their courses inevitably play second fiddle to the studio. […] They don't want to compromise their studio designs to satisfy building codes or environmental concerns. (Fontein, 1997, p. 160).

3.4.3 Curricular and Instructional Problems

Ideally, design disciplines require a knowledge base and skills from a wide range of areas, but also the ability to combine these diverse fields in a single project. As a result, design education covers a lot of knowledge fields in its curricula, mostly in an incoherent way. This divergence is also observed in design research. Additionally, especially in the last few decades, the increasing fragmentation in the design professions and numerous specializations within design disciplines caused more interconnectedness in design curricula and among faculty and professions belonging to these specific areas.

The accelerating necessity for interdisciplinarity in design professions is also another reason for curricular gaps in interior design, too. Specialization and fragmentation of design knowledge resulting in decreased communicative abilities between parties has its implications in design studio. As stated by Pultar (1998) within the context of building sciences, having such different worldviews and value judgments, professionals have a distorted conception of the importance of their own field within building (p.157).

Each instructor of interior design conceives interior design discipline and its boundaries differently. Having pre-conceptions nourished from their backgrounds and experiences, educators of interior design attribute deviant values to the definition and practical realm of the discipline. For instructors having architectural education degrees the profession may entail more architectural attributes, whereas for industrial designers teaching in interior design schools it may comprise entities at a different scale, like furniture design. Although clear-cut objectives and definitions are available underlining the duties and obligations of

interior designers, each school pursues its own trend and goal emphasizing different paths for education and practice (architectural, fine arts domains etc.).

Therefore, design students' undervaluing supportive courses is directly related with their instructors' attitudes towards the notion of design. Instructors' values on defining the boundaries of the practice of that particular design discipline propose problems pertaining to students' approach to designing.

In 2001-2002 fall semester fourth-year interior design studio final jury (in the Department of Interior Architecture and Environmental Design, in Bilkent University - IAED), one of the jury members uttered the following sentence which can be considered as a significant example for the valuation of interior design education and its practice: "If we are to evaluate an interior architecture project, it is nonsense for us to discuss the design of façades as well as asking students to design and treat them". However, openings on building envelope are one of the key factors for an interior designer to characterize the space atmosphere. Even if they may not be dealing with the dimension, form and orientation of openings after graduation, they may be asked to devise solutions for controlling daylight such as by canopies, shading devices and shutters.

If such conceptions are maintained by studio instructors, students may fail in treating the facades by disregarding building orientation and ignoring environmental parameters (Figure 3.7).

Figure 3.7. Incompetency in façade treatments

FIDER has recognized content units and achievement levels for interior design education to describe the subject matters and their interrelatedness in an interior design curricula (Hegde-Niezgoda, 1991). While the content areas reveal the subjects to be covered in an interior design curriculum, achievement levels define the expected outcome from the implementation of those particular subject matters. The achievements discussed in the report are measured at three levels: Competency, understanding, and awareness.

> Awareness: Basic familiarity with concepts and examples that provide a broad general knowledge about a subject.
> Understanding: A deeper level of comprehension regarding concepts, a more specific and detailed knowledge.
> Competency: A highly developed ability to apply concepts and information to specific tasks (Hegde-Niezgoda, 1991, p.31).

Although the achievement levels have been agreed on and adapted by interior design programs seeking for accreditation, variances in curricular structures and differences in instructional methods devised for each different interior design program makes it difficult to generate strong links of relationships between the supportive courses and the design studio. In Bilkent University, in IAED, a systematized program has been developed, adopting the framework from FIDER, comprising each design studio's objectives, structure and implementation. The achievement levels with respect to the issues covered in design studios can be seen in figure 3.8.

Design Issues		1st Year		2nd Year		3rd Year		4th Year	
		Basic Design I	Basic Design II	Interior Design Studio I	Interior Design Studio II	Interior Design Studio III	Interior Design Studio IV	Interior Design Studio V	Interior Design Studio VI
Perceptual Elements	Org. of Geometric Shapes & Forms	A	U	C	C	C	C	C	C
	Color	A	U	C	C	C	C	C	C
	Texture	A	U	C	C	C	C	C	C
Spatial Organization	Human Factors		A	U	C	C	C	C	C
	Human Behavior		A	U	U	U	C	C	C
	Programming			U	C	C	C	C	C
	Space Planning		U	C	C	C	C	C	C
	Furniture & Fixture			A	A	U	U	C	C
Building Elements	Structure		A	U	U	U	U	U	U
	Construction			U	U	C	C	C	C
	Detailing					A	U	C	C
	Materials		A	U	U	C	C	C	C
	Codes & Standards			A	U	U	C	C	C
Environmental Factors	Lighting		A	U	U	C	C	C	C
	Acoustics						U	U	U
	HVAC					A	A	U	U
Presentation Techniques	Technical Drawing	U	C	C	C	C	C	C	C
	Model Making	U	C	C	C	C	C	C	C
	Rendering			U	C	C	C	C	C
	Working Drawing					A	U	C	C

A: Awareness U: Understanding C: Competency

Figure 3.8. Bilkent University, Department of IAED's Committee Report on Issues Covered in Design Studios

As seen from the figure, students' competency in lighting is required starting with the third year of their education. However, as described by the problems pertaining to instructors, students and instructional methods, there are substandardizing factors in education that prevent full accomplishment of the underlined levels of achievement. For example lighting course is not a requisite for attending to third or fourth year interior design studios although students' competence in applying lighting notions to their projects is expected (Figure 3.9).

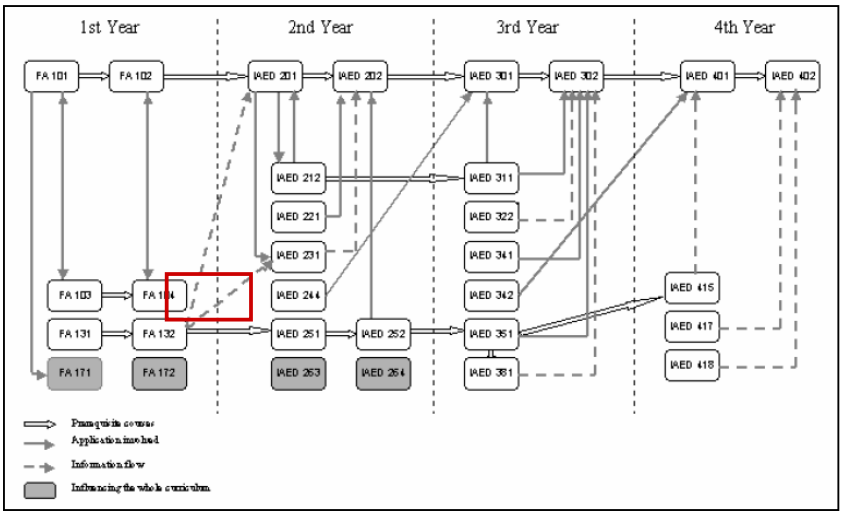

Figure 3.9. Course relationship chart (retrieved March 14, 2004, from http://www.art.bilkent.edu.tr/iaed/report1.htm)

Additionally, students that are attending to third or fourth year design studio courses without having taken the lighting course can not present any ideas about lighting during critiques and juries. Either acquainted with lighting course prior to fourth year studio or not, if the student does not represent any approach about lighting it becomes difficult for the instructor to enter a dialogue. Students' should generate an initial response to the problem creating a basis for the dialogue to begin. Following excerpt portrays such an instance where the juror tries to assess students' approaches to lighting design:

> Juror: How do you illuminate this space?
>
> Student: I have thought of it although I do not have reflected ceiling plans.
>
> Juror: Do you have anything else about lighting on your other drawings? (besides reflected ceiling plans)
>
> Student: (explains her ideas by indicating the spaces on plans and perspectives – Figure 3.10) There is lighting between these stacks and here over the circulation desk… I mean lighting is always from the topside.
>
> Juror: Can we see them on your drawings?
>
> Student: Well (looks at the drawing sheets), you cannot see.
>
> Juror: Anything else?

Student: There is lighting installed on the stacks that I have designed. It is designed for lighting the books rather than the space.

Juror: Where do you install the lamp on the stack, how do you mount the luminaire?

Student: I am thinking to install it through the plexiglass element (Not drawn, just explains by words).

Juror: Anyway, there are lots of things here that you have to consider. There is an exhibition space, an art section, reading rooms and spaces, carrels and a café. These all have distinct characteristics and have different lighting requirements. However, regarding lighting design, you propose nothing for those spaces.

Student: … (no response)

Juror: Unless you draw, we cannot see, understand and talk about your ideas. The only thing you have drawn about lighting is a lamp on the ceiling of head office (Figure 3.11). Right? And I really can not understand why you have designed it like that. I don't want to talk about the quality of your perspective drawings and the way you describe the space, but I cannot find any relationship between the lamp and the space defining elements – the backside wall- and also between the lamp and workspace -tables and armchairs.

Student: … (no comment)

Juror: … You cannot just say I had no time to think about it (lighting). It is not something to be left to the latter stages in design process.

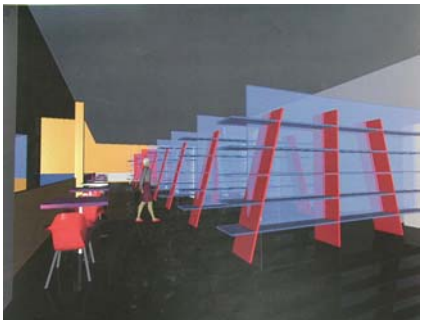

Figure 3.10. Stack perspective used for explaining lighting approaches

Figure 3.11. Perspective of the office space drawn in class weeks before the final jury.

Student-instructor ratio in a design studio is another important parameter affecting knowledge acquisition and level of interaction. For attaining the required achievement levels the ratio should not exceed 12 to 1 (Ochsner, 2000). However in interior design schools, the ratio is assumed to be plausible if it does not exceed 20 to 1. Such ratios may significantly change the instruction dynamic by limiting the time for discussions.

Asking students to draw reflected ceiling plans for explaining their lighting ideas is a common method employed in design studios. The results point out students' difficulty in visualizing the space three dimensionally. As seen from the figures 3.12 and 3.13, reflected ceiling plans are conceived as last minute sketch drawings full of unorganized circles which represent spot lighting. Even if the students would design artificial lighting applications other than pure spot lights for every single space they design, they would not be able to communicate their ideas just by drawing reflected ceilings.

> Most schools, both engineering and design, teach students to lay out lighting designs in two dimensional reflected ceiling plans. In actuality, no one ever sees the ceilings in two dimensions. The space is always seen in three dimensions with perspective. Until that type of perception is taught, lighting education is lacking (qtd. in Ruffett, 1985, p.42).

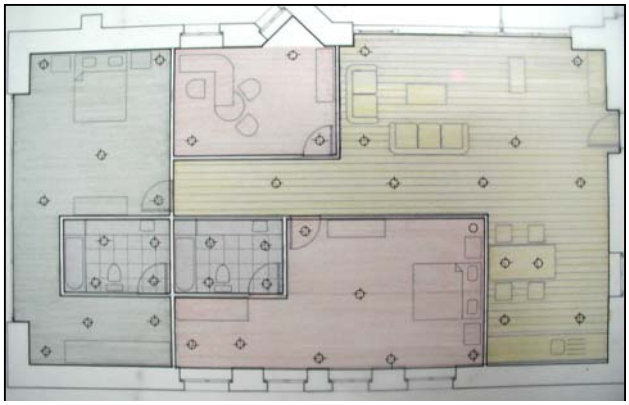

Figure 3.12. Sample reflected ceiling plan

Figure 3.13. Sample reflected ceiling plan

Also current instructional methods do not respond to all types of learning styles. As justified in literature, especially among design students, it is possible to observe different types of learning preferences and personalities (Demirbas & Demirkan, 2003; Nussbaumer, 2001; Watson, 2001; Kvan & Yunyan, 2005; Klein, 2003). In that sense, it would not be realistic to expect that all students will benefit in the same amount from critiques and a similar jury experience.

Design problems are complex in nature since there are a great variety of issues needed to be identified and addressed. They are assumed as ill-defined or ill-structured problems devised to make students analyze the misfits and pursue course of actions to come up with solution(s) that is/are favorable to the existing condition[11]. The structure or the definition of the problem is very important as it will maintain a boundary or provide more openness to students within the whole design activity. However, is it possible to observe projects or problem definitions in interior design studios that present an apt outline that is parallel to interior

[11] According to Simon to design is to "devise courses of action aimed at changing existing situations into preferred ones" (Simon, 1982, p.129).

design profession? Do they provide adequate problem solving dynamics that potentially entail lighting subjects?

> Problems are often poorly described and where models of behaviors or performance exist, they are often weak (Warren, 2002, p. 157). Professional education emphasizes problem solving but as in studio education "problem-finding" is most urgent and important (Schon, 1990, p. 11).

Since the tutors of interior design involve professionals with other design backgrounds, interior design studio projects sustain an analogous outline with projects of architecture, industrial and urban design. If the student deals with problems that shift towards other disciplines, how can he/she develop an own cognizance of the profession that is being studied? It is with no doubt insightful for a student to experiment with different scales in design, but it is the professional boundary that would encourage them to specialize and get acquainted with the information they are asked to seek for.

Referring to the discussions on the previous chapter, it can be stated that current situation of lighting courses do not provide a systemized approach in the curricular maps they are offered. The 21 schools of interior design in Turkey are by no means the same although their curriculum descriptions express similar attributes of the interior design profession. Some does not hold any lighting-related courses in their curricula and the rest approach to the issue by offering these courses in different years of the program, from 2nd year to 4th year. The success of conveying lighting issues to students starting with the fourth year of their design education is certainly debatable.

Although it is possible to say that there is a methodological shift in design realm from the traditional token emphasizing product and artifact towards

responsibility and systemized questioning in design (Findeli, 2001; Giard, 2005), current form of interior design does not support teaching processes and methods of designing and therefore fail to construct its own specific form of training. Product or the end project is emphasized with a greater significance than the processes of design. In most design schools in Turkey, final presentations as fine finished drawings and the final juries that evaluate those, are still assumed as the main and essential ingredients of designing (Gurel and Basa, 2004).

The unique nature of pedagogical approaches in design studio addresses teaching of analytical thinking, technical abilities and graphic and verbal presentation skills in the form of giving feedback by means of constructive criticisms to students. Final juries representing the evaluation stage of this pedagogy is expected to evaluate these abilities and skills following a similar procedure -dialogue between students and educators. However, as mentioned before, juries rarely evaluate achievement of all educational goals (especially lighting requirements) in the student project.

The evaluation criteria followed in the juries are also almost never totally clear to students and visitor jurors. Even when there are attempts to clarify it to the participants, there is no guarantee that it is carefully followed for each student fairly. This is partly due to the fact that guest jurors are almost never familiar with the project development phase and are never present in the improvement stages. This also leads to the domination of final graphical presentation on the actual design project. Gurel and Basa (2004) also underlined the over-concern of graphical representation in final juries as ignoring particular design parameters while promoting others.

The excessive subjectivity on the part of the jury members is underlined in literature (Anthony, 1991; Frederickson & Anderton, 1990; cited in Shaffer, 2003, p.5), in the form of bias toward their own priorities. One common tendency in jury evaluations is prioritizing creativity over and above other design requirements, and overlooking other project goals. This statement is also supported by de Graaff and Cowdroy (2002):

> … in design evaluation the rules under which the evaluation occurs, the criteria used for evaluation, and even the process of evaluation all change when we are faced with work that is outstandingly brilliant or work that is on the borderline between passable and unacceptable. [I]ssues which are overlooked in the brilliant design, however, are not overlooked in lesser work. That is, certain issues remain important in the evaluation of all except the brilliant designs. The rules have therefore broken down at the upper boundary, because the criteria which apply in general cannot cope with extreme cases and other sets of criteria are therefore introduced.

Akin (n.d.) defines this product-based and precedent-bind traditional focus as a particular weakness in design education. As students analyze the precedents they engage in an activity that helps them developing conceptual framework of their projects and formulating abstractions devised from concrete examples. However engaging in such activities emphasizing products of precedent as references for future solutions, there is lack of process analysis and students are again coached for and encouraged in final production. At this level where students are focused on production there is no direct connection between lighting knowledge that is relevant to what is to be designed and the process of learning how to design (Purcell and Sodersten, n.d.).

4. ADOPTING CONSTRUCTIVIST LEARNING FRAMEWORK FOR INTEGRATING LIGHTING ISSUES TO STUDIO INSTRUCTION

4.1 Constructivist Theory

Almost every youngster encounters stories starting the exposition with “in our times” from their parents, older relatives, brothers, sisters and so on. Many of those depict educational burdens and illustrate the change in the body of education, regarding mostly its technics -teaching tools and aids-, and to some extent the variance in content and context wise, but they usually do not state the similarity in the way they are taught with their younglings.

Today it became more challenging for a student to find a job after graduation, since the expectations are towards the ones who can operate their accumulated knowledge on solving problems, and adapt themselves to unresolved tasks rather than pursuing what is told to do. However, in almost every developing country in the world, there is an expression of discomfort considering the situation of graduates, their knowledge acquisition, and their lack of success in the way they utilize the learning that they have acquired through formal education. Von Glasersfeld (1995a) feels that the main root of this issue is the traditional behaviorist learning theory, based on the “power of reinforcement” that favored students’ performance rather than “the reasons that prompt them to respond or act in a particular way” (p. 4). As reinforcement leads to the repetition of the reinforced entities, students’ response is left into incompetence.

To increase learner effectiveness and provide them cognitive skills, much research in the past 50 years has been structured around developmental psychology (Fosnot, 1992). The research in the area started debates around instruction and instructional design (Winn, 1992). In search to accommodate new ideas in teaching and learning, traditional approaches have been questioned, and learning theories were redeemed to foster knowledge acquisition rather than performance.

Although constructivism seems to be a recently flourished idea in instruction, it has been realized by many as a theory of knowing and learning for over a decade. Working on the construction of constructivism, Mahoney (n.d.) highlights the increase in the frequency of the use of construct-based wording in psychology, and related research studies, articles, and papers in the last 30-40 years.

Piaget introduced the idea of constructivism about 70 years ago. It is claimed to flourish out of dissatisfaction with the theories of knowledge in the Western philosophy (von Glasersfeld, 1995a) and is said to be postepistemological[12] in that sense. As von Glasersfeld (1995a) states, it was the idea of knowledge having an adaptive function rather than the "purpose of producing representations of an independent reality" (p. 4). It is a philosophical view about how one "comes to know" and describes "knowing" (Fosnot, 1996a, p. ix; Savery & Duffy, 1996, p. 135).

To examine the transition towards constructivism in pedagogical terms, a clear-cut comparison and explanation is needed regarding the preceding paradigms:

[12] Von Glaserfeld uses the term citing a remark by Noddings in her chapter "Constructivist Views on Teaching and Learning of Mathematics".

Previous theories underlined knowledge acquisition as the awareness of objects that exist independent of any subject. As noted by Powers (2001) in that objectivist view, objects have intrinsic meanings, and knowledge is defined as a reflection of reality. He says that knowledge represents a real world that is thought of as existing, separate and independent of the knower; and this knowledge should be considered true only if it correctly reflects the independent world (Powers, 2001).

As an objectivist approach and theory, behaviorism explains that learning is a system of behavioral responses to physical stimuli (Fosnot, 1996a). Therefore, it is assumed that students engage in learning activity by listening to the explanations from teachers, practice activities and experiences that end up with feedback sessions (Bloom, 1956 & Gagne, 1965, cited in Fosnot, 1996a, p. 9). In line with this definition, as learners are passive actors of reinforcement, teachers become the active stimuli, with a well-structured curriculum and with a determined assessment technique. Fosnot (1996a) stresses that learners' progress is assessed by measuring their behaviors on the predetermined tasks in the curriculum structure.

Such theories still dominate most instruction and pedagogy today, in the form of memorization, direct lecturing and passive learning strategies. In their book about instructional design, Duffy and Jonassen (1992) underline that the formation and development of instruction is strongly related with an objectivist tradition, in which the world, meaning and the goal of understanding is structured around entities and attributes, taking experience as an insignificant aspect. However, in constructivist approach where situating is emphasized, meaning is rooted in experience.

Constructivism is fundamentally non-positivist in its nature (Fosnot, 1996a). Thus, constructivism provides an alternative epistemological base to the objectivist tradition. Grounded on research in psychology, philosophy, and anthropology, constructivism considers knowledge as temporary, developmental, nonobjective, internally constructed, and socially and culturally mediated (Fosnot, 1996a).

Increasing interest in constructivism and its reflections on instructional design have led to discussions confronting individual cognition and socio-cultural effects on learning (Fosnot, 1992). Below is a comparative summary of the points of views in constructivism.

As discussed before, in Glasersfeld's words, personal constructivism is a reaction towards traditional epistemologies, towards the one-way conveyance of knowledge from instructor to learner. "Knowledge is actively constructed by the learner, not passively received from the environment" (Dougiamas, n.d.).

Radical constructivism adds another principle to the former: "Coming to know is a process of dynamic adaptation towards viable interpretations of experience. The knower does not necessarily construct knowledge of a "real" world" (qtd. in Dougiamas, n.d.). The realities that one constructs are his experiential worlds that are formed in the mind by the mental operation of reflective abstraction (Bodner & Klobuchar, n.d.). This may call a non-positivist approach in first sight, but radical constructivism does not deny an objective reality, rather simply states that we have no way of knowing what that reality might be. "Mental constructs, constructed from past experience, help to impose order on one's flow of continuing experience" (Dougiamas, n.d.).

Von Glasersfeld suggests that 'to know' actually should be understood as 'to know how to make' (cited in Powers, 2001). Therefore, the acquired knowledge must be viable. In other words, in radical constructivist theories, knowledge should no longer be judged in terms of whether it is true or false, but in terms of whether it works. It should function satisfactorily in the context in which it arises (Bodner & Klobuchar, n.d.). To summarize, "radical constructivism replaces the observer-independent model of knowledge with the idea of knowledge that is comprised of conceptual structures created by individuals in a fashion congruent with their experience and perspective" (Powers, 2001).

In contrast, social constructivists approach to the generation of knowledge from a social interaction perspective. They assert that the world is accessible only through shared interpretations and knowledge is a product of social practices and institutions (Powers, 2001). Studies on social constructivism is nourished with the ideas of Vygotsky, whose studies focused on cooperative learning, giving attention to mental process of abstraction, generalization, comparison, representation, judgment, consciousness, and so on (Gergen, 1995). Social constructivism sees consensus between different subjects as the ultimate criterion to judge knowledge. "Truth or reality will be accorded only to those constructions on which people of a social group agree" (Heylighen, 1993, qtd. in Powers, 2001). Language and "linguistic artifacts" like texts, documents and journals are very important for social constructivism studies, as language serves communal functions (Powers, 2001; Gergen, 1995).

Besides personal, radical and social constructivism theories, studies imply cultural and critical constructivism premises. The former emphasizes the effect of cultural influences including customs and religion as affecting learning, and

implies that it is only possible to understand an individual's cognitive structure within the culture, and the interacting context it belongs (Fosnot, 1996a). The latter points out a critical dimension in studying both social and cultural environments (Dougiamas, n.d.).

According to Fosnot (1996a), the use of terms like social or radical constructivism depends on the ground of the study; whether social or cognitive approach is emphasized. As the implied idea in general stresses the construction of our version of reality, while constructing and transforming our mentality as well, it is more plausible to work on the interplay between cognitive individual and social learner rather than giving priority to one over the other.

Constructivism is a theory of learning, not a way of teaching; but utilizing the theory in many learning environments, studies reveal instruction techniques, and propose teaching practices to enrich the learning activity and the environment.

Summarized below are the assumptions and propositions derived from the current literature that holistically characterize the philosophical view of constructivism:

Pertaining to Learners

- Learners actively engaging in constructing meaning (Driver, 1995)
- Learners as interpreters of prior experiences and knowledge to test and elaborate concepts (Roantree & Bonollo, n.d.)
- Learners utilizing reflection as a method of transforming physical actions to mental operations, to create meanings (Confrey, 1995; Wood, 1995)
- Learners learning by self-regulation and through reflection and abstraction (von Glasersfeld, 1995a)

- Understanding is in learners' interactions with the environment (Savery & Duffy, 1996)
- Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned (Savery, & Duffy, 1996)
- Learners taking responsibility for determining the subjects they pursue.
- Learners having a role in identifying the issues and directions as well as goals and objectives in a learning environment; accepting and encouraging student autonomy and initiative (SCIMAST Classroom Compass, n.d.)
- Teachers becoming learners, to continually adjust their actions to engage students in learning (Dougiamas, n.d.)

Pertaining to Curriculum and Instruction

- Concerning learners' cognitions and conceptions of knowledge, not just mere conception.
- Employing active learning strategies.
- Making maximum use of existing knowledge (Honebein, 1996)
- Encouraging student-centeredness (Honebein, 1996)
- Situating learning in realistic, relevant and rich context settings (Merill, 1992; Honebein, 1996; Dunlap & Grabinger, 1996)
- Using activities that promote high-level thinking with authentic, open-ended problems with natural uncertainty, complexity, decision-making, and ambiguous information. (Dunlap & Grabinger, 1996)
- Emphasizing collaborative, negotiable and discursive approaches, since conceptual growth comes from the sharing of multiple perspectives (Roantree & Bonollo, n.d.; Ernest, 1995; Merill, 1992)

- Guiding, coaching and helping learners to construct their own meaning (Jonassen, Peck & Wilson, 1999)
- Drawing wisdom from data
- Encouraging testing ideas against alternative contexts (Savery & Duffy, 1996)
- Articulating beliefs and discussing why one believes them
- Be willing to gather new information when it's time to change what is believed.
- Involving cognitive apprenticeships and negotiation (Roantree & Bonollo, n.d.)
- Presenting multiple perspectives to teach and learn content (Jonassen, Peck & Wilson, 1999; Roantree & Bonollo, n.d; Dunlap & Grabinger, 1996)
- Embedding learning in social experience and social negotiation (Honebein, 1996; Roantree & Bonollo, n.d.)
- Using actual examples (Jonassen, 1994)
- Encouraging reflective and circumspect self-awareness (Honebein, 1996; Ernest, 1995; Roantree & Bonollo, n.d.)
- Encouraging the use of multiple modes of representation (Honebein, 1996)

Pertaining to Knowledge

- Knowledge is constructed from experience, not transmitted, embedded in activity, action or experience (Merill, 1992; Jonassen, Peck & Wilson, 1999). It is:
    - Physically constructed by learners who are involved in active learning. (Gagnon & Collay n.d.)

    - Socially constructed by learners who convey their meaning making to others (Gagnon & Collay n.d.)
    - Theoretically constructed by learners who try to explain things they don't completely understand (Gagnon & Collay n.d.)
    - Symbolically constructed by learners who are making their own representations of action (Gagnon & Collay n.d.)
- Learning is a constructive process in which the learner is building an internal representation of knowledge
- Anchored in and indexed by the context in which the learning activity occurs (Jonassen, Peck & Wilson, 1999)
- Meaning making is unique to the learner, different from the others' conceptions (Jonassen, Peck & Wilson, 1999)
- Meaning making is prompted by a problem, question, and confusion etc. involving personal ownership of that problem (Jonassen, Peck & Wilson, 1999)
- Knowledge evolves through social negotiation and through the evaluation of the viability of individual understanding (Savery & Duffy, 1996)

4.2 Constructivism and Design Education

It is difficult to trace constructivist perspectives in design studies and education although the philosophy reveals essentials of problem-based learning which is inherent in design education.

One particular reason for lack of constructivist premises is the undertheorized body of design education itself. Referring to architectural education, the undertheorized body is identified by professionally driven design

education, and educators' prioritizing "practice and theory of architecture as more important than the practice and theoretical development of education" (Dutton, 1991).

Looking at the teaching and learning process in design from a constructivist point of view, design instructors ought to teach as they were taught to teach, rather than teaching like they were taught (Fosnot, 1996b). However, architectural and interior design disciplines do not possess or try to develop such convenience where traditional views of studio teaching are experimented with new models of pedagogy. Even the knowledge disseminated in studios is formulated and originated from precedents or drawn from the generalizations referring to former instances (Akın, n.d.).

> Despite the fact that the shelves are buckling under the weight of books on architectural theory, and every school teaches some form of 'theory' or 'history and theory', there is little evidence to suggest that these books or courses are significantly and creatively informing either the design teaching or the overall education of students (Teymur, 1992, pp. 32-33).

Besides, most of the studies on architectural design education, and design studio dealt with the processes of design focusing on computer aided design or distant learning (Demirbas & Demirkan, 2003) and there are few studies dealing with the problems of fragmentation raising more epistemological and pedagogical questions. The process oriented studies investigated 'designing' in general and did not shed light on the methods of teaching for developing design pedagogy to deal with the nature of instruction in terms of dislocating the barriers discussed before.

"It is common for design tutors to suggest that theory is not needed because design teaching is, and should be, intuitive" (Webster, n.d.). Revealing their position as intuitive experts, design instructors tend to support their argument by underlining that they went through the experience of design as students, therefore

have an understanding of what is involved in teaching; and arguing that expert practitioners automatically make good teachers.

However, in order to make students understand the essence of learning by doing, and to help them gain expertise in problem solving, it is necessary to equip them with conceptual understanding skills developed through constructed and cognized relationships between the design studio course and its supportive courses in design curricula.

In addition to that, as a body having artistic and aesthetic aspects in instruction, merging theory and kinesthetic skills- design education has its unique characteristics. “It is an art not only in sense of craft of design, but also because it uses … experience … as a medium of aesthetic expression” (Schon, 1985, p. 30).

These characteristics necessitate an alternative pedagogical approach. Since creativity and artistry are to be considered within such approach, objective truth of things needs to be rejected.

Taking constructivism as a developmental and nonobjective theory of knowledge construction, the study aims to suggest its framework as an instructional approach to recall knowledge from all courses in design curricula into the design studio, particularly bridging the gap between lighting-related courses and design projects.

4.3 Design Studio as a Constructivist Learning Environment

In the following section, reasons for choosing constructivism as a treat to the disintegration in studio will be discussed. The aim is to elucidate those reasons by explanations based upon an ideal studio setting, extracting particular barriers

awhile. Yet, emphasizing the parallelisms and analogous nature between design teaching and constructivist learning pedagogy, this study aims to uncover certain obstacles that prevent learners from constructing their own understanding of lighting.

Previous chapters, explaining the nature of design in a studio setting, proposed problem based learning and active learning strategies as form-givers of design teaching and learning. As problem-based learning is consistent with the principles of instruction that are derived from constructivism, each "ideal" design studio setting actually confronts constructivist methods to some extent.

Since constructivism is a theory of learning, not a way of teaching, the theory will be utilized to draw general principles and guidelines to reorganize the educational practices -specifically lighting education- in design studios. While describing the aptness of adapting constructivist learning theory into the studio environment, referring to the aforementioned propositions, the intent is to suggest an understanding of how a constructivist studio should be structured in terms of instructor, learner, instructional method, and setting. Therefore, in addition to revealing the matching features of constructivism and studio education in pedagogical accounts, matters that hinder learning process and prevent the integration of learners' past knowledge and experience to design and knowledge construction are discussed. It is neither the intent, nor possible to reveal all aspects in the design studio that affect knowledge construction.

Accommodation and Assimilation Constructs in Design Studio

Piaget, working on child understanding and cognition, has introduced the idea of cognitive equilibrium as an outcome of his studies on biological

equilibration of organisms (Fosnot, 1996a; Wadsworth, 1996). The cognitive equilibration theory presents assimilation and accommodation as two complementary processes of adaptation through which awareness of the outside world is internalized (Atherton, 2004). “In assimilation, what is perceived in the outside world is incorporated into the internal world, without changing the structure of that internal world, but potentially at the cost of squeezing the external perceptions to fit” (Atherton, 2004) In other words, it is an experience organization with one’s own logical structures or understandings (Fosnot, 1996a). “In accommodation, the internal world has to accommodate itself to the evidence with which it is confronted and thus adapt to it, which can be a more difficult and painful process.” (Fosnot, 1996a, p.13) Accommodation is comprised of reflective and integrative behavior that operates to change one’s own self, to fit new information by developing new categories or fields (Atherton, 2004). Constructivists utilize both as a theory to define and describe learning, hence to develop a psychological theory of constructivism.

Both cognitive processes can be analyzed in terms of creation of new schemata in critique sessions. During a critique, both the instructor and the student encounter assimilation and accommodation sequences to cognitively fit the opposing idea, solution or suggestion to develop an understanding of it. In other words, from a constructivist viewpoint, what one says remains nonsense until the other assents to its meaningfulness, and vice versa (Gergen 1995).

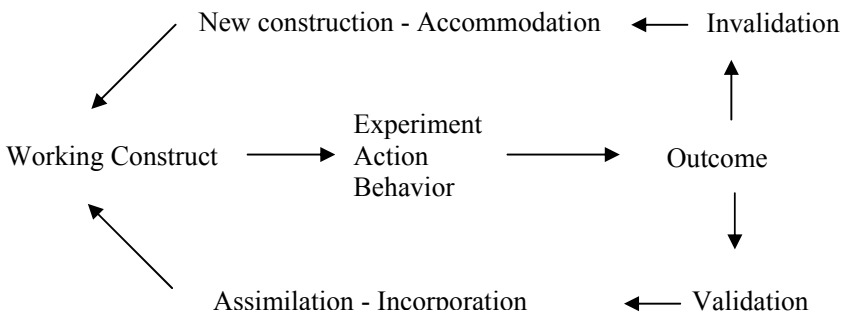

Figure 4.1 Piaget's model of the active meaning construction

Assimilation sequences call for classifying new stimulus in cognitive mapping, for instance, when the instructor explains an entity that is new for the student, such as instructor's asking the student which type of lamp is proposed for a specific task during a critique session. If the student had assimilated knowledge on lamp types -during lectures on lighting or with other a priori experiences- and never accommodated on it, then it would be difficult or not possible to detect the variety that the instructor inquires in that particular lamp family. Then, the instructor's assertions would help the student to reach to cognitive equilibrium state by accommodating the new information on that specific lamp type. This is a way of constructing knowledge by assigning new categories.

A more clear cut example for assimilation and accommodation is fantasy play (Canter, 1974), which can be referred as scenario writing for the design project. In such exercise, the design student constructs a case for the real world and assimilates this distortion to fit to own cognition. Since the scenario –if not strictly outlined by the instructor- depends on experiences derived from sub-cultural, social, physical etc. contexts, the created world is usually the one that is easily assimilated. It is possible to assert that adaptation would begin with creativity in production. When the student is asked about a particular issue

pertaining to the space created in line with the scenario, the answer would outline whether it consists of patterns of assimilated knowledge or aspects of accommodation. That kind of internal and external experience was also identified by psychoanalyst studies as "belonging to the realm of play in children and as the root of creativity in adults" (Ochsner, 2000, p.198). Ochsner (2000) underlines this experience significant for design students as it allows one to see the external world as he/she rationally know it to be, and also to imagine it as it might otherwise be.

Also existing knowledge can be upgraded or changed to newly defined classifications. During a critique session, impulses from both ends create a cognitive disequilibrium where student constantly coordinates, differentiates and constructs knowledge.

> Change through adaptation, according to radical constructivists, is how one begins to build knowledge. Knowledge is then maintained or disregarded through the process of adaptation as new and old concepts loose their poignancy or viability (Powers, 2001).

However, it becomes rather difficult for adults to accommodate to new ideas. Atherton (2004) underlines this cognitive problem of ageing as "hardening of categories". This calls for receptive instructors in a studio setting, ready to discuss and accommodate. Yet, most stuckness problem in a studio setting occurs from conflicting ideas between student and mentor. As Sachs (1999) emphasizes, stuckness in design studio may be characterized by clashes with the instructor. This may be the result of instructors' difficulties to accommodate or students' failures in identifying the advice. It is not our attempt to conceive stuckness as a problem related with instructors or to degrade it to such conception.

Cognitive (Dis)Equilibrium in Constructivist Paradigm

Using Piaget's biological model on equilibration, previous section suggested basis for understanding cognition in design and in constructivism. Developed through the interaction between the subject and the world (snail's biological adaptation to its habitat in Piaget's studies), constructivism recognizes knowledge and mind inseparable, and defines knowing as an adaptive activity (von Glasersfeld, 1995a; Fosnot 1996a). It determines learning as development, in opposition to preceding theories.

Design studio provides an interactive environment and sources for perturbations for developing cognition (Cobb, 1996). Action theories by Schon (1987; 1990) describing the notion of knowing in design process are congruent with constructivist accounts of reflective abstraction, where patterns of knowledge constructs are derived from one's iterate reflection on actions or operations. Each reflection action refers to categorizing cognized information either by assimilation or accommodation.

In order to enhance design-based knowledge categories in a design student's mental schemata and manipulate experience for abstraction (von Glasersfeld, 1995b), studio instructors should be capable of discussing various issues within a project. Unmentioned categories of knowledge –pertaining to lighting within the scope of this study- would not disequilibrate students' cognitive structure, and result in immature and underdeveloped projects and design knowledge cognition. To be able to stimulate disequilibria in students' cognition, design instructors should be well-equipped in almost all subjects comprised by their profession.

However, revealing as much categories as possible does not indicate an instructional gesture that means to explain everything explicitly. Explicit explanation of contexts may prevent the learner from thinking and constructing his/her own understanding. Piaget used to tell his students that each time they explained something to a learner, they prevent him/her from discovering it (cited in Ackermann, 1995). Unluckily, design students generally favor instructors that come to the studio with their pencils. In other words, to take easy way out, students ask their tutors to correct, guide and analyze their projects by sketching or re-drawing during critique sessions. Since in most cases, especially in final presentation juries, where guest instructors and/or professionals are involved, instructors may feel themselves more responsible on the project and feel as if they are doing well or failing. This mistaken belief leads some instructors to the aforementioned un-constructivist approaches, as resolving sub-problems in the project scenario by explicit explanations or by formal representation, e.g. by sketching and drawing. The result of such mode teaching is underdeveloped design cognition for students, and they usually fail to solve particular details and sub-problems since the solution is already introduced by the instructor. Students, when faced with a new problem, will then get stuck and get confused in the process of designing, and eventually search for authority to guide them again.

Therefore, in a constructivist design studio, errors need to be perceived as a result of students' conceptions and not minimized. From the constructivist perspective a truly final project can never be achieved so process should take precedent over product (Powers, 2001). However, while appreciating students' cyclic design activity (requestioning, rephrasing, redesigning when countered with certain design problem) efforts should be directed to avoid students' re-starting

after every error, but rather allowing them to question possibilities, by offering meaningful contexts.

Constructivism invites beyond the information given (BIG), and without the information given (WIG) approaches to enhance reflexive reaction in learning environments (Perkins, 1992). Design studio portrays comparable perspectives illustrating instances for each approach. For instance, while teaching the distinction between color of light and pigment colors to the freshman design students, BIG approach suggests introducing the contrast in between by mental models, and a number of thought-oriented activities. On the other hand WIG approach would not characterize light and pigment colors directly, but rather encourages students to explain the concepts involving instruments demonstrating related phenomenon such as color additive mixing, refraction etc. Appropriate balance of the approaches would reinforce knowledge construction in design studio promoting anomalies in students' cognition. Students will be searching for models to explain the occurrences if the instruction facilitates extrapolation.

Constructivism and Dialogical Nature of Studio

"Constructivism invites a development in students' role in drawing the contours of a dialogue, and in shaping its direction over time" (Gergen, 1995). However, as mentioned before, as a barrier in third chapter, most instructors implicitly decide on the outline of a critique session. This mind-filling attitude is a stature of authority of traditional lecture formats and should be abandoned in a constructivist learning environment -studio- for helping learners to view the problem from multiple perspectives. Students should be encouraged, and be able to plan and set their goals, assess their own progress and try to determine how to go

one step further (Powers, 2001). In other words, students should be empowered to participate in structuring the work. Teachers should provide multiple representations and students should be given opportunity to present their ideas in a variety of ways (Powers, 2001), e.g. presenting lighting ideas with computer aid or making an illuminated model. Ideally, students should decide when they need guidance or alternative views and when they prefer freedom to explore (Ackermann, 1995).

Current pedagogy in design studios is conflicting with the constructivist model in the sense that there is lack of methodology in design teaching. As noted before in chapter 3, and underlined in section 4.1, design instructors teach by normative theories structured upon their prior experience and intrinsic nature of information. As underlined by International Union of Architects (UIA), in addition to the formation in the domains of design activity, design instructors should have a "specific specialization along with at least a preliminary pedagogical formation or expertise" (UIA Architectural Education Commission, 2002).

A jury session in a design studio setting -with the knowledge acquisition and assessment methods- is an example of radical constructivist ideology. There is almost no absolute right or true way to evaluate projects, since no standardized or normalized method of evaluation can be applicable in all situations for all times (Powers, 2001). Given the particular goals, context and content of the projects, teachers utilize a method that would seem viable to their evaluation.

> This method may, for example, tend to be qualitative or quantitative depending on a variety of factors the teacher has considered important. The teacher utilizes their adopted evaluative method until it does not seem viable or effective any longer (Powers, 2001).

This is the point where the instructor is obliged to construct a new assessment method by adaptation. However, in cases where juries exceed several hours, assessment becomes more dependent on psychological and physiological contexts. Viability brings about arguments on the objectivity of assessment. The objectivity of the assessment criteria is always arguable. So is the objectivity of the evaluators.

The concepts and the issues that are discussed within a critique session are variable and viable just like juries and not structured by nature, but the approach by which the instructor handles the notions significantly affects the way that the student conceives the project.

Constructing Design Knowledge

Vygotsky's studies on social constructivism proposed an unnoticeable transition in thinking of children, from complexes to concepts, as they coincide with verbal communication with adults (Fosnot, 1996s). In other words, the sessions what we call critiques -the communication lines between mentor and the apprentice- formulate the medium where the student's impulsive ideas encounter with -in Kozulin's words- the 'systematicity and logic of adult reasoning'(cited in Fosnot, 1996a, p. 19). This is the region what Vygotsky calls 'zone of proximal development' (ZPD) and we shall discuss its designation in terms of the contextual approach within a critique session.

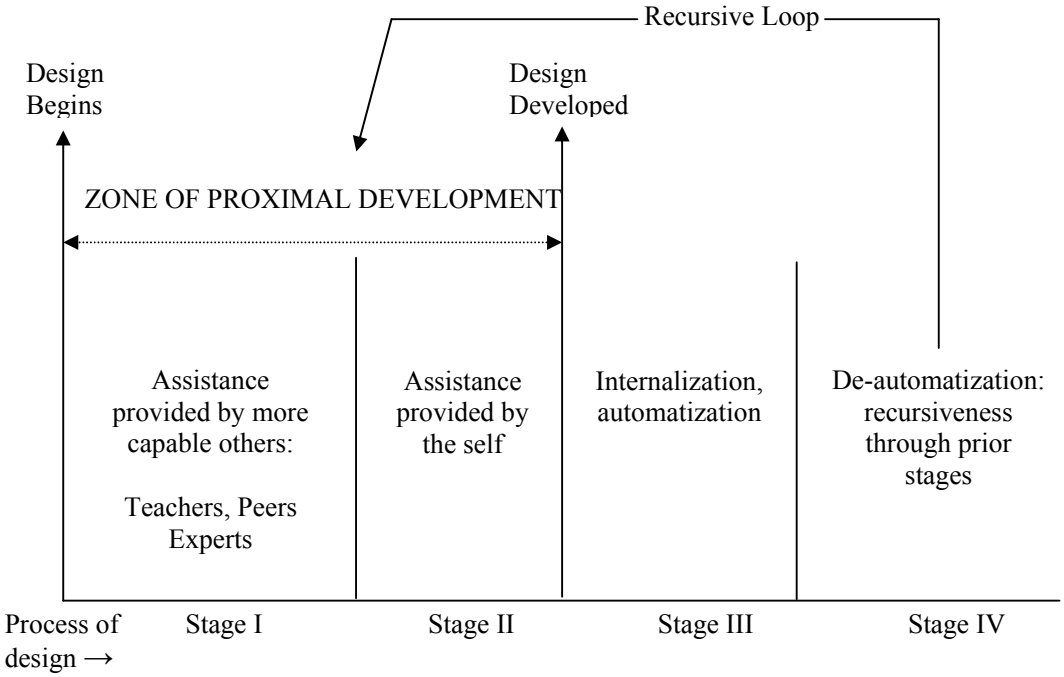

Figure 4.2. Zone of Proximal Development in Design (adapted from Tharp & Gallimore, 1988; North Central Regional Educational Laboratory, n.d.)

The authenticity and the way the instructor introduces -actually constructs- the notions affect the student's operation on a problem. Vygotsky, working on learning, development and concept formation, stated that both spontaneous (developed and constructed naturally through reflections of everyday experience) and scientific concepts (more logically defined concepts, formal abstractions- instructed) formulate human's mental activity (Fosnot, 1996a; Newman & Holzman 1993).

Thinking of a design students' mental process, it is the instructor who mediates both types of concepts, to pursue the apprentice in outlining meaningful relationships among the objects, the problem and the project. Since "scientific concepts work their way down imposing their logic on the student, spontaneous concepts work their way up, meeting the scientific concept and allowing the

learner to accept its logic" (Fosnot, 1996a, p. 19), adult cooperation -instructor in our case- is utmost important. As an example, the concept of skylight for a student can begin to develop as his/her everyday concept of day and night is comprehended, and when solar time and declination concepts are grasped. While discussing the skylight in a project, the instructor therefore should try to apprehend the student's previous knowledge on solar movement and declination in order to make the student remember, and use the knowledge about daylighting, e.g. solar altitude and azimuth angles. This apprehension will call for constructing natural lighting knowledge with the student's attempt to solve the skylight problem. In other words, to avoid the student memorizing the presented notion, the instructor should make him/her make use of the information and help to make the subject their own.

As illustrated in figure 4.2, the ZPD in a design studio is the continuum between the beginning of design activity "the actual developmental level" as determined by problem solving under instructors' guidance, and the level of developed design "potential development level" (Tharp & Gallimore, 1988; North Central Regional Educational Laboratory, n.d) by self reflection. Studies on experimental psychology depict that there are certain limitations in human cognitive system when development level is considered. For designers, short term memory is introduced as one particular limit (Akın & Akın, 1996). In order to prevent the acquired knowledge from fading out in first stage design, the chunks of information should be transferred to the long term memory in cognition.

Constructivist criticism –reminding acquired knowledge with examples, cases, etc- is an essential transference mean for making the chunks of data more permanent and is necessary for providing the base for stage two, three and four

through which learner constructs design knowledge by reflecting on the actions performed in the process. Therefore, the beginning level characterizes mental development retrospectively, while the ZPD describes mental development prospectively. Figure 4.2 illustrates the recursive loop within the process of designing, where the student performs independently on solving certain aspects and needs guidance for solving others.

Automatization presented by Vygotsky is ideally encouraged near to the termination of the instructional interaction (Confrey, 1995). However, the action is presented in the continuum of design process as stage III (and its multiples) since the activity of design is iterative in its essence -but not terminating- necessitating the revisit of expert knowledge. During this cyclic activity, the cognition of student is constantly disequilibrated by including him/her into an external dialogue where spontaneous concepts are collided with scientific ones to achieve development in design. "Ideally the utterances are aimed at ensuring the learner's maximal involvement … nudging … from one level of competence to the next and eventually to independent application of the instructed skill" (Palincsar, 1986, cited in Cheyne & Tarulli n.d.).

Piaget's studies in 1920s suggested egocentric and socialized speech as preoperational child conversation (Wadsworth, 1996). Vygotsky later proposed that this egocentric speech is the elementary nature of inner speech what we use as a tool in thinking (Fosnot, 1996a). In those cases, students -by asking the questions to themselves- formulize particular problems through self reflection in their projects. This self-critique makes it easier for students to attribute meaning to their own expressions (Spivey, cited in Ackermann, 1995).

In a design studio, given the context of the project, the student intuitively starts working on pseudo-concepts. At different stages of designing, sketching, and drawing most design students use an inner speech. By the use of inner speech and verbal communication, pseudo-concepts turn into complex entities so as to solve the obstacles in the scenario and the project.

"As soon as an idea takes shape, it gains both a physical and a social existence" (Habraken, 1985, qtd. in Ackermann). The idea is then used to converse to express the mental constructs to include viewpoints of others.

The notion of dialogue and social interaction as form givers to social constructivism studies by Vygotsky (Newman & Holzman, 1993) describes dialogue generally as a face to face speech, and rarely deals with the inner speech.

Referring back to the studies on social constructivism, the dialogical encounter with self or inner speech is explained by 'otherness.' Backtin, taking the idea of self one step further, asserts that there are many others within one's self, and productivity comes from the fact that the others speak on a different horizon than the self (Cheyne & Tarulli, n.d). By constructing others out of entities and elements of himself/herself, the designer constructs a self image to understand and explain "the knowledge of others on basis of individual experience" (von Glasersfeld, 1995a, p. 12).

When taken as a dialogical setting in Vygotskian sense, the studio suggests multiple genres, and levels of dialogical involvement as an extended version of ZPD. The first level is characterized by authoritative dialogue where there exists an authority, a first voice (design instructor(s)) over the novitiate voice (design student) to assist learner to begin development –design process in our case (Cheyne & Tarulli, n.d) (Figure 4.3). Constructivist studies on this kind of

dialogue call a third voice in the setting by which the first voice maintains the superiority. This may be in the form of prior experience, texts, books, etc. all sources of information that the design instructor may utilize (Perkins, 1992). Constructivism also utilizes studies on cognitive apprenticeship (Collins, Brown & Newman, 1989, cited in Kehoe, 2001) to draw emphasis on the role of guided experience, taking notion of learning through traditional apprenticeship to the learning of cognitive skills by dialoguing.

Latter phase in communication is the Socratic type of dialogue (transition from Stage I to Stage II in the design studio ZPD model) where the student is left with questioning the other (Cheyne & Tarulli n.d.). The questioned other in this stage is characterized by self –as inner speech or multiple selves-, the novitiate voice (students' own ideas) or the first voice. Student then proceeds through the project by re-working on and re-accentuating the assertions by other(s). Therefore, the authoritative dialogue transforms into a questioning one as the student takes a more active role in the educational process, and become more skilled at negotiating meaning and generating ideas (Bruner, 1986).

It was mentioned before that as a constructivist approach design students are invited to draw outlines of the dialogue within a critique session. A potential result of this active engagement is the transformation of Socratic dialogue to menippean one, when the first voice resists the changing status of second voice (Cheyne & Tarulli n.d), or when the first voice is no longer appreciated as a figure of guidance by the second. The issue becomes more evident in critique sessions or pre-juries where the criticisms given by the instructors do not fulfill the expectations of students.

Students' points of views about instructors and jurors, and associating them with "the Gods" (Ahrentzen & Anthony, 1993, p.16) due to the authority figures and hierarchical relationships originating from the jury structure and the ongoing design cultures, and the attitudes of jurors supporting this image, such as sustaining juries in the form of one-way judgmental statements, is also another factor preventing a reciprocal relationship and constructive dialoging during critique sessions and juries.

The three types of verbal communication above are introduced to identify the phases of the design studio ZPD model. "All offer an opportunity for productive change, on the one hand, and for oppression or disorder, on the other" (Cheyne & Tarulli n.d).

Perception of reality in constructivism is an outcome of one's own constructive process (Duffy & Jonassen, 1992). Design studio with regards to verbal communication aspect, proposes a similar framework where the uncertainty between instructor and student is favored and maintained by their difference in their perception of reality. Both parties sustain doubts through their discussions, and construct an understanding of their own. The variance in their understanding is favorable to prolong the uncertainty until they come to a point of agreement.

The provision of uncertainty condition, in pursue of an understanding within constructivist studio is supported with authentic problems. Realistic and authentic problems, similar to the challenges that will be faced after graduation, will engage students with high degree of cognitive complexity and increase their interest on the possible outcomes (Powers, 2001).

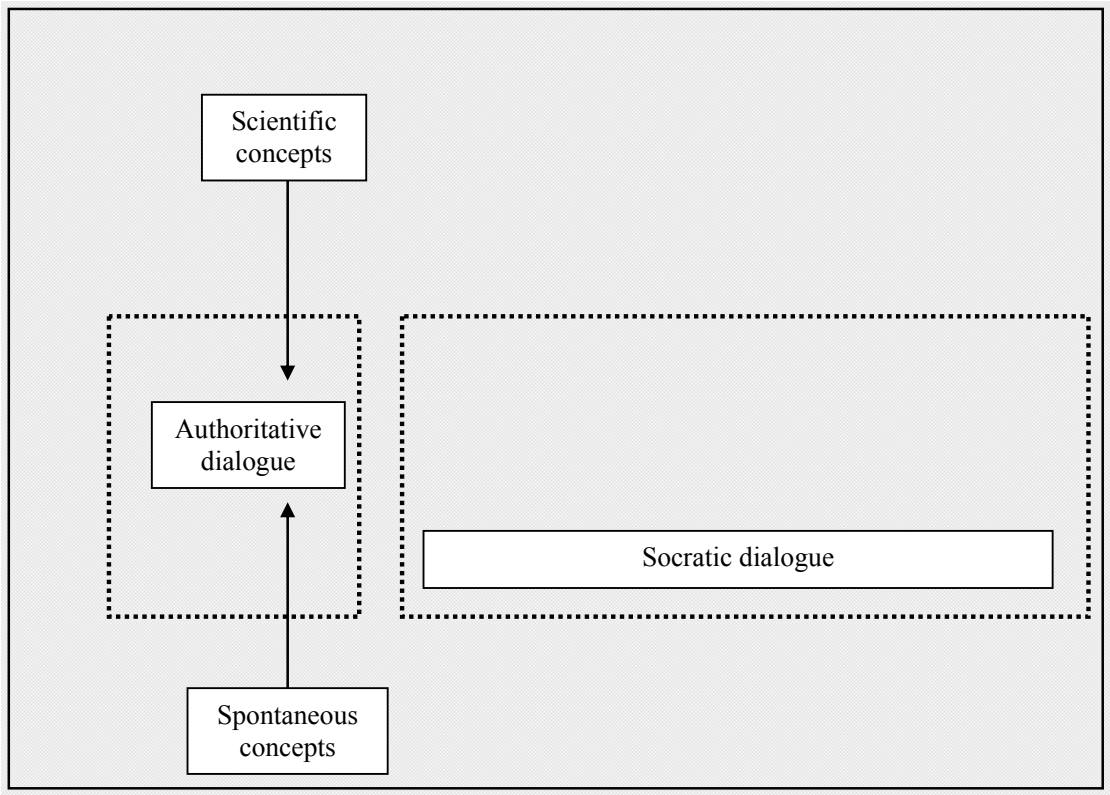

Figure 4.3. Design knowledge construction

Language in Studio for Social Construction of Meaning

ZPD in design learning and comprehension is variable for each design student. They achieve meaning and cognition through social interdependence and coordinated efforts between self and others. From social constructivism stance, language serves a significant function in this communal action.

It is important for the design parties to realize the correct use of language and wording as redefiner and reminder of a concept in critique and jury sessions. As word meaning is an active process in the development of thinking and speech (Newman & Holzman, 1993), the instructor's use of language affects the way the student develops. Use of design jargons, reminding terms through communication

would help the student to develop an own professional language. The use of language is also important for a student in explaining ideas through the process or the outcome. Studies underline a parallel development of conceptual ability through language and representation (Wadsworth, 1996).

In almost all privately founded interior design schools in Turkey, English is the education language used in lectures and studios. Also, most departments welcome visiting or full-time foreign instructors so as to share and appreciate differing perspectives and experiences. Since, for most design instructors, it is difficult to maintain the conversation in English for at least half an hour for each student, in a section of fifteen students, both instructors and students eventually come about to use their native language in discussions. Although language is underlined as an important variable for comprehension and understanding, it is not possible to trace inter-cultural studies of language in constructivist pedagogy. During a critique session, Turkish design instructors literally use a merged kind of language involving both Turkish and English statements, words and phrases from each language. Also students do not feel comfortable in expressing their ideas in English, and even most of them do not get the message or advice during a jury or a critic unless it is stated in Turkish[13]. Both parties in the conversation believe that using English in discussions is a time-consuming barrier. Consequently, use of English as an instruction language in Turkish interior design schools may be regarded as an obstruction to constructivist theory of knowledge generation. However, the problem should further be uncovered in terms of English preparatory

[13] In the teaching workshops held in Bilkent University, participant instructors depicted language issue as an important problem affecting their teaching and assessment methods (Bilkent Centre for Teaching Excellence, 2004).

departments, debating on approaches in teaching language for undergraduate studies.

It is not possible to observe well-executed content in jury or critique dialogues in a studio environment. This is something in the nature of design studio and favorable in terms of enhancing mutual interchange. Studio critics and juries draw parallel lines between constructivist theory of generation of meaning and the pragmatist tradition under which the dialogues may be linked to the ongoing practical pursuits of persons and communities (Gergen, 1995).

Besides, it is not always possible to observe design instructors' competence in taking out the other's -students'- words and actions to be coordinated to preceding notions, in extending and elaborating the preceding patterns of words in a dialogue, leaving space in the interchange for the other's participation –student or another tutor-, and in avoiding moves that terminate the discussion. These moves designate the success of a dialogue in constructivist terms (Gergen, 1995).

Moves that are terminating discussions can be examined in condition to the judgmental, value-laden and emotional assertions. Austerlitz et al.'s (2002) research on the emotional phenomena and student-instructor relationship points out that emotions and emotional expression in final presentation or in studio settings have high potential for affecting learner-teacher relationship and therefore the educational process as a whole. Contrarily, for a constructionist design educator, enabling student participation in a range of design conversations should be one of the primary challenges (Dougiamas, n.d.; Gergen, 1995). Orienting students' attention and enhancing motivation during their pursuit for finding solutions for particular design problems is necessary to eliminate standardized reinforcement in education. Instead, students -by realizing the satisfaction of

reaching certain solutions at different phases of design process- are effectively motivated to search further (von Glasersfeld, 1995a). Such motivational account will expand the self reflection and automation stages in design ZPD model, resulting in students' increased attachment to knowledge construction.

Another conception of social constructivism studies, to be correlated with studio and critique sessions, is the creation of semiotic spaces where experiences are represented with symbols, language, metaphors and models (Fosnot, 1996a). Students are in need of cases and live perspectives to construct their own models. In design studio, students are required to take an active part in the learning process by experiencing and reflecting on cases through preliminary research on project and group discussions.

Regarding content of instruction, constructivism –specifying the core knowledge domain- sustains research, encourages students to investigate for other knowledge domains, and considers alternative sources that may be relevant to the issue (Bednar, Cunningham, Duffy & Perry, 1992). In design studios, student research is always expected, and utilized as a method in teaching, although practically students show little interest in doing research.

Papert and et al.'s idea of constructionism draws another analogy with design studio learning. He takes the idea of constructivism –expressing that knowledge is built by learner- one step further, and states that learner reaches to another level, 'constructionism' when engaged in the construction of something that is external or at least sharable by society (cited in Ackermann, 1995). Design studio similarly brings the idea of externalizing the internal constructs, in a variety of products, ranging from conceptual approaches that influence some part of social life, to more concrete entities like space and furniture designs. Design studio is

assumed to base its methodology on learning by doing. Papert et al., by recognizing learning as constructing meaningful products that express something of importance to the learners, add a rider to the preceding account: “by thinking and talking about what you do” (qtd. in Ackermann, 1995).

4.4 Chapter Conclusion

A design studio setting with multiple sources of information and several modes of representations embedded in social interaction, dialogue and experience is an ideal place for developing constructivism to help learners and instructors construct design knowledge by reflecting upon their prior knowledge. Besides an ideology for knowledge generation, constructivist education in design studies suggests a credible theoretical framework for -and in opposition to- the existing teaching practices in studio. It suggests reconsidering the normative views of current pedagogy prioritizing the “passive reception of information” (Powers, 2001).

Lighting design, presented as a fragmented and inexistent subject in interior design studio projects, necessitates an evolutionary approach of transference within the ongoing knowledge generation premises in design studio. Although learners have the information on lighting, available in their memory, they never recognize when to use it since the topic is isolated from the context of designing.

Previous sections dealt with the epistemological basis of constructivism and introduced the key conceptions inherent to the constructivist theory to show the aptness of employing its notions to design studio education. Exemplified constructs and the framework of constructivism are utilized to develop a research design, and adapted to the body of interior design studio. The aim is to analyze the

effectiveness of constructivist learning in studio environment by experimenting it as a tool for integrating lighting knowledge to studio projects. The following chapter and the subsequent sections are structured to demonstrate the design, implementation, analysis and results of the integrative research and will discuss the implications of this educational approach within the context of interior design education.

5. A CASE STUDY FOR THE CONSTRUCTIVIST APPROACH: THE BILKENT UNIVERSITY FOURTH-YEAR INTERIOR DESIGN STUDIO

5.1 Research Design

The following sections describe the framework of the research design which was devised as a case study in an interior design department to test the effectiveness of constructivist paradigm in bridging the gap between lighting notions and the studio project.

The research design is framed according to constructivist theory of learning and constituted of qualitative and quantitative methods and utilized multiple tactics for gathering the data.

5.1.1 Research Question

The study aims at answering the following primary research question:

Does incorporation of constructivist theory and learning approaches into design studio education process have an effect on students' use of prior lighting knowledge in their design projects?

The following questions are devised to respond to the primary research question using the research strategies as discussed in the following sections. The given lighting exercises, constructivist criticisms in response to those exercises and the relationship of both strategies with the final student projects were of concern.

The results of the data analyses for the questions are given in section 5.3.1 under corresponding headings ordered in the same sequence as questions.

a. Are the students who were given the lighting exercises more successful in responding to the lighting requirements of the design project compared to the students who did not complete these lighting exercises?

b. Is there a relationship between students' final lighting performances and their success in the lighting exercises?

c. Is there a relationship between students' final lighting design performances and their project grades?

d. Is there a relationship between students' lighting course grades and their final lighting performances?

e. Is there a relationship between students' completion of studio sketch problems on lighting (apart from the implemented lighting design exercises in section 1, both sections had a sketch problem on lighting given by their instructors) and their final lighting design performances?

f. How well do the combination of variables of students' lighting design exercise performances, lighting course grades and final jury grades predict their final lighting design performances?

g. Is there an improvement in students' lighting design performances when their successive exercise scores are compared (i.e. from exercise 1 to 2 and 2 to 3)?

h. Is there a relationship between lighting design exercises and the individual lighting design performances in the final jury regarding exercise foci? For example: Is there a relationship between students' stack exercise score and final stack lighting score?

i. Is there a relationship between final lighting scores of the students' who presented their lighting ideas by means of reflected ceiling plans (even though it was not a submission requirement)?

j. Is there a tendency among students towards satisfying design criteria based on general lighting provision or specifying the task-related source and luminaire types and attributes? In other words, are the general lighting provision scores higher than the specification scores?

Additionally, by the qualitative analyses of final jury sessions the study aims at finding answers to the following questions:

- What value do instructors and students of interior design attribute to lighting subjects during final project assessment?
- What kind of terminology do instructors utilize while asking lighting-related questions? What are the contents and types of questions?
- What are instructors' conceptions of lighting design?
- Do they have any consistent evaluation criteria for evaluating lighting design approaches?

To answer these questions, a case study employing studio exercises and constructivist criticisms and assessment of final projects was conducted in Bilkent University.

5.1.2 Research Context

The study was conducted in the Department of Interior Architecture and Environmental Design at Bilkent University, Ankara, Turkey[14]. During the 2004-

[14] The program offers four-year training for bachelor's degree in interior architecture. Students are admitted to the program by their ranks at the first phase university qualification exam and no longer

2005 Fall Semester Fourth-year interior design studio courses were selected for testing the suggested theory since the author was one of the seven instructors in the studio course.

In this studio, students competence comprising all the acquired knowledge areas from the preceding courses is required (except subjects of structure, acoustics and HVAC –in which students' understanding is required) (chapter 3 figure 3.7) for successful completion of the project and attaining the course objectives (see Appendix B). Illumination is one of the significant aspects of those objectives in which students' competence is required.

The course was offered in two design studio sections with equal number of students (44 students in each section) and took place on two days of the week, with six hours duration on each studio day. There were three instructors in each section. Similar to the described attributes of a design studio in chapters two and three, the course was implemented by means of a design project, studio discussions (group discussions at the first week of process and desk critiques in the succeeding ones), sketch problems (as take-home assignments or studio studies), at most two preliminary juries (two pre-juries conducted during research) and a final jury for assessment of the projects.

The students in each section were the subjects of the study and were divided into three groups, two of them comprised of 15 students and the third one of 14. Each instructor was responsible to give desk-critiques to the student group that was assigned, and each studio day, instructors shifted their critique-groups in order to get into dialoguing with the whole class and to give students opportunity to have all instructors' opinions on their projects (Figure 5.1). During the

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asked to be qualified with an aptitude exam which previously was prepared by the Faculty of Art, Design and Architecture.

particular semester in which the study was conducted (2004-2005 Fall Semester), students were given an adaptive reuse project in which they were asked to design an educational institution—a public library—within the envelope of the given building that has been serving as a concert hall.

5.1.3 Research Strategies and Procedure

Lighting Design Exercises

In the section where the author of this study was tutoring (section 1), students were given three exercises related to lighting design in order to engage them in active learning processes, and to make them revisit their previous knowledge on lighting subjects. Whereas, the students in the other design studio section (section 2) were not given the lighting exercises as opposed to section 1, and were defined and used as the control group in the study.

From the constructivist point of view, the lighting exercises were considered as incentives and opportunities that were provided for students to build up their own lighting knowledge (von Glasersfeld, 1996). Using the exercises, lighting knowledge was not dispensed directly during critiques, but rather students were implicitly asked to analyze particular needs, tasks, and functions in the project to reflect on to lighting design problems.

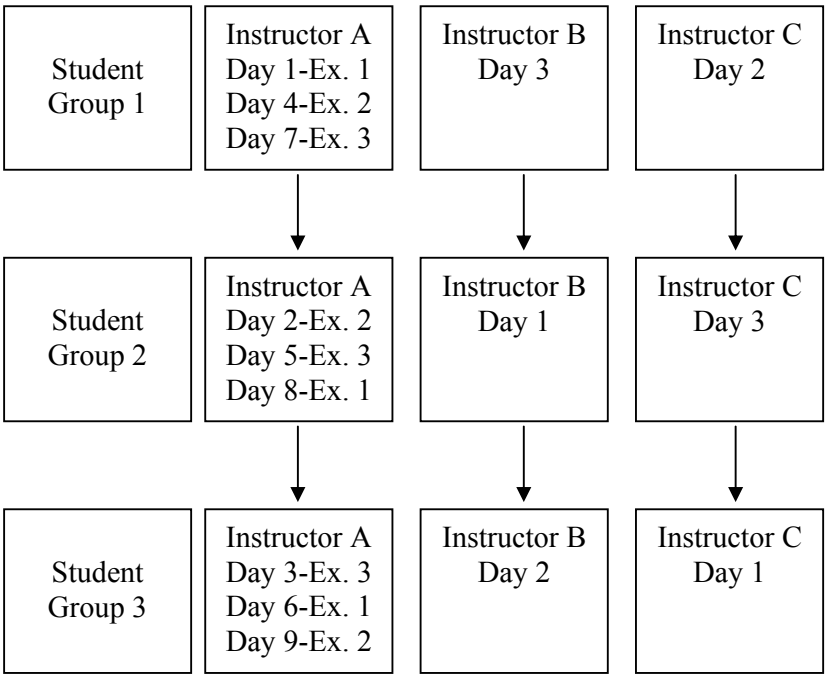

Figure 5.1. Three-day critique cycle

Learning would remain inert if it occurs in isolation as separate topics (Duffy & Jonassen, 1992). Although students have some lighting knowledge and information in their memory, they cannot recognize when it is relevant to integrate that particular data into design. The primary aim of implementing lighting knowledge with exercises was to propose learning in context (of the project). The emphasis was given on the lighting generative tasks in order to immerse students in the project having particular sub-consciousnesses on lighting. The exercises took on meaning in the larger context (rather than being ends in the context or of themselves) of the project as students continued working on the design project for several weeks. By this method, the knowledge that is recalled and then utilized by means of exercises were not just seen as a new and temporary learning demand, but rather recognized as useful information to be utilized in the larger context of the project. According to Duffy & Jonassen (1992) this type of learning is

generative learning, where sub-problems and sub-goals are given to learners in order to make them notice relevant information for achieving the larger task (design project).

Evaluation in the constructivist perspective examines thinking without separating it from the content domain (Bednar et al., 1992). Therefore, the exercises help to analyze students' ideas on lighting by categorizing the content domain of artificial lighting such as their general provision approaches and further technical selections (regarding source type, cost etc.). Since they were asked to reflect their own view and decisions on lighting content by proposing apt solutions for the given spaces in each problem; by looking at their scores, it was possible to see whether they developed an awareness of the constructivist process by interpreting those solutions into the context-specific nature –the design project- in the finalized design.

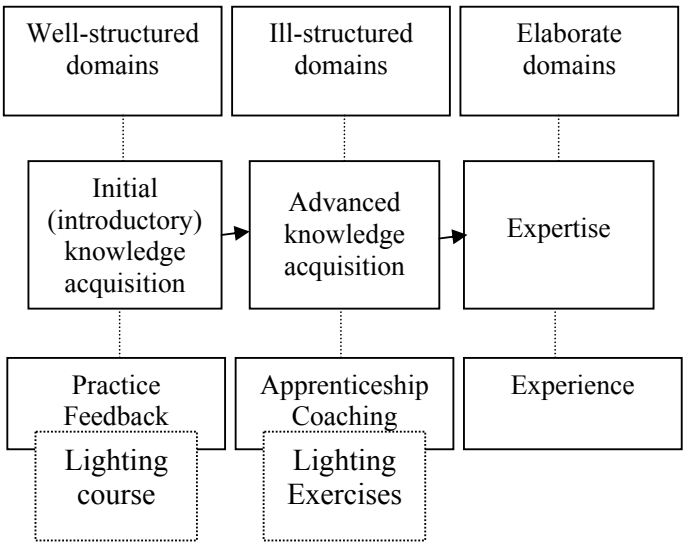

Figure 5.2. Three-stage knowledge acquisition. Adapted from Jonassen, (1992)

Taking design studio as an ill-structured domain, the exercises were assumed as knowledge builders in the second stage of the knowledge acquisition process. According to Jonassen (1992), constructivist learning dynamics are most appropriate for second stage knowledge acquisition (advanced knowledge acquisition), since experts need little instructional knowledge and at the initial phase the knowledge is more likely to be objectivist in opposition to constructivism (Figure 5.2). Looking at the process from the point of exercises, the introductory knowledge gathered from the preceding lighting course can be transferred to more complex constructs by reasoning, problem solving and investigating the information within multiple perspective tasks presented to the students.

Starting with the first week of their individual desk critiques, the first group students in section 1 had their lighting design exercises as take-home assignments (Figure 5.1). They took their second assignment (exercise 2) on the fourth studio day, at instructors' second critique cycle in the studio. The third assignment (exercise 3) was given to the first group students on the third cycle. The other groups were treated similarly and had each of their assignments at each critique cycle, in other words when they meet the same instructor the second and the third time respectively throughout the design process.

Each group had their assignments in different order. The reason for assigning the exercises in different order for each group was to avoid each group seeing the solutions offered by others. Although the topics were different, lighting design criteria they were expected to respond to were similar. Besides, context wise, they did not necessitate a direct time-line match with the design process. They were devised to give students flexibility to adapt the solutions that they

derived in the exercises, to the project at any point in the process. Also using the constructivist approach in preparing the exercises, it was anticipated that no two students would perceive or propose identical lighting solutions (Brent, 1985).

As mentioned earlier, the content of the lighting exercises were complementary with the project's context and topic. The content of the proposed problems in the exercises were therefore intended to make students see the exercises as part of their design problems. This is related to the constructivist accounts of teaching, where learners are required to consider the problem as their own; in other words, to apprehend the given problem as an obstacle that hinders their progress in designing (Honebein, 1996; von Glasersfeld, 1995a).

The three topics selected for exercises were related with the three functions that were considered indispensable for every library: need for studying, borrowing and returning of books and browsing the collection. The spaces or entities that correspond to those needs were defined as individual study units –carrels, circulation desk, and book stacks respectively.

Each exercise was prepared in English for distribution to the students (see figures 5.3 to 5.5). In each exercise, firstly the problem was introduced and then the requirements were listed.

Similar to the design phases, lighting design process is not a strictly predictable, linear process. It may begin with the formation of a design concept selected from numerous design considerations (The lighting design process, 1994), and continues with the stages of programming, schematic design and design development. Students, given the exercises, were asked to consider the programming phase and present an approach to lighting design for the given spaces and the particular tasks.

In order to encourage them to focus on lighting design, all attributes related to programming, space design, furniture and material selections were left to their choices and creativity. However, necessity of identifying and designing spatial attributes in relation to lighting design, responding to the task requirements in terms of users' visual comfort level and also answering to their physiological as well as psychological needs were underlined as crucial factors.

For each exercise, the students were asked to respond to the following tasks and visual comfort requirements: For carrels, they were required to consider reading, writing and computer aided study tasks with sitting body gesture. They were also reminded to think about discomfort parameters that decrease the efficiency of those tasks such as veiling reflections as well as physiological needs that may arise in time such as eye muscle relaxation need in particular time periods. Besides, they were asked to think about other kinds of tasks (e.g. space cleaning and maintenance when needed) that would necessitate relevant lighting solutions.

Regarding stacks, the tasks were defined as browsing and reading with standing body gesture and dynamic visual perception. Therefore, students were asked to consider the effective perception of the book spine and signage as well as the circulation spaces between the stack systems.

The third exercise, lighting approach proposals for circulation desks, necessitated an understanding of lighting in relation to both sitting and standing body gestures. Besides task oriented approaches, they were reminded to consider provision of particular luminance patterns to make the circulation space more perceivable for readers, more/less private, and spacious for librarians, etc.

All exercises, parallel with the constructivist pedagogical goals, encouraged the use of multiple modes of representation and promoted student articulation and presentation of ideas, solutions and approaches (Dunlap & Grabinger, 1996; Wilson, 1996) by giving students opportunity to communicate with any kind of drawing type they preferred. They were also allowed to communicate by writing the ideas which they cannot visualize or illustrate by means of technical or sketch drawings.

In all the exercises, students were also invited to consider light distribution characteristics by selecting an appropriate source type, considering its color temperature, color rendering abilities, initial cost of the source, the luminary system and its ease of maintenance, and also expected to reflect on the light distribution strategies (e.g.: general, ambient, local, etc.). Consideration of daylighting was eliminated from the required design criteria in all three exercises. Consequently, the exercises were formulated so as to make students:

- Draw on their past experiences in designing,
- Consider several factors and data about lighting by recalling the acquired knowledge in lighting course,
- Experiment with techniques and ways of presenting lighting design ideas,
- Make meaning on lighting, and build an own lighting knowledge body through experiential, active and generative learning strategies (by exploring and manipulating the parameters of lighting and observing the results of their responses and create meaning of what they are studying, to use it in the larger design context) (Dunlap & Grabinger, 1996).

Definition of the problem:
How can a circulation desk/counter/section be illuminated in a library?

1. Firstly, design a space for this activity. Design of the space and the counter (if any), its placement within the space, design of space defining elements like walls, panels and separations as well as their colors, materials and other attributes are all left to your decision and creativity.
2. Assume that there is no daylight in the space housing the activity.
3. There are 3 people working in the circulation area for the issue and returning of books. They use computers to perform these activities.

What kind of lighting design would you propose for this space?

You can use any drawing technique that will best fit in defining your ideas. You can illustrate your ideas using orthographic techniques like plans and sections, and also you can draw perspectives to help assist in the presentation of your thoughts. You can draw free-hand sketches or make scaled drawings. Also feel free to write down ideas that you cannot demonstrate or explain in the drawings.

Submit your drawings in the next studio session!
Use **A3** format as your drawing media!

Figure 5.3. Lighting Sketch Problem 1 Problem on Circulation Desk (in English)

Definition of the problem:
How can a carrel be illuminated in a library?

1. Design a carrel and a space for housing the unit. The design of the carrel, its placement within the space as well as its color, material and other attributes are all left for your choices and creation.
2. The carrel should be designed as semi-open study carrel or be proposed as a closed space or be an enclosure itself.
3. Assume that there is no daylight in the space housing the activity.
4. If the carrel that you design has close contact/relationship with other carrels and/or study units (in terms of modular design, placement, location etc.), present their interaction from the point of your lighting approach.

You can use any drawing technique that will best fit in defining your ideas. You can illustrate your ideas using orthographic techniques like plans and sections and also you can draw perspectives to help assist in the presentation of your thoughts. You can draw free-hand sketches or make scaled drawings. Also feel free to write down ideas that you cannot demonstrate or explain in the drawings.

Submit your drawings in the next studio session!
Use **A3** format as your drawing media!

Figure 5.4. Lighting Sketch Problem 2_ Problem on Carrel (in English)

Definition of the problem:
How can book stacks be illuminated in a library?

1. Design a stack and the space where it will be located. This design can be thought for an imaginary library (does not have to be directly related to the spaces that you deal with in your studio project). Design of the stack (height, width, shelf dimensions), its placement within the space as well as its color, material and other attributes are all left for your choices and creation.
2. Assume that there is no daylight in the space housing the stack(s).
3. You are required to draw at least four of your designed stacks within the space to present your lighting design ideas.

You can use any drawing technique that will best fit in defining your ideas. You can illustrate your ideas using orthographic techniques like plans and sections and also you can draw perspectives to help assist in the presentation of your thoughts. You can draw free-hand sketches or make scaled drawings. Also feel free to write down ideas that you cannot demonstrate or explain in the drawings.

Submit your drawings in the next studio session!
Use **A3** format as your drawing media!

Figure 5.5. Lighting Sketch Problem 3_ Problem on Stacks (in English)

Constructive Critiques for Active Use of Knowledge

The given exercises were asked to be submitted by the following studio session and collected by the instructor. Each assignment was examined in terms of students' responses to the given lighting problem, and discussed with the student in the following studio hour.

The dialogues were structured around constructivist premises, avoiding direct information transference and explicit interpretation of solutions. Rather, the communication was formulated around questions that initiate, extend or synthesize student thinking on lighting subjects.

Firstly, the situation was re-introduced to define categories of discussion within the dialogue. Then, guiding questions were proposed to create thinking opportunities to students. These questions examined the viability of students'

approach referring to radical constructivist accounts (Dougiamas, n.d.). An example of such question is “will it work?” which examines student thinking in terms of whether it works, rather than being true or false. Then, ‘clarifying questions’ (Gagnon & Collay, 2001) originated from the problem definition were asked. These helped students to guide the conversation by re-visiting particular parameters considered for lighting such as users of the space, their activities, visual tasks and critical components within those tasks (such as accuracy, speed, etc.). To identify misconceptions or errors ‘anticipated questions’ (Gagnon & Collay, 2001) were asked.

For the following example (figure 5.6) which illustrates a student’s approach to lighting the circulation desk, a clarifying question was “will glare be a problem?”. The question examined whether the student considered brightness difference phenomenon while designing the luminous panels behind the counter. Prompted by student’s answer, an anticipated question followed the preceding inquiry: “What causes glare?” Without implying an answer, the student was challenged to investigate the relationship between the definition of the fact and the approach that he/she proposed.

While discussing the subjects, most students constructed contradictions to their ideas and approaches. Going back to the cognitive equilibrium theory proposed by Piaget, the contradiction issue was described as two or more opposing theories or ideas that disequilibrate learners’ cognition (Fosnot, 1996a).

In the exemplified discussion, student’s cognition of glare was identified by a contradiction where the student had problem in differentiating the intended glare issue (to direct people’s attention) with the excessive brightness difference in the proposed lighting design.

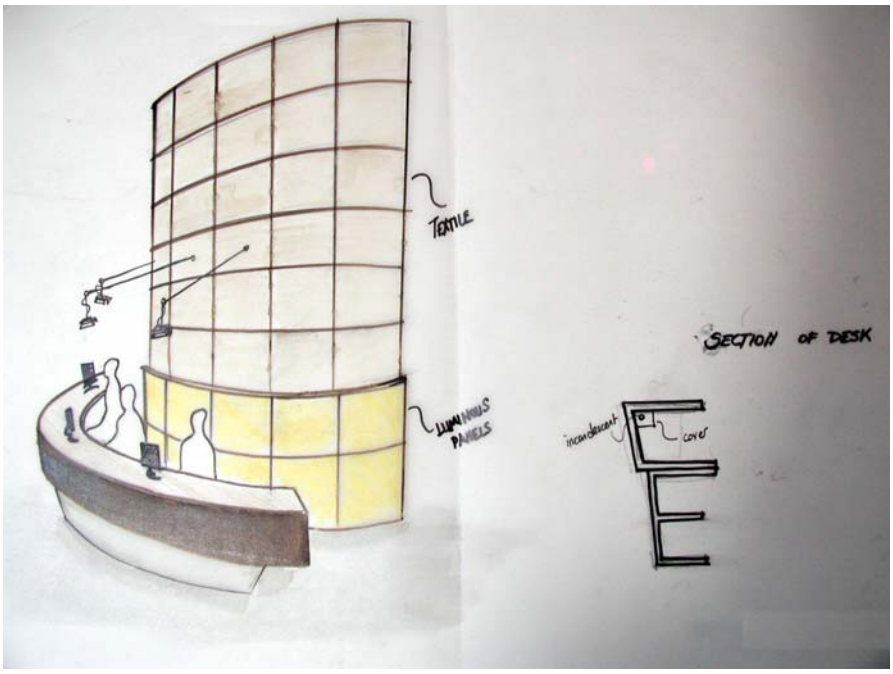

Figure 5.6. Sample Lighting Design Exercise – Circulation desk

Students were asked to develop empathy to make them understand how would the users perceive and interpret the lighting patterns that they proposed in the exercises. They were suggested to ask themselves questions as if they were the users of the spaces. (such as: will the space be a pleasant place -in terms of lighting design- for users to enter and in which to spend time? Adapted from, the lighting design process, 1994)

To support knowledge construction, students were also encouraged to 'reflect on their actions' (Schon, 1985; 1990). Therefore, the critiques involved discussions that moved students towards analyzing their own actions which also extended their responsibility and ownership of the problem.

5.2 Data Gathering

Two kinds of data gathered for doing the analyses. For analyzing the effectiveness of constructivist pedagogy, two sources were identified and utilized: students' submitted sketch problems and their final project performance scores (see Appendix C for sample student lighting design exercises and final project photographs illustrating their final lighting approaches). In order to analyze instructors' perspectives in their assessment of the lighting subjects, final design juries were recorded in both sections.

As described at the beginning of this chapter, the primary aim of this study was to investigate whether incorporation of constructivist theory and learning approaches into design studio education process has a significant effect on students' apprehension and use of lighting knowledge in their final projects. Additionally, as implied by the extended research questions, particular relationships were investigated by the quantitative data, to understand if students' performances can be increased or related to their completion of the lighting design exercises, their performances in the prior lighting course they have taken, and their lighting design presentation skills –referring to the use of reflected ceiling plans. Recorded final jury sessions were used to discuss instructors' perceptions and pre-conceptions of lighting design in interior design studio projects.

5.2.1 Formative and summative evaluation of lighting approaches: Sketch Problems and Final project assessment

In the studio section where the constructivist theory of learning and instruction was implemented by means of lighting exercises and lighting design critiques that were structured around constructivist dialoguing, students' lighting

approaches were assessed by the evaluation sheets during the semester –as formative evaluation, and at the end of the semester in final projects –as summative evaluation.

Both collected sketch problems and students' final project drawings were photographed for formative and summative assessment of their lighting approaches. For evaluating both the processes and products of student learning (the three exercises and final studio project lighting approaches) and making a comparative assessment in between, 'rubrics'[15] and evaluation sheets were developed (figures 5.7, 5.8, 5.9). Rather than assigning grades, developed rubrics and evaluation sheets were utilized to categorize the inquired knowledge and approach for the exercises, and each category was devised to be scored according to its implementation levels.

Three scale ratings (0-1-2) were defined in the rubrics, to score each category and their sub-categories according to the provision of the notion that was assigned for that category. "0" meant that the notion was either not considered or not controlled. "1" referred to the consideration or control of notion to limited extents. "2" was the highest rating, meaning full accomplishment in consideration and control of the notion in the assigned category.

The same evaluation sheets were used for both formative and summative evaluation. In the summative evaluation, students' approaches to lighting in their finalized design projects were evaluated with respect to their lighting design approaches for the three spaces and functions given in the lighting design exercises (carrel, circulation desk and book stacks).

[15] Rubrics are codes or sets of codes, designed to govern action (Jonassen, Peck and Wilson, 1999). In educational realm, they are referred as tools in assessing performances.

The ratings were also defined as provision scores which were totaled for each student to define performance scores for their lighting approaches in each exercise and in their finalized projects. Therefore, each student -in section 1 - where constructivist pedagogy was implied- had four major scores (figures 5.7, 5.8, 5.9); the first one was for the total lighting score in each exercise (e.g.: total scores for lighting design approach in book stack exercise), the second was the sum of total lighting scores of all three exercises (sum of total scores of exercise 1, 2 and 3), the third was their total lighting performance scores for each exercise task in the final project, and the last one was the total lighting scores in the finalized design project (sum of total lighting scores of carrel, circulation desk and book stack lighting approaches). Additionally, students' general lighting and task ambient / local lighting scores were used as general lighting provision measures, and type of source and type of luminaire scores were used as their lighting specification scores in the analyses.

The possible scores ranged from 0 to 34 for each exercise.

The students in the other design studio section (section 2) were not given any lighting design exercise or critique -based on constructivism, for helping them to integrate their previous lighting knowledge to the design project. They were regarded as the control group in the study, whose final lighting scores were compared with the other studio for analyzing the success of the implied theory for integration. Just like the other section, the final projects in that section were photographed and students' lighting design performances with respect to carrel, circulation desk and book stacks were evaluated and scored.

The categorizations were the same for each three exercises in order to have consistency in comparative evaluation between the exercise scores and between exercises and final lighting performance scores.

Four main categories were identified for evaluating lighting design approaches in the exercises:

General Lighting: Provision of general lighting over the entire area of the space, enclosure or units. The topic was classified as horizontal and vertical plane, to examine students' approaches in responding to the general distribution characteristics with respect to the location of lighting. For each exercise, students' lighting approaches regarding horizontal and vertical plane tasks were examined. For instance, in the definition of circulation desk problem, students were told that librarians working at the section used computers for issuing and returning of books. Therefore, students' lighting design approaches and solutions regarding the vertical plane of lighting distribution both in the exercise and in their final project circulation lighting designs were examined in terms their responses to visual display terminals (VDT), and their understanding of offending zone calculations. Sub-categories included evaluation of their approaches to controlling direct and reflected glare.

Task-Ambient / Local Lighting: The functions in each exercise necessitated an apt solution for completion of the defined tasks, such as the necessity of perceiving the signage in the book stack exercise. Therefore, in addition to the general lighting approaches students were evaluated for their lighting design solutions for particular task requirements.

Type of lighting source: In each exercise students were asked to include their ideas related to the type of lighting source, its family, color temperature property and initial cost. Thus, their selections were evaluated in each exercise.

Type of luminaire: Two attributes of a typical luminary system were included in the evaluations, reflector type and maintenance. Students had prior knowledge on reflector types and their influences in defining lighting patterns. Also they were taught in the preceding lighting course that luminaire design should entail relevant solutions for the ease of maintenance. The exercises recalled their past information on these attributes, and their approaches were included in the evaluations.

Circulation Desk - Lighting Design Approach

Tasks: Reading, lending and returning of books, writing, computer aid in working
Cone of vision: Two body gestures -standing and sitting, heads-up view for task plane (staff)

Considered/controlled - (2)
Considered to some extent (1)
Not cons./not controlled - (0)

	General Lighting							Task Ambient / Local Lighting				Type of the source			Type of the luminaire	
	Horizontal Plane			Vertical Plane												
Provision score																
	Location of lighting source with respect to horizontal task plane - **circulation tasks (issue and returning** (consideration of offending zone)		Lighting source layout (consideration of lighting distribution characteristics)	Location of lighting source with respect to vertical task plane - **VDT secreens** (consideration of offending zone)		Spatial Impressions		To aid in performing tasks -staff-issuing, returning book		To aid in perceiving circulation desk (visual attraction)						
	Glare - direct	Glare - reflected		Glare - direct	Glare - reflected	Spaciousness -room size etc.	Privacy	Glare - direct	Glare - reflected	Glare - direct / Intentional? (eg For visual attraction)	Glare - reflected	Initial Cost	Color Temperature	Family	Reflector	Maintenance
Score																

Name of the student:

Lighting Course Grade:
Final Design Grade:

Figure 5.7. Evaluation sheet for circulation desk exercise

Carrel - Lighting Design Approach **Tasks: Studying, reading, writing, computer aided study** **Cone of vision: Sitting body gesture, may need eye relaxation over time**														Considered/controlled - (2) Considered to some extent (1) Not cons./not controlled - (0)
	General Lighting							Task Ambient Lighting		Type of the source			Type of the luminaire	
	Horizontal Plane			Vertical Plane										
Provision score														
	Location of lighting source with respect to horizontal task plane - **reading-writing tasks** (consideration of offending zone)		Lighting source layout (consideration of lighting distribution characteristics)	Location of lighting source with respect to vertical task plane - **computer display-laptop secreens** (consideration of offending zone)		Spatial Impressions		To aid in performing tasks -writing-reading						
	Glare - direct	Glare - reflected		Glare - direct	Glare - reflected	Spaciousness -room size etc.	Privacy carrel-env. carrel-carrel etc.	Glare - direct	Glare - reflected	Intial Cost	Color Temperature	Family	Reflector	Maintenance
Score														

Name of the student:

Lighting Course Grade:
Final Design Grade:

Figure 5.8. Evaluation sheet for carrel exercise

Stack - Lighting Design Approach **Tasks: Reading, browsing of books** **Cone of vision: Standing body gesture, dynamic perception with changing cone of vision**																Considered/controlled - (2) Considered to some extent (1) Not cons./not controlled - (0)
	General Lighting							Task Ambient / Local Lighting				Type of the source			Type of the luminaire	
	Horizontal Plane			Vertical Plane												
Provision score																
	Location of lighting source with respect to horizontal plane - **circulation path** (consideration of offending zone)		Lighting source layout (consideration of lighting distribution characteristics)	Location of lighting source with respect to vertical task plane - **reading-book spine** (consideration of offending zone)		Spatial Impressions		To aid in performing tasks - **browsing**		To aid in seeing **signage**						
	Glare - direct	Glare - reflected		Glare - direct	Glare - reflected	Spaciousness -room size etc.	Privacy	Glare - direct	Glare - reflected	Glare - direct	Glare - reflected	Intial Cost	Color Temperature	Family	Reflector	Maintenance
Score																

Name of the Student:

Lighting Course Grade:
Final Design Grade:

Figure 5.9. Evaluation sheet for book stack exercise

5.2.2 Final Jury Observation

Final design juries in both sections were recorded using two analog video cameras (two Sony Handycam Video Camera Series). The video cameras were located towards the presentation boards in order to record the voices of both the jurors and the students, as well as to capture students' presentation drawings. The instructors and the jurors were aware of the recording processes and the recordings were done with their consents. However, they were not informed about the objectives of the research to minimize the bias in the jury conversations. In order not to disturb the jurors and the students during jury discussions, the camera positions were kept stable throughout the recording processes.

The juries lasted three days, about eight to nine hours on each day. In addition to the instructors of the course, three visiting jurors were invited to each section. The recordings were analyzed in order to discuss instructors' evaluations of the final projects in terms of their considerations of artificial lighting and daylighting design, and in order to understand their conceptions on lighting by detecting the terminology they used in discussions as well as their questions and utterances. Besides drawing contours of instructors' approach in their evaluations of lighting design, students' explanations of their lighting approaches were examined.

5.3 Data Analysis and Findings

5.3.1 Analysis and discussion of constructivist pedagogy

To find out the effectiveness of integrative power of the implied theory in design studios, students' lighting performance scores were analyzed using

statistical methods. For statistical data analysis of the collected lighting design scores, Statistical Package for Social Sciences (SPSS) v.13.0 software was used. The graphical presentations were prepared using Microsoft Excel software, in addition to the SPSS's chart outputs.

a. Comparison of the two sections for the final lighting scores with respect to the application of lighting exercises:

An independent samples *t*-test was conducted to evaluate the hypothesis that students to whom the lighting exercises prepared within the constructivist framework were given will be more successful in responding to the lighting requirements of the design project compared to the students who do not complete these lighting exercises. The results of the *t*-test for unequal variances were statistically significant, $t(53.68) = 3.78$, $p < .01$.[16] The sum of the final lighting scores of the section with lighting exercises ranged from 0.00 to 51.00, whereas the scores of the other section were ranged from 0.00 to only 13.00. The 44 students of one section who have completed the lighting exercises and got feedback (M = 13.39, SD = 14.25) on the average scored better in the sum of the final lighting scores than the students of the other section who have not done the exercises. The 95% confidence interval for the difference in means ranged from 4.06 to 13.21. Figure 5.10 shows the distribution of the lighting scores for the two sections. These findings support the initial statement that introduction of lighting exercises to the studio process following a constructivist pedagogy results in a significant

[16] In this study, the decisions to use t-test for equal or unequal variances were based on the results of the Levene's test for equality of variances at $\alpha = .05$.

difference in the integration of lighting design aspects into the studio project in favor of the group that has completed the exercises.

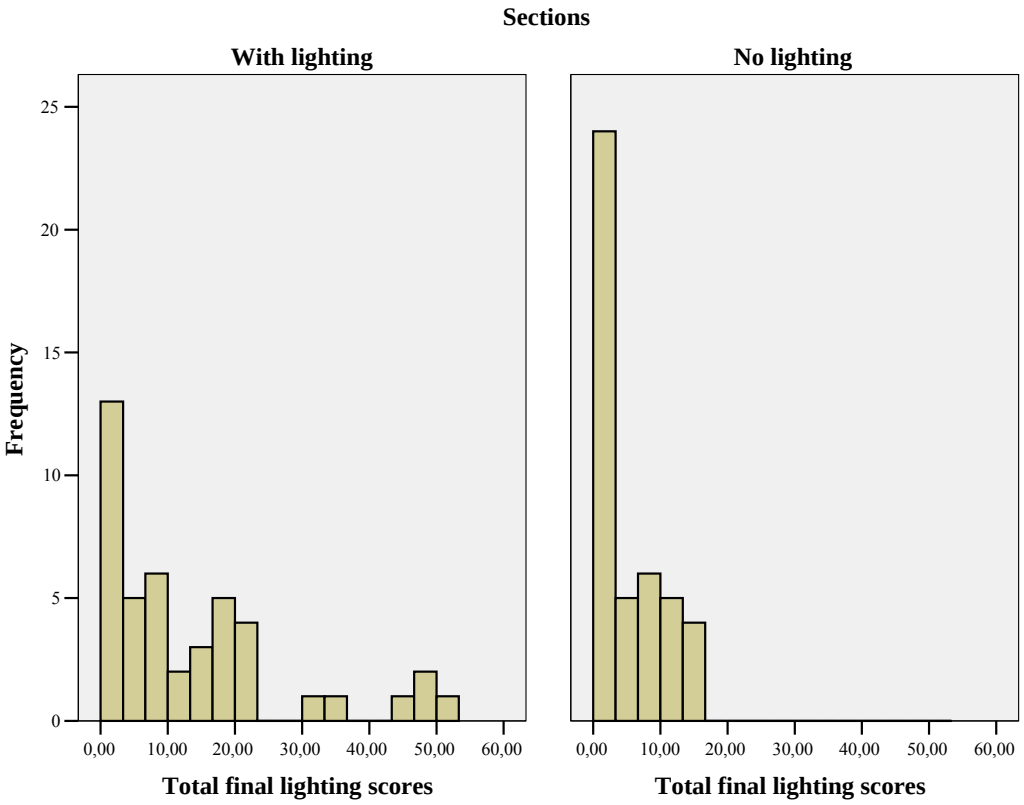

Figure 5.10. Histograms for the total lighting scores of the two sections.

Additionally, final lighting scores of the two sections were compared for each of the three exercises separately: final stack, carrel and circulation scores. The mean of the final stack scores for the section with lighting exercises was 6.34 (*SD* = 6.80), while the average score for the control group was only 3.18 (*SD* = 3.62). The results of the *t*-test for unequal variances were statistically significant, $t(65.56) = 2.72$, $p = .008$. The students of the section who have completed the stack exercise on the average scored better in the final stack lighting scores when

compared to the students of the other section. The 95% confidence interval for the difference in means ranged from 0.84 to 5.48.

Secondly, final carrel lighting scores were compared for the two sections. The average final carrel score for the section with lighting exercises was 2.84 (*SD* = 4.66), and the average score for the other section was only 0.75 (*SD* = 2.06). The results of the *t*-test for unequal variances were statistically significant, $t(59.2) = 2.73$, $p = .008$. The students of the section who have completed the carrel exercise on the average scored better in the final carrel lighting evaluation when compared to the students in the control group. The 95% confidence interval for the difference in means ranged from .56 to 3.63.

Thirdly, final circulation lighting scores were compared for the two sections. The results of the *t*-test for unequal variances were statistically significant, $t(52.7) = 3.16$, $p = .008$. Circulation scores of the 44 students who have completed the lighting exercises and got feedback ($M = 4.20$, $SD = 6.73$) on the average were higher than the scores of the students who have not done the exercises ($M = 0.82$, $SD = 2.27$). The 95% confidence interval for the difference in means ranged from 1.24 to 5.53.

As a result, the analyses for comparison of mean scores for individual lighting areas (stack, carrel and circulation) as well as the sum of the final lighting scores among the two sections provide sufficient evidence to conclude that students who had the chance to complete the lighting design exercises during the semester, and received constructive feedback on their lighting design proposals for the specific areas managed to develop better understanding and competency in

lighting design aspects, and were more successful in reflecting their lighting knowledge into their design projects.

b. Relationship between lighting exercises and the success in the final jury in terms of lighting requirements of the project:

For the section where lighting exercises were incorporated into the studio process ($N = 44$), the Pearson correlation coefficient between lighting exercise scores and the total final lighting score (as the indicator of the competence in lighting) was .638 ($p < .01$). The regression equation with the lighting exercise scores as the predictor of success in lighting design was significant, $F(1,42) = 28.765$, $p < .01$, and the linear model accounted for 40.6 % of the variance in final lighting scores, $R^2 = .406$, adjusted $R^2 = .392$. The predicted final lighting scores increased 0.56 for every unit increase in the sum of lighting exercise scores, $B = 0.558$, $SE_B = 0.104$, $\beta = .638$, $t(42) = 5.363$, $p < .01$, supporting the argument that completion of lighting exercises increased success in the final jury with respect to satisfying the lighting design requirements of the studio project. The positive trend in the final lighting scores in relation to the lighting exercise scores can be seen in Figure 5.11.

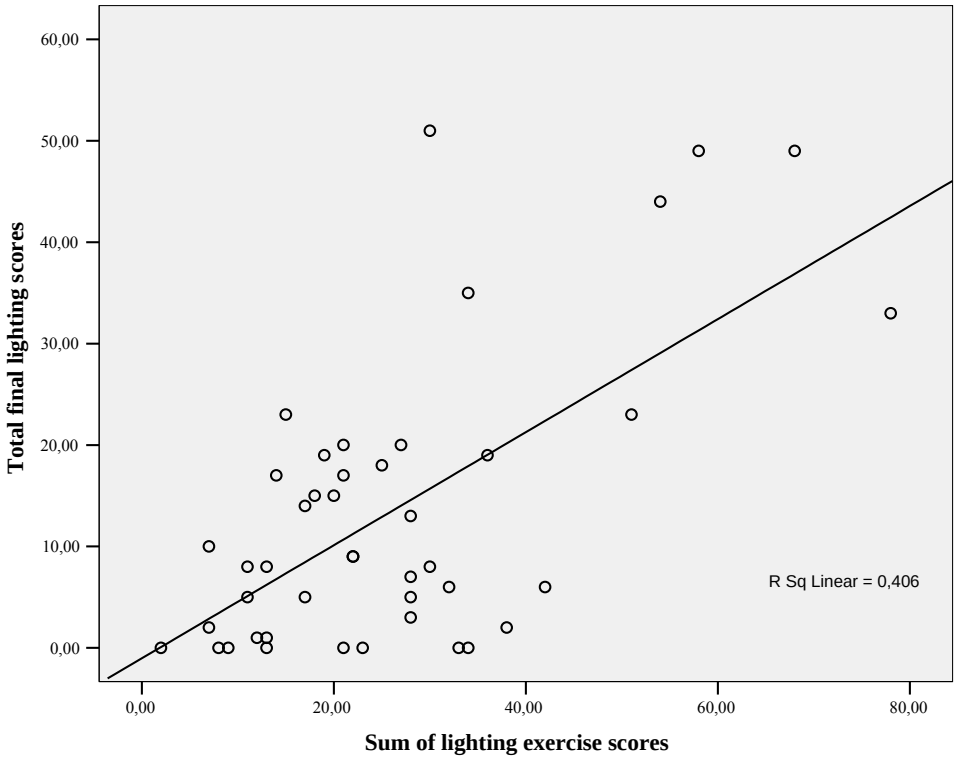

Figure 5.11. Scatterplot for the final lighting scores in relation to the lighting exercise measure.

c. Relationships between final lighting scores and final jury grades:

The correlation between total final lighting scores and final jury grades was .385 ($p < .01$). When the section with the lighting exercises was examined separately, the correlation was found to be stronger, $r = .483$, and the relationship was statistically significant ($p < .01$), meaning that students who score higher in lighting design tend to get higher grades in final juries. The correlation for the section with no specific lighting focus was lower and not statistically significant at $\alpha = .05$ level, $r = .289$, $p = .06$.

d. Relationships between lighting design performance and the previously taken lighting course grade:

All interior design students in Bilkent University are required to take, in their second year program, the IAED 244 Building Physics course which specifically deals with lighting design topics prior to the 4th-year interior design studio. An analysis was done to evaluate whether students' performance in lighting design within the studio context is related to their previous performance in the lighting course. For the both sections, the correlations between final lighting scores and the lighting course grades were low and not statistically significant, $r = .11$, $p = .483$, and $r = .285$, $p = .067$ respectively for the sections with and without lighting focus. Additionally, for the section with the lighting focus, the relationship between the performance in the lighting exercises and the lighting course grade was calculated in order to see if the previous lighting score is an indicator of lighting design performance in the exercises. The Pearson correlation coefficient between the two measures was also very low, $r = .191$ ($p = .22$). The findings were significant for underlining the gap between the studio and supportive courses in the curriculum within the context of the lighting course, indicating that students were not always able to transfer the knowledge they had gained in a supportive course to their design projects.

e. Relationship between the final lighting score and the completion of the lighting sketch problem during the semester:

Students in both studio sections were given a sketch problem about the lighting problems of the design project in the 9th week of the semester. Among the

88 students in total, only 33 of them submitted the assignment. The average final lighting score for the students who did not submit the lighting sketch problem was 9.35 (*SD* = 12.33), and the average score for the ones who completed the assignment was 8.60 (SD = 10.09). The Pearson correlation coefficient between the final lighting score and the completion of the lighting sketch problem was very low (almost no correlation), r = -.031, *p* = .772. An independent samples *t*-test was conducted to evaluate whether submission of the sketch problems as an indicator of the effort in lighting design aspects of the project is related to the final lighting score of the design project. The result of the *t*-test for equal variances was not statistically significant, *t*(86) = .291, *p* = .772. In addition to the result of the *t*-test, the lower final lighting scores for the students who have turned in their sketch problems, when compared to the ones who did not submit, support the argument that introduction of lighting concepts as a disentangled topic in the design studio with a separate lighting design problem is insufficient, and not related to and do not guarantee the success in the final lighting achievements of the design projects.

f. Multiple regression models predicting final lighting design score:

For the students who have completed the lighting assignments during the studio process, the average final lighting score was 13.65 (*SD* = 14.31). In this regression analysis, final jury grade, lighting course grade and the sum of the scores in the lighting assignments were included as the predictors of the final lighting score. The means and standard deviations of the variables can be found in Table 5.1. The correlations between the final lighting score and the predictors ranged from .11 to .66 (see Table 5.1). The intercorrelations among the predictor variables were relatively lower, and ranged from - .04 to .42.

Table 5.1

Descriptive Statistics and Correlations between Lighting Design Score and the Predictor Variables

Measures	*M*	*SD*	Correlations 2	3	4
1. Final lighting score	13.65	14.31	.49**	.11	.66**
2. Final jury grade	2.07	0.67		.04	.42**
3. Lighting course grade	2.00	0.97			.23
4. Sum of lighting exercise scores	25.58	16.38			

$N = 43$ (the student who has not taken the lighting course was not included in the analysis).
** $p < .01$.

A multiple regression analysis was conducted including all these variables as predictors (Model 1, Table 5.2). The regression equation was significant, $F(3,39) = 12.534$, $p < .01$, and the linear combination of the predictors accounted for 49.1 % of the variance in final lighting scores, $R^2 = .491$, adjusted $R^2 = .452$.

Among these predictors, lighting course grades were the weakest measure. Partialling out the effects of other predictors, the unique contribution of this variable was almost 0%. Holding other measures constant, the predicted final lighting score decreased 0.44 for every unit increase in the lighting course grade, $B = -0.44$, $SE_B = 1.74$, $\beta = -.03$, which is not meaningful within the context of the problem. This contribution was not statistically significant, either, $t(39) = -0.253$, $p = .80$, supporting the argument that lighting course grade was the least contributing predictor in the full model due to the disintegration in the interior design curricula as argued before. Thus, since lighting course grade does not offer a significant

additional predictive power, it was appropriate to eliminate this measure from the final model.

As a result, the final model incorporates final lighting score regressed on the sum of the lighting exercise scores and the final jury grade (Model 2 in Table 5.2). This regression equation was also statistically significant, $F(2,41) = 17.803$, $p < .01$, and the linear combination of the predictors accounted for 46.5 % of the variance in final lighting scores, $R^2 = .465$, adjusted $R^2 = .439$. Table 2 demonstrates the unique contributions of each predictor, holding the others constant.

Table 5.2

Summary of Regression Analysis for Variables Predicting the Final Lighting Score

Variable	*B*	*SEB*	β	Unique cont.
Model 1: ($R^2 = .49$)				
Intercept	-9.121	6.169		
Final jury grade	5.358*	2.685	.251	.050
Lighting course grade	-0.440	1.738	-.030	$.8x10^{-3}$
Sum of lighting exercise scores	0.492**	0.113	.563	.248
Model 2: ($R^2 = .47$)				
Intercept	-10.315	5.343		
Final jury grade	5.695*	2.694	-.265	.058
Sum of lighting exercise scores	0.462**	0.110	.528	.231

N = 43 for Model 1, excluding the subject who has not taken the lighting course and *N* = 44 for Model 2. * $p < .05$. ** $p < .01$.

The results suggest that in the section where lighting exercises were incorporated in the studio process, the students who scored higher in the lighting design exercises, and are more successful in the overall studio project with higher jury grades tended to score higher in the final lighting assessment, and seemed to better integrate the lighting design concepts and criteria to their projects.

g. Students' improvement through the lighting exercises:

During the data gathering process, the section where the lighting design exercises were applied was divided into three subgroups, as described in the previous sections, and these three groups took the exercises in different orders. An analysis was conducted to see whether there were any improvements in students' lighting scores from exercise 1 to exercise 2, from exercise 2 to exercise 3, and from exercise 1 to exercise 3. Paired samples *t*-test was conducted to see whether mean scores differ among exercises. Even though exercise scores slightly increased toward the latter exercises, none of the mean differences were statistically significant. The mean score and standard deviation of each exercise can be found in Table 5.3. Mean differences and corresponding t statistics and p-values are listed in Table 5.4. Even though one would expect an improvement in the exercise scores in the latter assignments (since the students were accumulating lighting knowledge), it is rational to see no increase in the subsequent exercises due to the different foci of the lighting design problems in the exercises.

Table 5.3

Descriptive Statistics for the Lighting Exercise Scores

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total score for Ex1	9.5500	40	7.40045	1.17011
	Total score for Ex2	9.5750	40	6.60570	1.04445
Pair 2	Total score for Ex2	9.8710	31	6.90769	1.24066
	Total score for Ex3	10.4516	31	7.12666	1.27999
Pair 3	Total score for Ex1	10.1212	33	7.94024	1.38222
	Total score for Ex3	10.4242	33	6.91931	1.20450

Students who have not submitted the concerned lighting exercise were excluded from the paired-sample analysis for that exercise.

Table 5.4

Results of the Paired Sample t-test for the Lighting Exercise Scores

		Paired Differences					*t*	*df*	*p* (2-tailed)
		M	*SD*	*SE of Mean*	95% CI of the Difference				
					Lower	Upper			
Pair 1	Total score for Ex1 - Total score for Ex2	-.02500	7.75089	1.22552	-2.50385	2.45385	-.020	39	.984
Pair 2	Total score for Ex2 - Total score for Ex3	-.58065	7,54442	1.35502	-3.34796	2.18667	-.429	30	.671
Pair 3	Total score for Ex1 - Total score for Ex3	-.30303	9.21780	1.60461	-3.57152	2.96546	-.189	32	.851

h. Relationships between the lighting exercises and the individual lighting design performances in the final jury concerning the topics of the exercises:

Since the lighting exercises concern stack, carrel and circulation lighting as explained in the preceding sections, while measuring of the design performance in the final projects, these three areas were evaluated separately. The correlations between the individual exercises and the corresponding final lighting scores were positive and ranged from .34 to .59, and all correlations were statistically significant (see Table 5.5). However, when the mean score differences were analyzed by paired sample *t*-tests, significant declines were observed in the final lighting scores when compared to the lighting exercise sore of the concerned area. As seen in Table 5.6, while the average lighting exercise scores for the stack, carrel and circulation spaces were 9.20 (*SD* = 6.63), 9.45 (*SD* = 7.12), and 10.58 (*SD* = 7.09) respectively, the corresponding final lighting scores were only 6.80 (*SD* = 6.83), 3.21(*SD* = 4.91), and 4.63 (*SD* = 7.08). The mean differences were found to be statistically significant (see Table 5.7 for the specific *t* statistics and the *p* values). Figure 5.12 demonstrates the decreases in the lighting design

performances from the exercise scores to final scores for the three design areas separately. These decreases in the lighting scores can be explained by the undervaluation of the lighting aspects in the overall design process by the instructors with regards to their expectations from the students as reflected in the submission requirements and evaluation criteria. In a parallel sense, students underestimating the significance of lighting aspects seemed to prioritize other design dimensions over lighting design.

Table 5.5

Correlations between Lighting Exercise Scores and Final Lighting Design Scores

	Correlations		
Exercise types	Final stack score	Final carrel score	Final circulation score
1. Stack	.457**		
2. Carrel		.587**	
3. Circulation			.338*

Table 5.6

Descriptive Statistics for the Paired Samples

		M	*N*	*SD*	*SE Mean*
Pair 1	Stack	9.1951	41	6.62654	1.03489
	Final stack	6.8049	41	6.82356	1.06566
Pair 2	Carrel	9.4474	38	7.12323	1.15554
	Final carrel	3.2105	38	4.90536	.79576
Pair 3	Circulation	10.5789	38	7.08875	1.14995
	Final circulation	4.6316	38	7.08413	1.14920

Table 5.7

Results of the Paired Sample t-test for the Mean Differences between Lighting Exercises and Final Lighting Scores

		Paired Differences					*t*	*df*	*p* (2-tailed)
		M	*SD*	*SE Mean*	95% CI of the Difference				
					Lower	Upper			
Pair 1	Stack – final stack	2.39024	7.01027	1.09482	.17753	4.60296	2.183	40	.035
Pair 2	Carrel – final carrel	6.23684	5.81440	.94322	4.32570	8.14799	6.612	37	.000
Pair 3	Circ – final circ	5.94737	8.15706	1.32325	3.26621	8.62853	4.495	37	.000

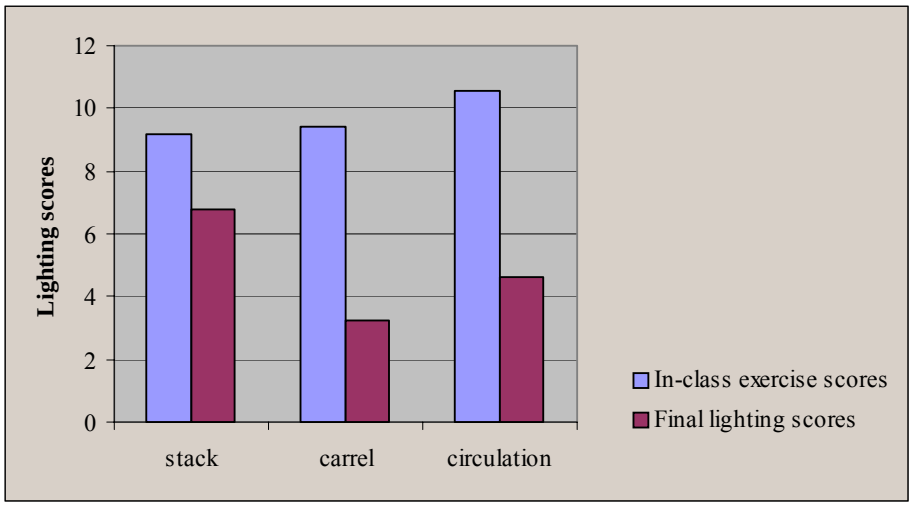

Figure 5.12. Comparison of performance scores for the exercises and final project lighting designs.

i. Relationship between students' preferences for drawing reflected ceiling plans and their final lighting design performances:

In interior design schools, reflected ceiling plan is a common tool to communicate lighting ideas. Even though it was not a submission requirement for the final project, some students from both sections chose to present their lighting design ideas by drawing reflected ceiling plans. Considering that providing

reflected ceiling plans as an extra may be an indication of students' giving more priority to lighting design ideas, an analysis was conducted to evaluate whether students who drew reflected ceiling plans scored higher in the final lighting design assessment as opposed to the ones who did not draw. Even though the students who provided reflected ceiling plans scored slightly higher in final lighting performance (M = 11.32, SD = 11.03) when compared to the lighting scores of the students with no reflected ceiling plans (M = 8.32, SD = 11.62), the t-statistic for equal variances was not statistically significant, $t(86) = -1.06$, $p = .15$ (1-tailed).

j. Sub-score (general lighting provision versus specific concerns) differences within the exercises:

Three separate analyses were conducted for the lighting exercises in order to evaluate whether there was a tendency among students toward satisfying design criteria on 'general' lighting provision (which can be solved by basic lighting knowledge, such as on lighting distribution patterns), or toward stating the more 'specific' properties of their lighting design proposals that requires an understanding and proper selection of lighting source or luminaire types. General lighting scores were rescaled in all three exercises so that they will be in the same scale with task-ambient lighting, source type and luminaire type scores for the ease of comparison.

For the circulation exercise, when the mean score differences were analyzed by paired sample t-tests, significant differences were observed between general lighting provision scores, i.e. general and task-ambient lighting scores, and specification scores, i.e. source type and luminaire type. While the average general lighting provision scores were 0.84 (SD = 0.59), and 0.91 (SD = 0.54) for general

lighting and task-ambient lighting scores respectively, the average specification scores were only 0.18 (*SD* = 0.46), and 0.32 (*SD* = 0.42) for source type and luminaire type scores respectively. All mean differences were found to be statistically significant (see Table 5.8 for the specific *t* statistics and the *p* values). Figure 5.13 demonstrates the differences in the lighting subscores for the comparison of general and task-ambient lighting scores with source and luminaire type scores separately.

Table 5.8

Results of the Paired Sample t-test for the Mean Differences between General Lighting Provision Scores (general and task lighting) versus Specification Scores (source and luminaire) for the Circulation Exercise

		Paired Differences					*t*	*df*	*p* (2-tailed)
		M	*SD*	*SE Mean*	95% *CI* of the Difference				
					Lower	Upper			
Pair 1	C.task - C.source	.65789	.74530	.12090	.41292	.90287	5.441	37	.000
Pair 2	C.task – C.luminaire	.52632	.60345	.09789	.32797	.72467	5.376	37	.000
Pair 3	C.source – C.general	-.72368	.66472	.10783	-.94217	-.50520	-6.711	37	.000
Pair 4	C.luminaire - C.general	-.59211	.59110	.09589	-.78639	-.39782	-6.175	37	.000

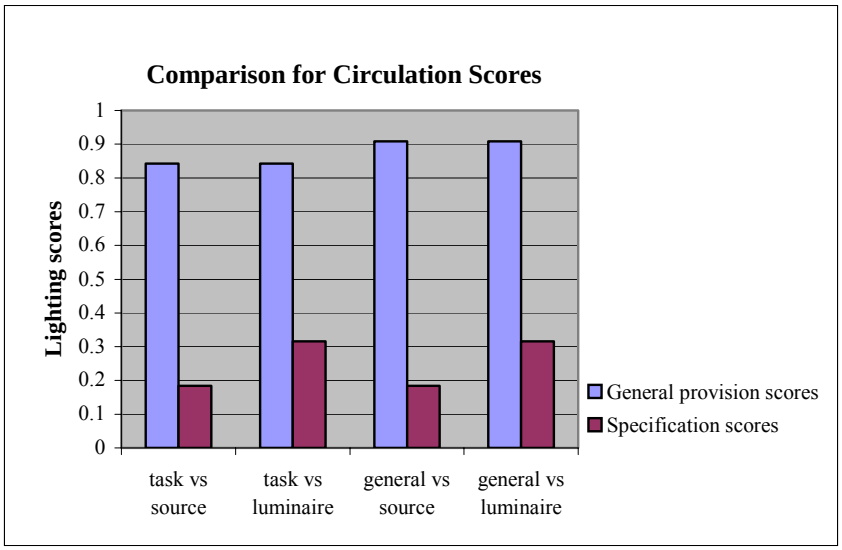

Figure 5.13. Comparison of general lighting provision scores and specification scores for the circulation exercise.

For the stack exercise, results of the paired sample *t*-tests demonstrated that, even though general lighting provision scores were higher than specification scores as in the circulation exercise, the mean differences were significant only for the general lighting versus source and luminaire type scores, but not for the task-ambient lighting comparisons (see Table 5.9). While the average general lighting score was 1.11 (*SD* = 0.48), the average specification scores were only 0.32 (*SD* = 0.47), and 0.41 (*SD* = 0.55) for source type and luminaire type specification scores respectively. Figure 5.14 demonstrates the differences in the lighting subscores for the comparison of general and task-ambient lighting scores with source and luminaire type scores separately. The reason for not finding a significant difference between task-ambient lighting scores, and source and luminaire type specification scores can be explained by students' concentrating more on general lighting requirements of the project rather than task lighting for this exercise -i.e. the general stack area with specific focus on the circulation spaces between the stacks.

Table 5.9

Results of the Paired Sample t-test for the Mean Differences between General Lighting Provision Scores (general and task lighting) versus Specification Scores (source and luminaire) for the Stack Exercise

		Paired Differences					*t*	*df*	*p* (2-tailed)
		M	*SD*	*SE Mean*	95% *CI* of the Difference				
					Lower	Upper			
Pair 1	S.task – S.source	.04878	.49755	.07771	-.10827	.20583	.628	40	.534
Pair 2	S.task – S.luminaire	-.04878	.49755	.07771	-.20583	.10827	-.628	40	.534
Pair 3	S.source – S.general	-.79268	.59135	.09235	-.97934	-.60603	-8.583	40	.000
Pair 4	S.luminaire - S.general	-.69512	.56875	.08882	-.87464	-.51560	-7.826	40	.000

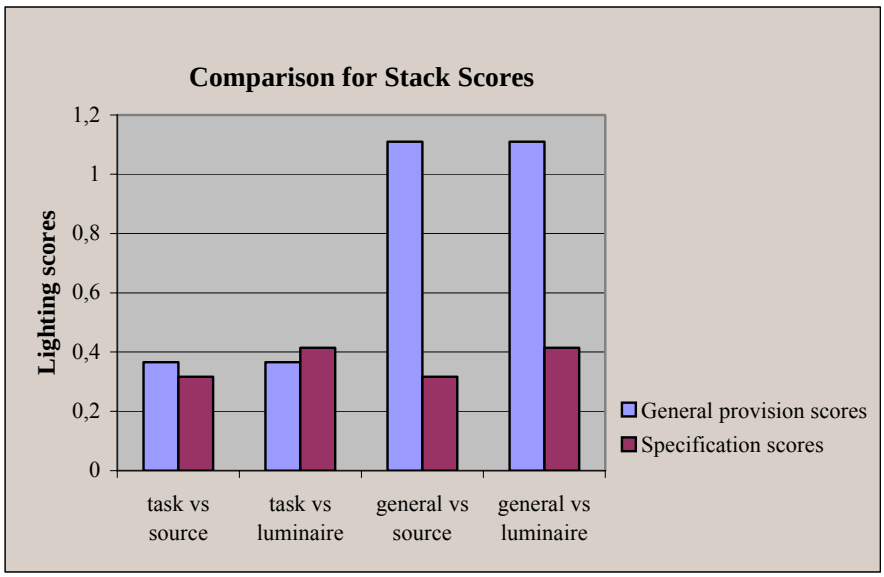

Figure 5.14. Comparison of general lighting provision scores and specification scores for the stack exercise.

In the paired sample *t*-test analyses for the carrel exercise, significant differences were observed between general lighting provision scores and specification scores (see Table 5.9), except the mean score difference between general lighting and luminaire type scores where the mean difference was not significant at $\alpha = .05$, $t(37) = -1.64$, $p = .11$. While the average general lighting provision scores were 0.62 ($SD = 0.62$), and 1.13 ($SD = 0.53$) for general lighting and task-ambient lighting scores respectively, the average specification scores were only 0.26 ($SD = 0.50$), and 0.42 ($SD = 0.60$) for source type and luminaire type specification scores respectively. Figure 5.15 demonstrates the differences in the lighting subscores for the comparison of general and task-ambient lighting scores with source and luminaire type scores separately.

Table 5.10

Results of the Paired Sample t-test for the Mean Differences between General Lighting Provision Scores (general and task lighting) versus Specification Scores (source and luminaire) for the Carrel Exercise

		Paired Differences					*t*	*df*	*p* (2-tailed)
		M	*SD*	*SE Mean*	95% *CI* of the Difference				
					Lower	Upper			
Pair 1	Car.task – Car.source	.86842	.62259	.10100	.66378	1.07306	8.598	37	.000
Pair 2	Car.task – Car.luminaire	.71053	.56511	.09167	.52478	.89627	7.751	37	.000
Pair 3	Car.source – Car.general	-.35526	.59170	.09599	-.54975	-.16078	-3.701	37	.001
Pair 4	Car.lumin. - Car.general	-.19737	.74016	.12007	-.44065	.04591	-1.644	37	.109

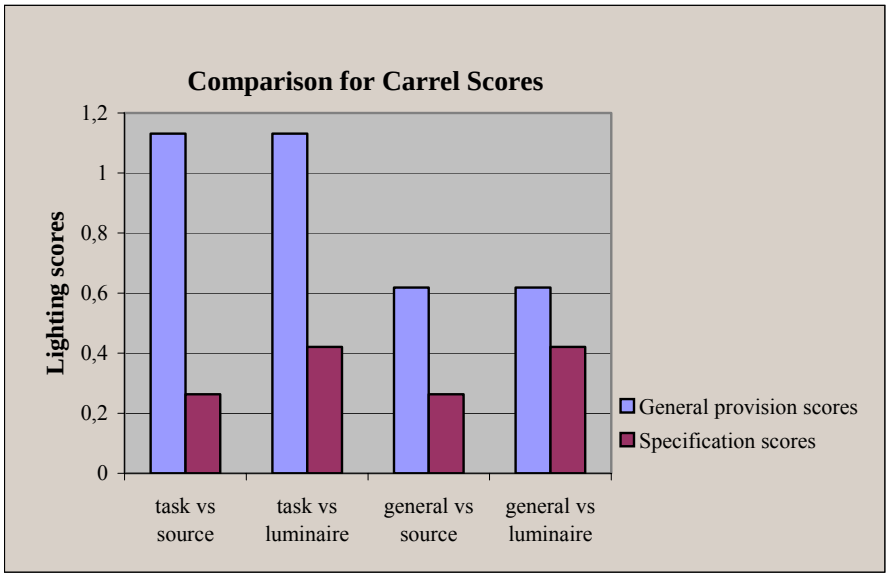

Figure 5.18. Comparison of general lighting provision scores and specification scores for the carrel exercise.

Both statistical analyses and graphical representations of the lighting subscores within the exercises demonstrate a tendency among students toward satisfying the basic general lighting provision but not being able to clarify the specific properties of their lighting design proposals. Even though students better

acquire the primary lighting knowledge with the basic lighting design principles, they were less successful in recalling their prior knowledge for specifying the types of lighting sources where they were expected to consider the attributes such as the family, color temperature and initial cost, and types of luminaires in relation to reflector and maintenance issues. As discussed in detail in the preceding sections, a holistic lighting design approach requires reconciliation of both design dimensions, i.e. the general lighting provision is not sufficient when the specific attributes of the lighting design were not specified by the designer. In that sense, this analysis is significant for underlining the necessity for giving more emphasis to a holistic lighting design approach in interior design education, especially in design studios, rather than educators' being satisfied only with the basic lighting provision in the projects.

5.3.2 Analysis and discussion of jury observations

The juries were recorded to analyze the content of discussions and to find out the extent of assessment of lighting within students' final design projects. Each recorded jury session was converted into texts and discussions on lighting subjects were excerpted from each student's session in order to examine the questions asked by the instructors, to discuss students' answers to those lighting-related inquiries, to detect lighting-related terminology used by the parties of jury, and to identify conceptions on lighting.

Lighting questions asked in juries

The main problem identified is instructors' undervaluation of the lighting subjects in their evaluation criteria. As described in section 3.4, this may be related with the interpersonal contexts, defined by the differences in instructors'

backgrounds, their expectations, areas of expertise and concentration, and their attachments to particular sub-cultures.

During the analysis of jury recordings, the number of lighting questions asked by jury members was examined as a measure of the interest by jurors in lighting design dimensions of the projects as a part of the evaluation criteria. The findings underlined the validity of the arguments in the preceding sections with regards to the defined barriers against the integration of lighting issues to interior design education in general, and design studio in particular.

As expected, majority of the students were asked either no or very few questions about lighting design dimensions of their design proposals. Among the 88 students in both sections, 39 students were asked no lighting question, while 15 of them encountered with only one question about the lighting design in their studio projects. Figure 5.16 demonstrated the distribution of lighting questions asked to students.

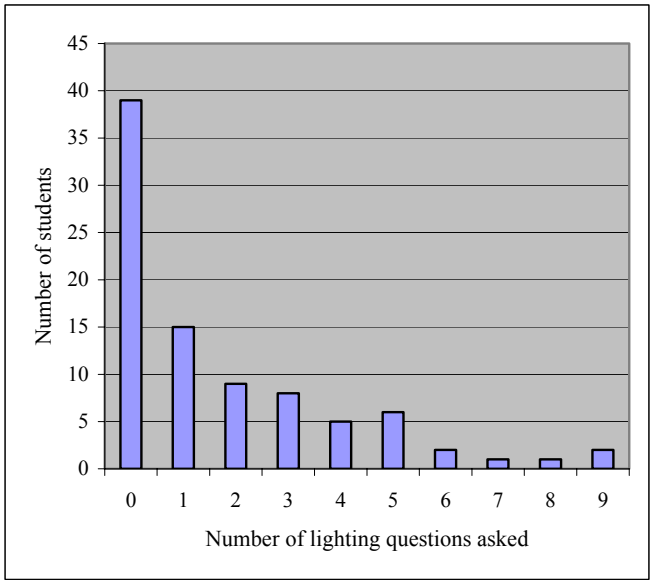

Figure 5.16. Distribution of the number of lighting questions asked in the final design juries.

Even though the average number of questions asked to each student was 1.73 (*SD* = 2.24); when examined in more detail, it was seen that 106 of 152 lighting questions in total (about 70%) were asked by the lighting course instructor. This means that the average number of questions asked about lighting was 0.68 (*SD* = 1.15) when the lighting course instructor was not in the jury, while 3.86 (*SD* = 2.45) lighting questions were asked when the lighting instructor was participating in the juries. Figure 5.17 shows the distribution of the lighting questions during the three jury days for the two sections. As seen in the figure, the number of lighting questions asked in the first-day jury session for Section 2 and in the third-day jury session for Section 1 when the lighting instructor was participating in the juries was significantly more than the rest of the jury sessions.

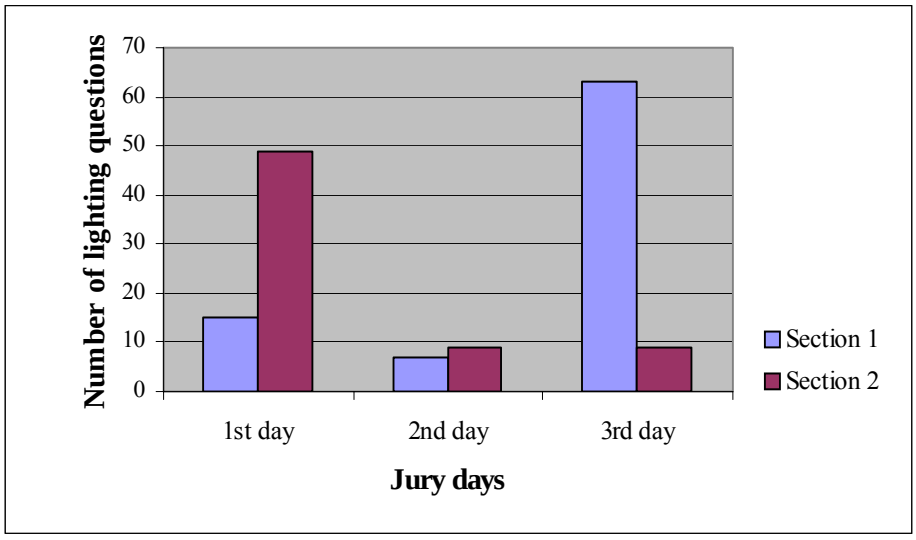

Figure 5.17. Number of lighting questions asked in the jury sessions.

An independent samples *t*-test was conducted to evaluate the hypothesis that students will be asked less lighting questions in juries when the lighting instructor was not available as a juror, compared to the students who are evaluated by the juries with the lighting instructor as a member. The result of the *t*-test for

unequal variances was statistically significant, $t(33.91) = -6.675$, $p < .01$. The 95% confidence interval for the difference in mean lighting questions ranged from –4.154 to –2.215.

The former section provided sufficient evidence that the students to whom the lighting exercises -prepared with reference to the constructivist pedagogies- were given, were more successful in their lighting design proposals. An analysis was conducted to see whether students' concentrating more on the lighting aspects in their designs and presentations has an effect on the nature of jury discussions with regards to the incorporation of lighting-related questions. In that sense, the number of lighting questions asked in the section with the lighting foci was compared to the other section – the control group where no extra lighting exercises were given. However, the result of the *t*-test for equality of means was not statistically significant, $t(86) = -0.854$, $p < .395$. This finding can be interpreted as follows: the roots of this disintegration can be traced more in instructor-based and curricular problems, rather than students.

Students' attitudes towards lighting subjects in juries

As portrayed by the excerpts listed in Appendix E, students did not present any lighting ideas unless they were asked to. The number of students who were not encountered with any lighting question also shows the amount of students who did not talk about their lighting proposals in their project presentations. There are particular examples (Figure 5.18) where students did not mention about their lighting designs although they have already drawn or they did not get any kind of response from the assessing parties.

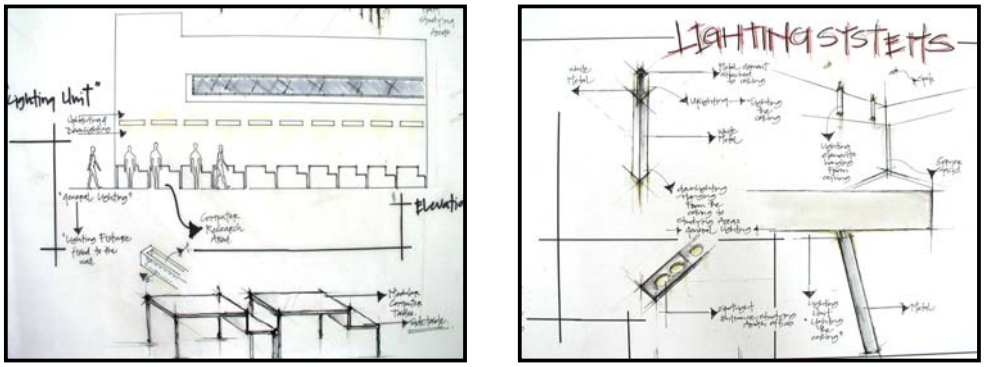

Figure 5.18. Project sec2 D3/3_Student project with a high grade and with unmentioned lighting proposals

Also, there are several cases illustrating students' ignorance of or not answering to particular lighting-related questions. They act as if they did not heard the inquiry and try to direct the content of conversation towards issues that they would feel more comfortable. Following excerpts demonstrate similar occasions.

Day 1_Sec1_Project 3

…

J1: Can you explain your reflected ceiling plans?

St: I used something like this (shows the ceiling of classroom/studio) I have spots.

J1: Where are the spots, are they all around the space?

St: … (no answer)

J1: What else? Where are you using these lighting fixtures? (The ones on the material board, figure 5.19)

St: … (no answer)

J1: At night what do you have under the skylight? What type of lighting you have at that space? Cove lighting? Wall washing? Can you see what I mean?

St: …(does not answer any of these questions)

…

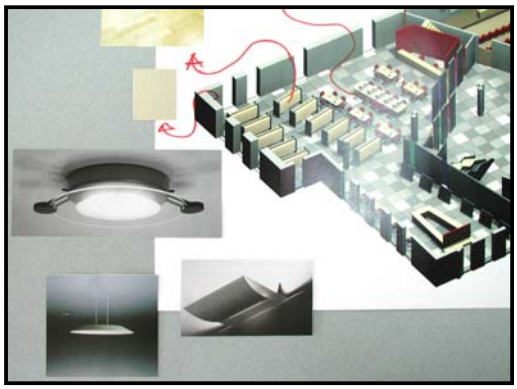

Figure 5.19. Project 3-Day1-Section 1 Material board

Day 1_Sec1_Project 9

…

J1[17]: There is a lighting system but it does not have lamps, right?

St: Yes.

J1: Each function has a different requirement, but you have the same type of lighting for everything.

St: … (no comment)

CY: Is it really acceptable or right? With these four lighting fixtures which are exactly the same you light different spaces.

St: … (no comment)

…

The reasons for the avoidance in answering particular inquiries can be traced within the instructional methods in design studio. Although the pedagogy defines a double-sided reflective and active learning strategy, in the current system it is evident that many instructors still maintain their authoritative figure, muting the voice of the student within conversations.

Students who were using computer software for modeling and rendering the project had particular problems pertaining to their presentation of lighting suggestions (Figure 5.20). The problem can be discussed as another disintegration

[17] Appendix F includes brief information on the backgrounds and expertise of the jurors.

problem in the studio, where computerized presentation is approached with an insecure attitude by instructors.

Figure 5.20. Students' problem in computer aided rendering and lighting

Instructors' lighting evaluation criteria

One factor affecting the emergence of the above mentioned problem is instructors' shifting rules under which evaluation occurs. As described by a barrier in previous chapters, the criteria of evaluation changes when instructors are faced with either a high or a low quality project. In either case, lighting subjects may be subject to under or overlooking, which is ignorance in the presented cases.

The project in figure 5.18 got one of the highest grades in the studio ('B' which was the highest grade). The above- mentioned situation is also evident when another project with a fair grade is examined (Figure 5.21).

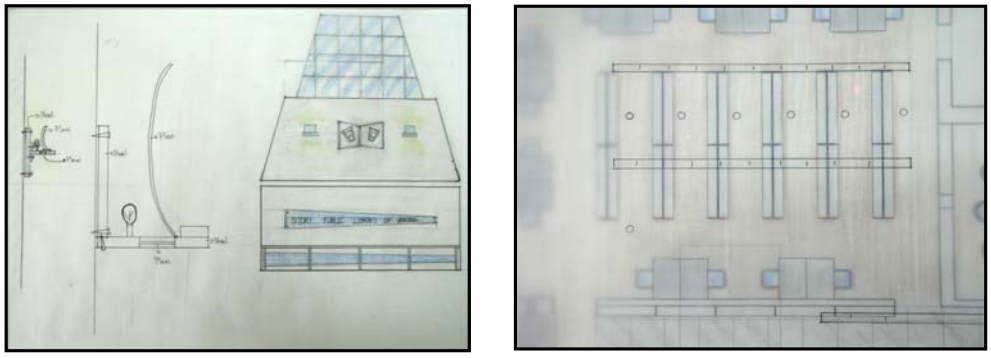

Figure 5.21 Project sec2 D3/14_Student project with a low grade having reflected ceiling plans and sketches for lighting ideas

In the following example of jury session, nothing asked, discussed and mentioned about artificial lighting and/or daylighting. The project was favored by the instructors because of its success in graphical presentation techniques. Since final juries in interior design education are almost like rituals, students are expected to display all their skills with multiple number of rendered and colored drawings (Basa & Senyapili, 2005).

Day 1_Sec1_Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

J3: The drawings are very good in this semester.

…

J1: All dimensions, dimensioning, doors and distances are correct, I think you are going to be an interior architect.

…

(Mis)conceptions on lighting and use of lighting-related terminology

The importance of language and wording in knowledge construction was underlined in the discussions comprising social constructivism studies. The use of lighting terminology in design juries was examined through the excerpts and it was found that the instructors had particular problems while communicating with students on lighting. Following excerpt is a significant sample that portrays the juror's misconception of fluorescent lighting sources. Besides, the juror, while mentioning about the color temperature of the source, intrinsically implied another miscomprehension, taking fluorescent light sources as only white light emitters. An experiential knowledge rooted in personal discomfort led the juror in establishing a faulty criticism.

Day1 Sec 1 Project 6

…

St: There are fluorescents as seen in the section. In here (talking about the atrium) there is skylight, I use spots for circulation desk. There is grid like lighting system at the carrels in order to have a diffuse lighting (folds the overlays while talking, explains by words).

J2: Don't you think that **fluorescent is a light which is uncomfortable with its sound and flicker**? I know it may have be with some kind of **yellow light** but normally isn't it something flickering and noisy? I do not think it is appropriate to use it in here.

St: … (no comment)

As illustrated in the second excerpt, instructors have limited terminology on lighting concepts. Several meanings are attributed to single words or phrases to define the technics as well as the methods of lighting design.

Day1 Sec 2 Project 2
Reflected ceiling plan: none
Skylight: presented incorrectly

…

St: Let me talk about the materials. (Talks about finishing materials then the material of stacks) Around the glass, at the stacks there is a light stripe.

J1: There **can be such lighting** and it is possible to **light** the aisles from the edge of stacks. (proposes a solution)

St: Over the stacks there is 'barrisol' and there are fluorescents behind it.

J1: He could **make the lighting** with glazing instead of using barrisol which is a kind of commercial fancy. Because it is a library…

Jurors and students trying to communicate in another language rather than their native language caused communication gaps, and terminated the jury dialogues earlier than required, due to the unwillingness to speak in a foreign language for a long time period. Under such situations, students are not able to get the useful feedback from their tutors.

The physical environment where the juries are held is also critical for the efficiency of the jury process. The comfort level provided to jury members and

students is really important for the quality of the discussions in the jury, thus very significant for the educational outcome of juries. Besides the physical attributes, number of students that jury evaluates in one day, the total hours spend in jury, and juror/student ratios affect the flow of jury discussions. When the number of students who need to be evaluated is high and the total duration of the jury is very long; due to metal and physical fatigue of jury members, it is impossible for the last student to get the same level of feedback the first student have received.

The findings of this study suggest that the number of lighting related questions decreases by the increase in the number of evaluated projects (Figures 5.22, 5.23). The decrease in the attention span, getting bored in the environment and from projects, and eventually total loss of interest result in unfair treatment and evaluation of students.

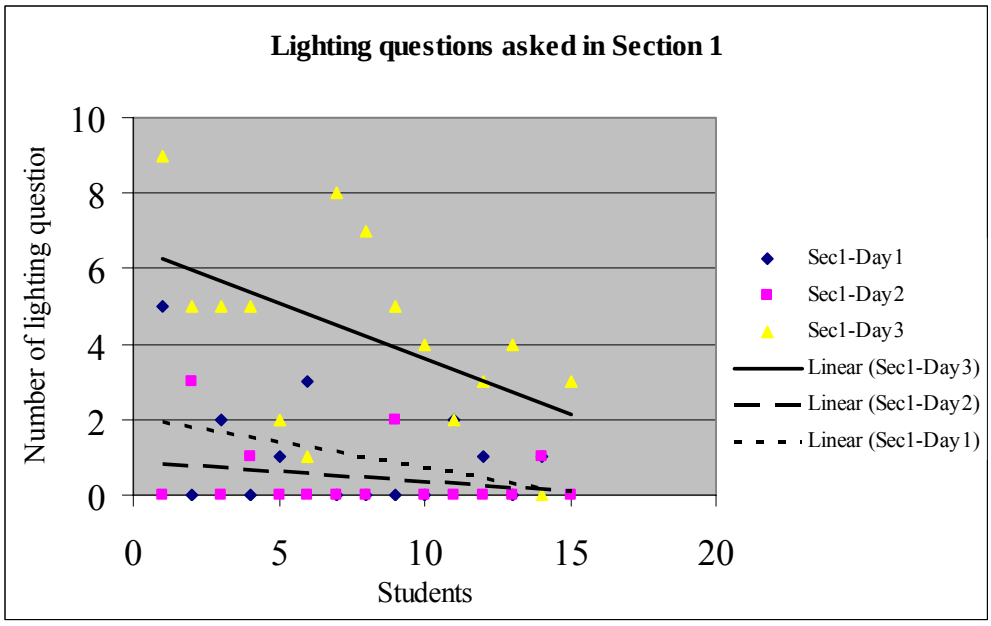

Figure 5.22. Number of lighting questions vs. students' jury presentation orders in section 1

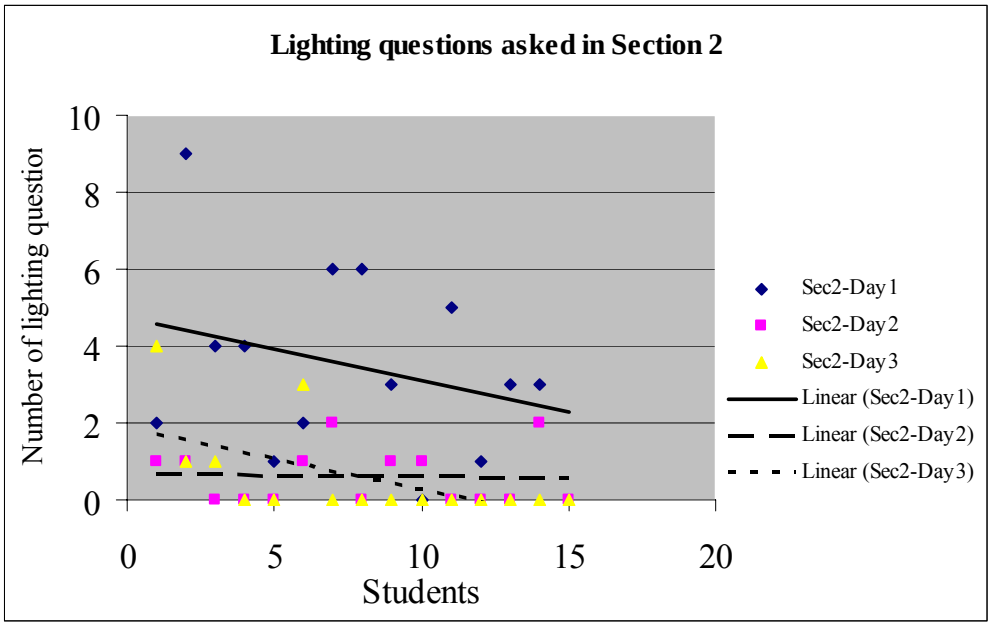

Figure 5.23. Number of lighting questions vs. students' jury presentation in section 2

Content and the type of questions:

As discussed above, majority of lighting related questions were asked by the lighting instructor. These questions were inquiring the design decisions about general lighting provision in the projects with regards to primary design principles, as well as the more detailed design decisions such as source and luminaire type selections. On the other hand, most of the questions asked by the jurors were either related to the completion of project's presentation requirements, such as: "do you have reflected ceiling plans?" which were followed by defensive statements by studio teachers, like "it was not a requirement; they were free in choosing the representation technique to explain their lighting ideas." Sometimes, the conversations on lighting design were limited to the question of "did you think anything about lighting?" which is sometimes answered, sometimes ignored by the student. Some of the more sophisticated questions could not be clarified due to the

reference to lighting sources, luminaire design, distribution of lighting, color of light, etc. as just ‘lighting’ or ‘light’ by some jurors, as further explained above in relation to improper use of lighting-related terminology.

6. CONCLUSION

Interior design profession has been confronted with the necessity of developing its own body of knowledge and has been challenged to devise an appropriate curriculum that answers to the scope of services which an interior designer is responsible to fulfill for providing adequate answers in order to respond to different levels of human needs. Lighting design has a significant role in satisfying human needs within physical environments in relation to functional, aesthetical as well as psychological requirements.

However, as illustrated in the previous chapters of the study, current curricula in interior design schools do not involve adequate lighting design knowledge to foster the creation and use of lighting knowledge, and students usually do not have the chance to apply the lighting knowledge they acquired within their design projects. Design education, being a problem-based learning approach lacks a very important dimension when students do not incorporate the knowledge they attained in the supportive courses.

As a response to this fragmentation in curricula, this study proposed and adopted a constructivist learning approach for studio education and demonstrated that constructivist pedagogies has the potential to overcome this disintegration problem with specific focus on lighting design concepts, which is illustrated to be a very significant aspect of interior design profession. Analyses and findings support the hypothesis that incorporation of constructivist theory and learning approaches into design studio education process has a significant effect on students' apprehension and use of lighting knowledge in final projects.

Additionally, by the jury observations, it was asserted that the roots of the problem cannot be solved just by curricular and pedagogical reforms. An important section of the problem is intrinsic to the attitudes and priorities of design instructors for teaching design and assessment of student projects.

Also, studio instructors need to be familiar to lighting concepts and accept the significance of the topic for the discipline. As implied by constructivism, tutors and learners should have willingness to gather new information when it is time to change what is believed and conceived.

Lighting and lighting design technology have been developing rapidly. It is more than difficult to follow these improvements day by day for the ones who are not experts of lighting design. Especially for studio instructors, there are many innovations in the field of building physics to engage in. Therefore, it would be useful if studio instructors are given chance to get acquainted with these developments in the other fields of design, at the beginning of each semester, by discussions held in the departments of design involving other supportive course instructors.

Yet, use of inappropriate language for discussions and underestimation of the lighting issues in studios still remain to be strong barriers against a comprehensive studio education.

Using constructivist paradigm, it was found to be possible to dislocate the defined barriers pertaining to instructors, learners and the curricula. If students are going to be responsible for the integration and use of their prior knowledge in the design studio projects, design educators and the studio environment should provide

a learning pedagogy and environment to foster the kind of instruction constructivism entails.

Using constructivism, students of design would be engaged actively in constructing meaning related to their projects. They can interpret their acquired lighting knowledge as well as their prior experiences in design processes. Schon's (1985) action theories would be supported by utilizing constructive reflection as a method to transform physical actions, -such as lighting experiments and observations- to mental operations in problem solving. Constructivist criticisms would also help learners in identifying the design issues and directions for solving problems.

Constructivist methodology can be incorporated into studio environment using a variety of tactics ranging from the utilization of case studies to establishing rules of thumbs for acquiring the preceding knowledge. Case studies would give the students opportunity to test the extent of their knowledge in particular domains and to become aware of their weaknesses.

There is very limited number of research studies in the area of interior design as well as lighting education. The current study contributes to this necessity of generating the interior design education theory as well as defining approaches for lighting design instruction.

Disintegration in design studio is not limited to nor constrained within lighting concepts. Therefore, as a further research, the findings of the current study will be utilized to propose integration models for incorporating other knowledge domains in interior design curricula, into studio instruction, such as bridging gaps between construction and materials, history of built environment courses and the studio project.

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APPENDIX A

Interior Design – Scope of Services by NCIDQ

- Research and analysis of the client's goals and requirements and development of documents, drawings and diagrams that outline those needs;
- Formulation of preliminary space plans and two and three dimensional design concept studies and sketches that integrate the client's program needs and are based on knowledge of the principles of interior design and theories of human behavior;
- Confirmation that preliminary space plans and design concepts are safe, functional, aesthetically appropriate, and meet all public health, safety and welfare requirements, including code, accessibility, environmental and sustainability guidelines;
- Selection of colors, materials and finishes to appropriately convey the design concept, and to meet socio-psychological, functional, maintenance, life-cycle performance, environmental, and safety requirements;
- Selection and specification of furniture, fixtures, equipment and millwork, including layout drawings and detailed product description' and provision of contract documentation to facilitate pricing, procurement and installation of furniture,
- Provision of project management services, including preparation of project budgets and schedules;
- Preparation of construction documents, consisting of plans, elevations, details and specifications, to illustrate non-structural and/or non-seismic

partition layouts, power and communications locations; reflected ceiling plans and lighting designs; materials and finishes; furniture layouts;

- Preparation of construction documents to adhere to regional building and fire codes, municipal codes, and any other jurisdictional statutes, regulations and guidelines applicable to the interior space;
- Coordination and collaboration with other allied design professionals who may be retained to provide consulting services, including bit not limited to architects; structural, mechanical and electrical engineers, and various specialty consultants;
- Confirmation that construction documents for non-structural and/or nin-seismic construction are signed and sealed by the responsible interior designer, as applicable to jurisdictional requirements for filing with code enforcement officials;
- Administration of contract documents, bids and negotiations as the client's agent;
- Observation and reporting on the implementation of projects while in progress and upon completion, as a representative of and o n behalf of the client; and conducting post-occupancy evaluation reports.

American Society of Interior Designers. (n.d.). NCIDQ's interior design definition and scope of services. Retrieved October 10, 2003, from http://www.asid.org/asid2/pubs/Definition%20of%20interior%20design%202.pdf

APPENDIX B

IAED 401 Interior Design Studio V Course Objectives

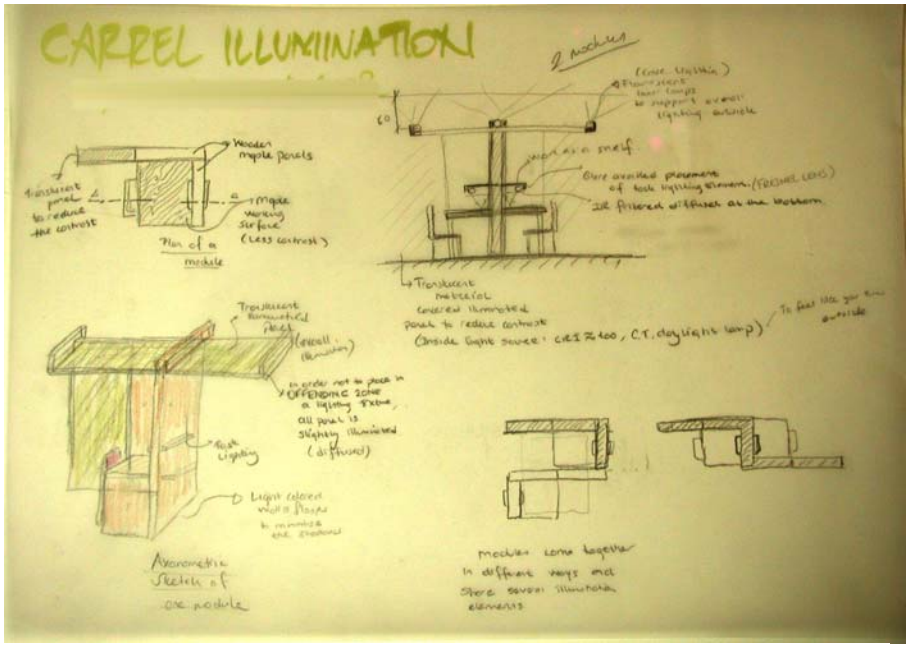
- To demonstrate a refined application of design process and creative problem solving technique, for large public spaces in relation to more confined subspaces and objects,
- To exercise conceptual process for the whole complex, trying to achieve integrity with interiors and architecture, with other disciplines in environmental design, as well as landscape and interior planting,
- To experience appropriate use of materials, finishes, furniture and fixture for specific interior environment, regarding functional factors for public's comfort and disabled's needs, aesthetic concerns, operational factors, maintenance, safety,
- To give emphasis on environmental control systems and their relations with interiors; physical and visual comfort requirements, illumination,
- To be acquainted with market sources, problems of modular coordination, manufacturing and production,
- To achieve awareness in architectural, technical and restorational conventions and their roles to accommodate reuse and adaptability in specific cultural environment,
- To consider by laws, codes, regulations and standards during design process,
- To understand and share the responsibilities in coordination of team-works by experiencing group studies in professional design process,

- To improve ability in presenting design concepts and solutions both verbally and graphically, using advanced techniques of innovative and contemporary media.

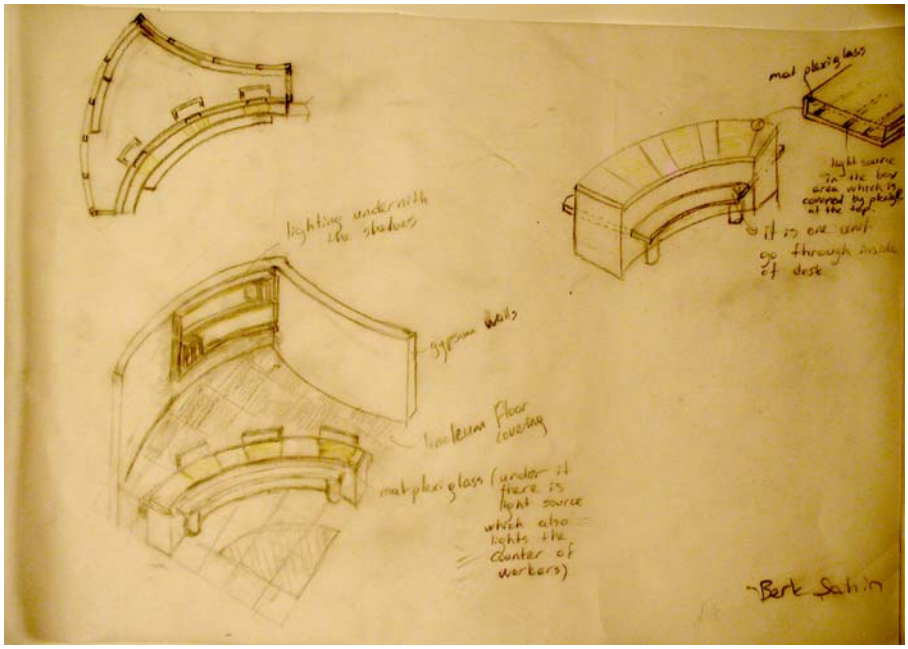
Demirkan, H., Gurel, M., Kural, N., Nalbantoglu, G. and Yardimci, T., 2000 *Curriculum assessment committee report 1.* Retrieved February 12, 2003, from http://www.art.bilkent.edu.tr/iaed/1report.htm

APPENDIX C

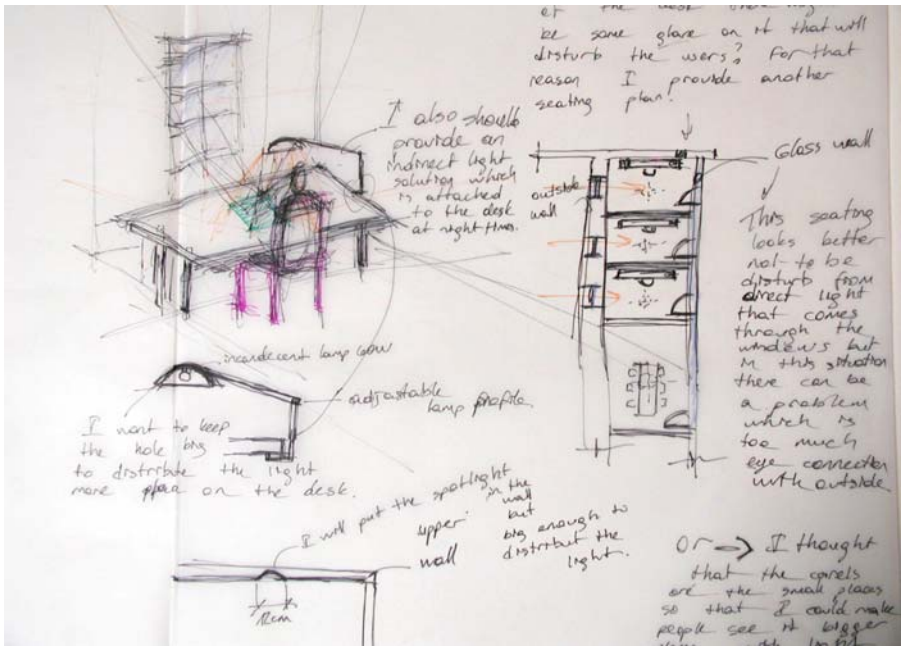
Sample Student Drawings



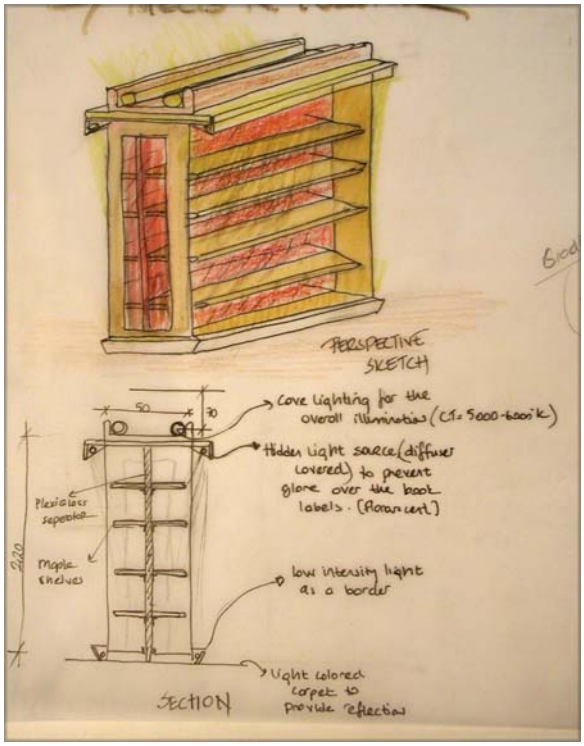
Sample exercise – approach(es) to lighting carrels



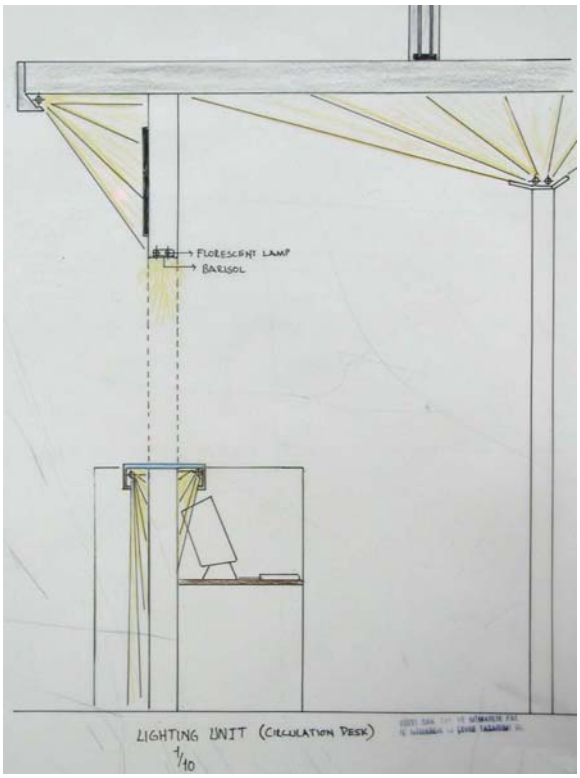
Sample exercise – approach(es) to lighting circulation desk



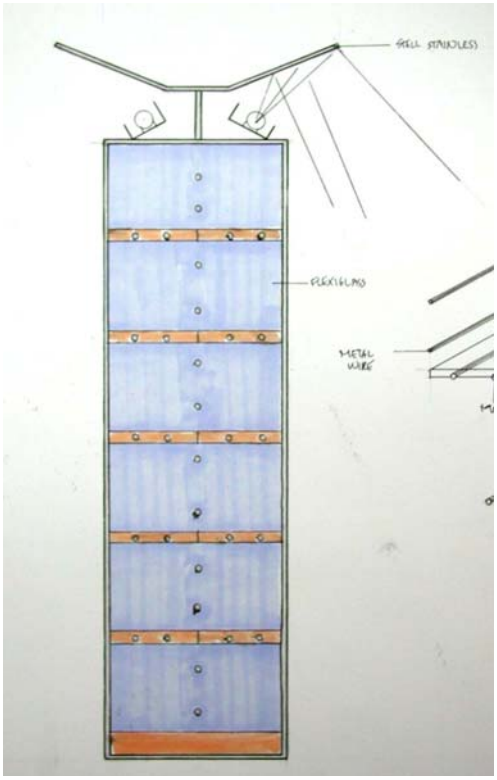
Sample exercise – approach(es) to lighting carrels



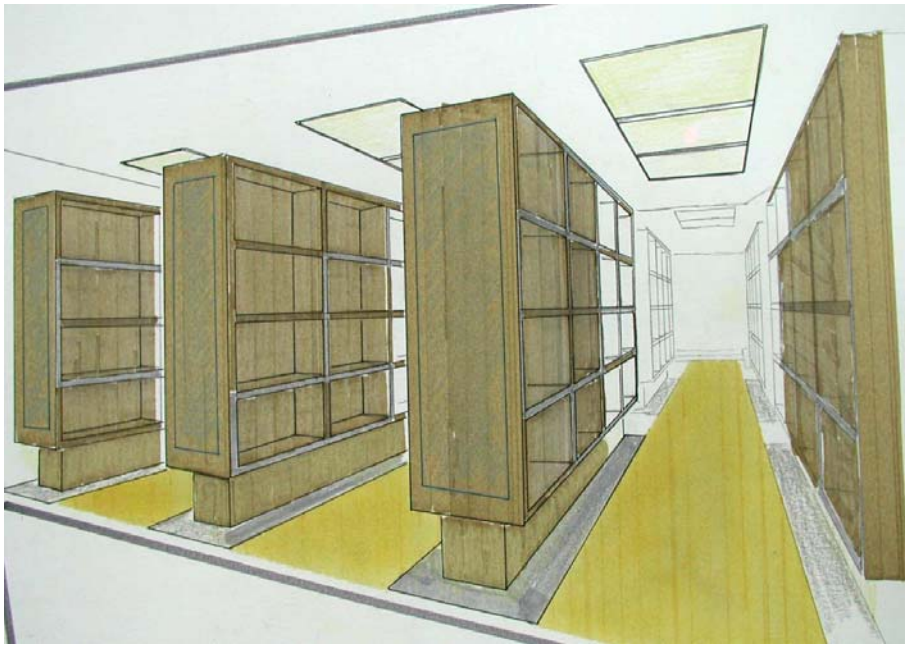
Sample exercise – approach(es) to lighting book stacks



Sample final project lighting approach – circulation desk



Sample final project lighting approach – book stacks



Sample final project lighting approach – book stacks

Sample final project lighting approach – circulation desk

APPENDIX D

SPSS Outputs for the Statistical Analyses

1. Analysis of lighting exercises and final design projects

a. Comparison of the two sections for the final lighting scores with respect to the application of lighting exercises:

Group Statistics

	Sections	N	Mean	Std. Deviation	Std. Error Mean
totalfinallighting	w.lighting	44	13.3864	14.25224	2.14861
	nolighting	44	4.7500	5.06298	.76327

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
totalfinallighting	Equal variances assumed	21.869	.000	3.788	86	.000	8.63636	2.28015	4.10357	13.16916
	Equal variances not assumed			**3.788**	**53.683**	**.000**	**8.63636**	2.28015	4.06432	13.20841

Group Statistics

	Sections	N	Mean	Std. Deviation	Std. Error Mean
Final stack score	w.lighting	44	6.3409	6.80610	1.02606
	nolighting	44	3.1818	3.62339	.54625
Final carrel score	w.lighting	44	2.8409	4.65530	.70181
	nolighting	44	.7500	2.05873	.31037
Final circulation score	w.lighting	44	4.2045	6.72925	1.01447
	nolighting	44	.8182	2.27497	.34296

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Final stack score	Equal variances assumed	23.733	.000	2.718	86	.008	3.15909	1.16240	.84831	5.46987
	Equal variances not assumed			2.718	65.562	.008	3.15909	1.16240	.83799	5.48019
Final carrel score	Equal variances assumed	18.859	.000	2.725	86	.008	2.09091	.76738	.56541	3.61640
	Equal variances not assumed			2.725	59.200	.008	2.09091	.76738	.55550	3.62632
Final circulation score	Equal variances assumed	18.063	.000	3.162	86	.002	3.38636	1.07088	1.25753	5.51520
	Equal variances not assumed			3.162	52.702	.003	3.38636	1.07088	1.23817	5.53455

b. Relationship between lighting exercises and the success in the final jury in terms of lighting requirements of the project:

Correlations

		totalfinallighting	Sum of exercise scores
totalfinallighting	Pearson Correlation	1	.638**
	Sig. (2-tailed)		.000
	N	44	44
Sum of exercise scores	Pearson Correlation	.638**	1
	Sig. (2-tailed)	.000	
	N	44	44

**. Correlation is significant at the 0.01 level (2-tailed).

Descriptive Statistics

	Mean	Std. Deviation	N
totalfinallighting	13.3864	14.25224	44
Sum of exercise scores	25.8636	16.29608	44

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.638[a]	.406	.392	11.10987

a. Predictors: (Constant), Sum of exercise scores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.035	3.168		-.327	.745
	Sum of exercise scores	.558	.104	.638	5.363	.000

a. Dependent Variable: totalfinallighting

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3550.407	1	3550.407	28.765	.000[a]
	Residual	5184.025	42	123.429		
	Total	8734.432	43			

a. Predictors: (Constant), Sum of exercise scores

b. Dependent Variable: totalfinallighting

c. Relationships between final lighting scores and final jury grades:

- For the section w. lighting exercises:

Correlations

		totalfinallighting	Final jury grade
totalfinallighting	Pearson Correlation	1	.483**
	Sig. (2-tailed)		.001
	N	44	44
Final jury grade	Pearson Correlation	.483**	1
	Sig. (2-tailed)	.001	
	N	44	44

**. Correlation is significant at the 0.01 level (2-tailed).

- For the section w.o. lighting exercises:

Correlations

		totalfinallighting	Final jury grade
totalfinallighting	Pearson Correlation	1	.289
	Sig. (2-tailed)		.060
	N	44	43
Final jury grade	Pearson Correlation	.289	1
	Sig. (2-tailed)	.060	
	N	43	43

- For all students in both sections:

Correlations

		totalfinallighting	Final jury grade
totalfinallighting	Pearson Correlation	1	.385**
	Sig. (2-tailed)		.000
	N	88	87
Final jury grade	Pearson Correlation	.385**	1
	Sig. (2-tailed)	.000	
	N	87	87

**. Correlation is significant at the 0.01 level (2-tailed).

d. Relationships between lighting design performance and the previously taken lighting course grade:

- For the sum of lighting exercise scores:

Correlations

		sumoflights	Lighting course grade
sumoflights	Pearson Correlation	1	.191
	Sig. (2-tailed)		.220
	N	44	43
Lighting course grade	Pearson Correlation	.191	1
	Sig. (2-tailed)	.220	
	N	43	85

- For final lighting scores in the section w. lighting exercises:

Correlations

		totalfinallighting	Lighting course grade
totalfinallighting	Pearson Correlation	1	.110
	Sig. (2-tailed)		.483
	N	44	43
Lighting course grade	Pearson Correlation	.110	1
	Sig. (2-tailed)	.483	
	N	43	43

- For final lighting scores in the section w.o. lighting exercises:

Correlations

		totalfinallighting	Lighting course grade
totalfinallighting	Pearson Correlation	1	.285
	Sig. (2-tailed)		.067
	N	44	42
Lighting course grade	Pearson Correlation	.285	1
	Sig. (2-tailed)	.067	
	N	42	42

e. Relationship between the final lighting score and the completion of the lighting sketch problem during the semester:

- Difference between the two sections in terms of submission of the sketch problems:

Group Statistics

	Sections	N	Mean	Std. Deviation	Std. Error Mean
Sketch problem scores	w.lighting	44	.23	.424	.064
	nolighting	44	.52	.505	.076

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Sketch problem scores	Equal variances assumed	17.784	.000	-2.972	86	.004	-.295	.099	-.493	-.098
	Equal variances not assumed			-2.972	83.480	.004	-.295	.099	-.493	-.098

- Relationship between the final lighting scores and the completion of the sketch problem:

Group Statistics

	Sketch problem scores	N	Mean	Std. Deviation	Std. Error Mean
totalfinallighting	not submitted	55	9.3455	12.32765	1.66226
	submitted	33	8.6061	10.09313	1.75699

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
totalfinallighting	Equal variances assumed	1.451	.232	**.291**	**86**	**.772**	.73939	2.54253	-4.31498	5.79377
	Equal variances not assumed			.306	77.926	.761	.73939	2.41870	-4.07594	5.55473

Correlations

		Sketch problem scores	totalfinallighting
Sketch problem scores	Pearson Correlation	1	-.031
	Sig. (2-tailed)		.772
	N	88	88
totalfinallighting	Pearson Correlation	-.031	1
	Sig. (2-tailed)	.772	
	N	88	88

f. Multiple regression models predicting final lighting design score:

Descriptive Statistics

	Mean	Std. Deviation	N
totalfinallighting	13.6512	14.31097	43
Final jury grade	2.0651	.67113	43
Lighting course grade	2.0000	.96831	43
Sum of exercise scores	25.5814	16.37977	43

Correlations

		totalfinallighting	Final jury grade	Lighting course grade	Sum of exercise scores
Pearson Correlation	totalfinallighting	1.000	.485	.110	.661
	Final jury grade	.485	1.000	.041	.417
	Lighting course grade	.110	.041	1.000	.230
	Sum of exercise scores	.661	.417	.230	1.000
Sig. (1-tailed)	totalfinallighting	.	.000	.241	.000
	Final jury grade	.000	.	.397	.003
	Lighting course grade	.241	.397	.	.069
	Sum of exercise scores	.000	.003	.069	.
N	totalfinallighting	43	43	43	43
	Final jury grade	43	43	43	43
	Lighting course grade	43	43	43	43
	Sum of exercise scores	43	43	43	43

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.701[a]	.491	.452	10.59670

a. Predictors: (Constant), Sum of exercise scores, Lighting course grade, Final jury grade

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4222.458	3	1407.486	12.534	.000[a]
	Residual	4379.309	39	112.290		
	Total	8601.767	42			

a. Predictors: (Constant), Sum of exercise scores, Lighting course grade, Final jury grade

b. Dependent Variable: totalfinallighting

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-9.121	6.169		-1.478	.147			
	Final jury grade	5.358	2.685	.251	1.995	.053	.485	.304	.228
	Lighting course grade	-.440	1.738	-.030	-.253	.801	.110	-.041	-.029
	Sum of exercise scores	.492	.113	.563	4.356	.000	.661	.572	.498

a. Dependent Variable: totalfinallighting

- Regression model without lighting course grade:

Descriptive Statistics

	Mean	Std. Deviation	N
totalfinallighting	13.3864	14.25224	44
Final jury grade	2.0636	.66336	44
Sum of exercise scores	25.8636	16.29608	44

Correlations

		totalfinallighting	Final jury grade	Sum of exercise scores
Pearson Correlation	totalfinallighting	1.000	.483	.638
	Final jury grade	.483	1.000	.412
	Sum of exercise scores	.638	.412	1.000
Sig. (1-tailed)	totalfinallighting	.	.000	.000
	Final jury grade	.000	.	.003
	Sum of exercise scores	.000	.003	.
N	totalfinallighting	44	44	44
	Final jury grade	44	44	44
	Sum of exercise scores	44	44	44

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.682[a]	.465	.439	10.67785

a. Predictors: (Constant), Sum of exercise scores, Final jury grade

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4059.754	2	2029.877	17.803	.000[a]
	Residual	4674.678	41	114.017		
	Total	8734.432	43			

a. Predictors: (Constant), Sum of exercise scores, Final jury grade

b. Dependent Variable: totalfinallighting

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-10.315	5.343		-1.931	.060			
	Final jury grade	5.695	2.694	.265	2.114	.041	.483	.313	.241
	Sum of exercise scores	.462	.110	.528	4.212	.000	.638	.550	.481

a. Dependent Variable: totalfinallighting

g. Students' improvement through the lighting exercises:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total score for Ex1	9.5500	40	7.40045	1.17011
	Total score for Ex2	9.5750	40	6.60570	1.04445
Pair 2	Total score for Ex2	9.8710	31	6.90769	1.24066
	Total score for Ex3	10.4516	31	7.12666	1.27999
Pair 3	Total score for Ex1	10.1212	33	7.94024	1.38222
	Total score for Ex3	10.4242	33	6.91931	1.20450

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Total score for Ex1 & Total score for Ex2	40	.392	.012
Pair 2	Total score for Ex2 & Total score for Ex3	31	.422	.018
Pair 3	Total score for Ex1 & Total score for Ex3	33	.236	.186

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Total score for Ex1 - Total score for Ex2	-.02500	7.75089	1.22552	-2.50385	2.45385	-.020	39	.984
Pair 2	Total score for Ex2 - Total score for Ex3	-.58065	7,54442	1.35502	-3.34796	2.18667	-.429	30	.671
Pair 3	Total score for Ex1 - Total score for Ex3	-.30303	9.21780	1.60461	-3.57152	2.96546	-.189	32	.851

h. Relationships between the lighting exercises and the individual lighting design performances in the final jury concerning the topics of the exercises:

Correlations

		stack	carrel	circ	finalstack	finalcarrel	finalcirc
stack	Pearson Correlation	1	.285	.340*	**.457****	.191	.128
	Sig. (2-tailed)		.096	.042	**.003**	.233	.427
	N	41	35	36	41	41	41
carrel	Pearson Correlation	.285	1	.424*	.490**	**.587****	.344*
	Sig. (2-tailed)	.096		.014	.002	**.000**	.035
	N	35	38	33	38	38	38
circ	Pearson Correlation	.340*	.424*	1	.303	.351*	**.338***
	Sig. (2-tailed)	.042	.014		.064	.031	**.038**
	N	36	33	38	38	38	38
finalstack	Pearson Correlation	.457**	.490**	.303	1	.389**	.441**
	Sig. (2-tailed)	.003	.002	.064		.009	.003
	N	41	38	38	44	44	44
finalcarrel	Pearson Correlation	.191	.587**	.351*	.389**	1	.395**
	Sig. (2-tailed)	.233	.000	.031	.009		.008
	N	41	38	38	44	44	44
finalcirc	Pearson Correlation	.128	.344*	.338*	.441**	.395**	1
	Sig. (2-tailed)	.427	.035	.038	.003	.008	
	N	41	38	38	44	44	44

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	stack	9.1951	41	6.62654	1.03489
	finalstack	6.8049	41	6.82356	1.06566
Pair 2	carrel	9.4474	38	7.12323	1.15554
	finalcarrel	3.2105	38	4.90536	.79576
Pair 3	circ	10.5789	38	7.08875	1.14995
	finalcirc	4.6316	38	7.08413	1.14920

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	stack & finalstack	41	.457	.003
Pair 2	carrel & finalcarrel	38	.587	.000
Pair 3	circ & finalcirc	38	.338	.038

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	stack - finalstack	2.39024	7.01027	1.09482	.17753	4.60296	2.183	40	.035
Pair 2	carrel - finalcarrel	6.23684	5.81440	.94322	4.32570	8.14799	6.612	37	.000
Pair 3	circ - finalcirc	5.94737	8.15706	1.32325	3.26621	8.62853	4.495	37	.000

i. Relationship between students' preferences for drawing reflected ceiling plans and their final lighting design performances:

Group Statistics

	Reflected Ceiling	N	Mean	Std. Deviation	Std. Error Mean
totalfinallighting	No Reflected	66	8.3182	11.61850	1.43014
	Reflected	22	11.3182	11.02977	2.35156

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
totalfinallighting	Equal variances assumed	.026	.873	-1.062	86	.291	-3.00000	2.82557	-8.61705	2.61705
	Equal variances not assumed			-1.090	37.739	.283	-3.00000	2.75229	-8.57299	2.57299

j. Sub-score (general lighting provision versus specific concerns) differences within the exercises:

- For the circulation exercise:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	circtask	.8421	38	.59395	.09635
	circsource	.1842	38	.45650	.07405
Pair 2	circtask	.8421	38	.59395	.09635
	circlum	.3158	38	.47107	.07642
Pair 3	circsource	.1842	38	.45650	.07405
	scaledcircgen	.9079	38	.54345	.08816
Pair 4	circlum	.3158	38	.47107	.07642
	scaledcircgen	.9079	38	.54345	.08816
Pair 5	circtask	.8421	38	.59395	.09635
	scaledcircgen	.9079	38	.54345	.08816

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	circtask & circsource	38	.010	.950
Pair 2	circtask & circlum	38	.376	.020
Pair 3	circsource & scaledcircgen	38	.125	.456
Pair 4	circlum & scaledcircgen	38	.328	.045
Pair 5	circtask & scaledcircgen	38	.372	.021

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	C.task - C. source	.65789	.74530	.12090	.41292	.90287	5.441	37	.000
Pair 2	circtask - circlum	.52632	.60345	.09789	.32797	.72467	5.376	37	.000
Pair 3	circsource - scaledcircgen	-.72368	.66472	.10783	-.94217	-.50520	-6.711	37	.000
Pair 4	circlum - scaledcircgen	-.59211	.59110	.09589	-.78639	-.39782	-6.175	37	.000
Pair 5	circtask - scaledcircgen	-.06579	.63853	.10358	-.27567	.14409	-.635	37	.529

- For the stack exercise:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	stacktask	.3659	41	.48765	.07616
	stacksource	.3171	41	.47112	.07358
Pair 2	stacktask	.3659	41	.48765	.07616
	stacklum	.4146	41	.54661	.08537
Pair 3	stacksource	.3171	41	.47112	.07358
	scaledstackgen	1.1098	41	.48104	.07513
Pair 4	stacklum	.4146	41	.54661	.08537
	scaledstackgen	1.1098	41	.48104	.07513
Pair 5	stacktask	.3659	41	.48765	.07616
	scaledstackgen	1.1098	41	.48104	.07513

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	stacktask & stacksource	41	.462	.002
Pair 2	stacktask & stacklum	41	.542	.000
Pair 3	stacksource & scaledstackgen	41	.229	.150
Pair 4	stacklum & scaledstackgen	41	.393	.011
Pair 5	stacktask & scaledstackgen	41	.411	.008

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	stacktask - stacksource	.04878	.49755	.07771	-.10827	.20583	.628	40	.534
Pair 2	stacktask - stacklum	-.04878	.49755	.07771	-.20583	.10827	-.628	40	.534
Pair 3	stacksource - scaledstackgen	-.79268	.59135	.09235	-.97934	-.60603	-8.583	40	.000
Pair 4	stacklum - scaledstackgen	-.69512	.56875	.08882	-.87464	-.51560	-7.826	40	.000
Pair 5	stacktask - scaledstackgen	-.74390	.52586	.08212	-.90988	-.57792	-9.058	40	.000

- For the carrel exercise:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	carreltask	1.1316	38	.52869	.08577
	carrelsource	.2632	38	.50319	.08163
Pair 2	carreltask	1.1316	38	.52869	.08577
	carrellum	.4211	38	.59872	.09712
Pair 3	carrelsource	.2632	38	.50319	.08163
	scaledcarrelgen	.6184	38	.61988	.10056
Pair 4	carrellum	.4211	38	.59872	.09712
	scaledcarrelgen	.6184	38	.61988	.10056
Pair 5	carreltask	1.1316	38	.52869	.08577
	scaledcarrelgen	.6184	38	.61988	.10056

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	carreltask & carrelsource	38	.273	.098
Pair 2	carreltask & carrellum	38	.503	.001
Pair 3	carrelsource & scaledcarrelgen	38	.461	.004
Pair 4	carrellum & scaledcarrelgen	38	.263	.111
Pair 5	carreltask & scaledcarrelgen	38	.034	.841

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	carreltask - carrelsource	.86842	.62259	.10100	.66378	1.07306	8.598	37	.000
Pair 2	carreltask - carrellum	.71053	.56511	.09167	.52478	.89627	7.751	37	.000
Pair 3	carrelsource - scaledcarrelgen	-.35526	.59170	.09599	-.54975	-.16078	-3.701	37	.001
Pair 4	carrellum - scaledcarrelgen	-.19737	.74016	.12007	-.44065	.04591	-1.644	37	.109
Pair 5	carreltask - scaledcarrelgen	.51316	.80107	.12995	.24985	.77646	3.949	37	.000

2. Analysis of jury recordings

a. Number of lighting questions in relation to the availability of the lighting course instructor as a jury member:

Group Statistics

	instruc	N	Mean	Std. Deviation	Std. Error Mean
questions	no lighting instructor	59	,68	1,121	,146
	w. lighting instructor	29	3,86	2,445	,454

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
questions	Equal variances assumed	22,137	,000	-8,399	86	,000	-3,184	,379	-3,938	-2,430
	Equal variances not assumed			-6,675	33,908	,000	-3,184	,477	-4,154	-2,215

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
question	88	0	9	1,73	2,242
Valid N (listwise)	88				

b. Number of lighting questions asked in the two sections – with and without lighting exercises:

Group Statistics

	sections	N	Mean	Std. Deviation	Std. Error Mean
question	no lighting	44	1,52	2,074	,313
	w lighting	44	1,93	2,405	,363

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
question	Equal variances assumed	1,254	,266	-,854	86	,395	-,409	,479	-1,361	,543
	Equal variances not assumed			-,854	84,178	,395	-,409	,479	-1,361	,543

APPENDIX E

Excerpts from final jury discussions

First Jury Day

Section with the implemented constructivist lighting pedagogy

Jury Members:
Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Industrial designer
Studio Instructor 3: Interior architect
Juror 1: Architect (prior experience in studio teaching and also in practice)
Juror 2: Architect (prior experience in studio teaching, expertise in CAD)
Juror 3: Interior architect (area of concentration: human factors, studio teaching experience-none)

Project 1

Reflected ceiling plan: none
Skylight: presented incorrectly

…
J1: Lighting is very important in a library, can you tell something about it?
St: I have light over the stacks.
J1: Is it something true? There will be lighting at 220 cm, washing the books. Could it be higher?
Student: The light will be less if it is located higher.
…
J3: Are you just lighting the books? What about general lighting? The tables?
St: There were going to be spots on the tables but I didn't want to do it as the reflected light will interfere with the other lighting.
Inst1: How do you provide general lighting?
St: … (no answer)
St: … I have lighting for carrels.
J1: (to the studio instructors) So, you did not ask them to submit reflected ceiling plans?
Inst1: Yes, you know they are always overlooked, and it is difficult to lay and then fold them. Therefore we wanted them to suggest lighting systems.
J1: Yes, they rather shown it from the perspectives.
(to the student) But, you have not considered.
St: …(no answer)
…
J2: You have to think more about the third dimension. You have to work on lighting details, window-desk relationships. Your desk and stack drawings tell nothing.
…
Inst1: Is there an adaptation in your project regarding the skylights?
St: No, I did nothing.
…
J3: You cannot light the space just by the lighting the books.
St: … (no comment)

Project 2
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: Let me talk about the materials. (Talks about finishing materials then the material of stacks) Around the glass, at the stacks there is a light stripe.
J1: There **can be such lighting** and it is possible to **light** the aisles from the edge of stacks. (proposes a solution)
St: Over the stacks there is 'barrisol' and there are fluorescents behind it.
J1: He could **make the lighting** with glazing instead of using barrisol which is a kind of commercial fancy. Because it is a library…
…
J3: Your material board is incomplete. We cannot see all the materials in relation with each other, colors, lighting etc.

Project 3
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J2: (talks about the perspectives) such lighting (meant luminaire) does not match the atmosphere of your design. It is hanged down the ceiling. Do you think it is something right to exhibit it as such an element?
St: … (no answer)
…
Inst1: Regarding the stacks… These are like being raised from the floor, right? I feel it is something good, having light both under and above it.
J1: (makes a judgment on the utterance) Ok, but there has to be detailed cleaning activity in that space. What is the floor material under that? I cannot visualize it with lighting.
St: … (no answer)
Inst1: I believe it would be better if the floor material is something dark.
J1: It may be, I am not sure, it has to be experimented. With color we have to consider dust and dirt as well. So you have nothing at the ceiling?
St: I have made the existing skylight one unit smaller (talking about the central one) but its projection cannot be seen on the plan.
J1: Besides shrinking it, what did you do to utilize its potential?
Inst1: Where is the skylight on the plan?
St: (does not answer the preceding question) It looks like its somewhere around, well its here.
J1: It would be better if you have shown it on the plan.

Project 4
Reflected ceiling plan: none

Skylight: presented incorrectly

Student was absent on the jury day and was evaluated later by a jury consisting of the studio instructors.

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 5
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J2: Where do you use that lighting? (meant luminaire)
St: In the art section of the library.
J2: Besides that? Over the shelves?
St: … (no answer)
J2: We do not know what kind of light your **lighting** would give. It is not flexible for future use.

Project 6
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J2: Let us see your reflected lighting plan.
Inst1: We did not specify these overlay sheets. We asked them to explain their lighting in any way, whichever method they choose.
J3: Actually I do not find that method right either. I think it is better to include it (means lighting) in the axonometric drawings, sections and perspectives.
Inst1: For that reason we did not want them to draw reflected ceilings. It is not good to overlay them. We just wanted them a kind of lighting system as a requirement. During the semester the lighting instructor came and had a discussion with the students.
St: I realized that I hanged the overlays incorrectly. This one belongs to the other floor plan. Anyway let me just tell you. **This is lit with barrisol**, the books are lighted in this way. There are fluorescents as seen in the section. In here (talking about the atrium) there is skylight, I use spots for circulation desk. There is grid like lighting system at the carrels in order to have a diffuse lighting (folds the overlays while talking, explains by words).
J2: Don't you think that **fluorescent is a light which is uncomfortable with its sound and flicker**? I know it may have be with some kind of yellow light but normally isn't it something flickering and noisy? I do not think it is appropriate to use it in here.
St: … (no comment)
J3: And also when one is looking towards downwards from the first floor how those fluorescents will be perceived on the stacks? (In the project the student has proposed an opening on the slab for visual connection)
St: It is not seen on the perspectives but …

Inst1: It is seen on the section, one can see them.
J3: That is what I meant, What kind of an atmosphere would it end up?
St: Actually I tried it on computer before I get the printouts and I decided to make it like that.

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

J3: The drawings are very good in this semester.
…
J1: All dimensions, dimensioning, doors and distances are correct, I think you are going to be an interior architect.
…
(while explaining the project, the student only mentions lighting installed on the stacks for lighting book spine)

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 9
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 10
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly

…

Inst1: Where are the structure's windows?
St: (indicates on plan)
J1: Where are they on the backside façade?
St: I did not make any openings there.
J1: Without having windows how could you manage to locate the stacks?
St: I could make the openings, but I did not.
J1: You can define and design stacks accordingly if only you make them.
St: I could not open them while modeling the structure (means while modeling in 3D using computer software).
…
J1: What are those stacks for?
St: Stacks for periodicals, there is plexiglass and I have light behind them (did not draw, just explains by words).
J1: You have used that space incorrectly.
…
J3: You have leaned those stacks against the windows. You are drawing the project on computer. While drawing you zoom and pan on plan but you cannot see these, so you have to take printouts while drawing as well. You cannot perceive them on screen.
…

Project 12
Reflected ceiling plan: none
Skylight: presented incorrectly

…
(Discussions about the design of the walls surrounding the atrium)
J3: What are you going to hang on that wall? You are saying that there will be exhibitions but what is going to be hanged? If it is a painting how can one hang it on a curvilinear wall? How will it be perceived? What kind of lighting it would have? There are many things to be considered.
St: … (no answer)
…

Project 13
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 14
Reflected ceiling plan: none
Skylight: Proposed layers for daylight control

…
St: (while explaining the design of circulation desk and its wall) There is **wall washing from the bottom of the wall.**

J1: Like a **floodlight**?
St: Yes, just like it
…
Inst1: The project has some kind of a potential but it is underdeveloped. There are meaningless empty spaces. I know you have something under skylight but…
J3: Yes, it is the first time that skylight is considered.
…

Second Jury Day

Section with the implemented constructivist lighting pedagogy
Jury Members: Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Industrial designer
Studio Instructor 3: Interior architect
Juror 1: Architect (prior experience in studio teaching and expertise in architectural discourse)
Juror 2: Architect (practitioner)
Juror 3: Architect (first year studio instructor, area of concentration: color theory and applications)
Juror 4: Architect (prior experience in studio teaching, lighting course instructor) (was present only in the first student's jury)

Project 1
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: (explaining her design of stacks)
Inst1: So they are your stacks ok. Are your windows located over stacks?
St: Yes, stack height is 2.00 meters and the windows are just above that height.
J3: Are they (means the height and shape of windows) existing or is that your design?
St: They are at 90cm but I changed them. We have given chance to change their design.
J3: Then you shouldn't draw them on plan right? (as they are located above the section line)
Inst1: (explains the issue) The moldings on the facades are their limits while designing the windows. They were able to design the openings and change their dimensions within those moldings on the facades.
…
J2: Let me look at your design from the point of education. There should be a connection in between the department you are studying in, and the work you have presented. This is a general problem, so do not take it personal. As an outsider I frequently come to the juries and encounter this issue. There exits a nice concept with at most two 1/5 details but having functional and aesthetic attraction in a project is something very different then those. It is possible to end up a messy structure starting with an excellent idea. But you can also design a fine space having well detailing although your had a mediocre starting concept. As an

example I cannot see any people in your sections. (Walks to the drawings and sketches a standing posture) These are just lines as long as you bring forth your own scale.
St: … (No comment from the student)
…
J4: Besides director's office[1], have you considered anything for lighting this building?
St: I thought but I do not have reflected ceiling plans.
J4: I do not ask whether you have drawn them, I am asking whether you have thought about it. For instance you have carrels over there, also reading areas, desks… How do you illuminate those spaces?
St: For circulation desk the light is coming from above.
J4: Anything else?
St: There is lighting in carrels, at the book stacks under the shelves.
J4: Ok, where are they, did you show them in your presentation?
St: No I did not draw. Here there is lighting (indicates desks)
J4: Can we see them on the sections?
St: No you can not, I did not draw.
…

Project 2
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J3: Are those dashes indicating skylight? There is something unexceptional in that geometry.
St: … (no answer)
Inst2: He has adapted it to the existing one.
…
J3: Well, your color choice… Which is your palette? Is it the one on your perspectives or on your plans or on the material board? Each one is different.
St: When I adjust lighting on perspectives using 'Autocad'… well I wanted to show the lighting in the space you know, the surface colors change a lot.
J3: We see very strong contrasts on your perspectives, between your colors and also in lights and shadows. Is that because you cannot have the perspectives in another way? Shouldn't it be a more homogenous kind of illumination?
St: It is not possible. For instance, when I take the perspectives from another view it gets (colors and light) more different. Although I decrease the light…
Inst2: Something like general lighting?
St: I already assigned general lighting.
Inst2: But it is seen as if there is no general lighting and the scheme is lit according to the local lighting.
J3: Yes, as if there is no general lighting. This is so dramatic, attractive but is it appropriate for a library?
St: When I increase lighting in Autocad (means intensity), everywhere becomes bright, when I decrease it to indicate the effect it becomes too dark.

[1] Its drawings including a plan, a section and perspective was asked as a sketch problem at the last week of the semester before the juries)

J2: Main question is: Is it a correct choice to use brick red in a library space? It can change extremely with light. It becomes something different when light comes from south direction. What else could be used?
(The discussion extends by debates on colors)
…
J2: Do you have lighting inside that blue wall?
St: (lays the reflected ceiling plans) No, I do not have but I have positioned the lights just beside it.
J2: Isn't it transparent, I mean translucent?
St: Yes a little bit.
J3: Then, general lighting will penetrate to the conference room as something bluish, I mean blue light.
St: Well… yes. What else could it be?
J3: Well you should have thought it.
J2: It can be an un-distracting shadow.
…
J3: Regarding your color choice… Their saturations are very different. That blue is brighter and will reflect towards other colors.
St: I wanted it to be more attractive.
J3: I believe it would be better if you have used yellow or green instead.
…

Project 3
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 4
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
Inst1: Can you explain your stacking system?
St: There are two types. One of them is lit from here. (continues by explaining their structure and material)
…
J3: Can you show the north of this building?
St: Towards this direction (shows on the plan).
J3: Guess why I have asked you the north direction. In the first year you have worked on this (means daylight and orientation). In your case it becomes more important. There is light coming from east and west sides. Here you have glazing and also here (indicates the facades on the model). What is going on in those spaces? To some extent there is green house effect in these spaces. Light and shadow occasions… well… Your friend had classic type of windows. They may have some precautions we haven't asked them but you have a huge opening and pure glass surfaces. You have to have some preventive measures.
St: … (no comment)

Project 5
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 6
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 9
Reflected ceiling plan: none
Skylight: presented incorrectly

(it is difficult to read the plans and there are particular drawing mistakes)
Inst1: Is there something over the stacks for lighting them?
St: Yes, I drew them on section. They are located on the beams in the skylight cavity and designed as linear elements.
…
J3: What you call a glass garden, well does it have any relation with daylight and air?
Inst1: Also with skylight?
St: Yes, I have made an opening at the bottom for air flow. (Does not answer on comment on to the daylight problem)
…

Project 10
Reflected ceiling plan: drawn
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.
Juror 3 left and did not participate in the rest of the sessions.
…
Inst1: Is there something special you want to tell as regarding your stacks?
St: I designed them thinking about light. I hanged steel suspenders on three columns and installed metal and plexiglass on them.
J2: Interesting idea… But as a result of its weight, it may swing.
St: (no comment)
…

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly
Juror 2 left and did not participate in the rest of the sessions.

St: (while explaining the stacking design) …there is lighting beneath them. And I have lighting just behind the atrium wall which is made of sand blasted glass.

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 12
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 13
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 14
Reflected ceiling plan: none
Skylight: presented incorrectly

…
Inst1: How do you utilize the skylights?
St: (shows on plan but did nothing on the existing openings)
…

Project 15
Reflected ceiling plan: none
Skylight: presented incorrectly

Inst1: On the first floor where you have located the carrels, there were windows. Where are they now? (asks because it was not allowed to threat the existing windows on the entrance façade)
St: I closed them down.
Inst1: But you can not do that. And how?
St: I can take out the window frame and cover the openings.
Inst1: But we did not allow you to do such things.

Third Jury Day

Section with the implemented constructivist lighting pedagogy
Jury Members: Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Industrial designer
Studio Instructor 3: Interior architect
Juror 1: Interior Architect (Third year studio instructor, experience in practice)
Juror 2: Interior architect (area of concentration: human factors, studio teaching experience-none)
Juror 3: Architect (prior experience in studio teaching, lighting course instructor)

Project 1
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J3: Let us see your reflected ceiling plans. Ok, tell us what you have thought.
St: (explains from the plan) I have lighting at the bistro, hanging down from the ceiling.
J1: Can we see it from your sections?
St: I thought it would be about 25-30 cm from the ceiling like a barrisol system.
J1: What else you have for the tables?
St: I've placed the sources according to the projection of tables on the ceiling. At the conference room I designed diffuse lighting and placed it on the ceiling aligned with the seating units.
J3: But, you did not draw it, ok what else?
St: (shows the offices from the plan) There is concealed lighting.
J3: Can we see it somewhere on your drawings, sections for instance?
St: No, I do not have a section from there.
J3: What are these circles for? Are they down lights?
St: (continues without answering) Skylights were open but I've closed some portion of the central one because I wanted to light the atrium.
J3: Do you have anything else besides these circles?
St: Here I have suspended ceiling and…
J3: (interrupts) But you haven't drawn.
St: … (does not answer)
…

J3: Let us talk about lighting. I was in the other section on the first day and I really can say that I haven't seen any project that ever considered lighting. You have thought a lot thinks, right or wrong, but I know you have something in your mind. (Indicating her drawings – study units etc.) But you have to fell the lighting details. (Makes some sketches explaining the correct approach) You have to think how you are going to install them as well. (Examines the basement plan) Can you explain this space?
St: It is foyer and there are some tables here.
J3: Suppose I came here with a large group of friends (point outs the foyer tables). Would you allow me to join these tables so that the entire group can sit together?
St: Yes.
J3: Then your lamp will be left here, lighting the empty space, right? If you have designed a fixed type of seating then it would be possible to suggest this kind of lighting. However, if you need flexibility in the space then it would be better to have a general lighting.
St: … (no comment)
…
J1: (talking about the basement) How do you light that space? There is no daylight I guess.
St: There is suspended ceiling…
J3: Can we see it on the drawings?
St: No I did not draw.
J3: Is it the only way to install the lamps on the ceiling? What about cove lighting or wall washing?
St: I liked that type so I did the lighting like that.
J3: What about other lighting techniques don't you like them?
St: (no comment)
…
J3: There are skylights in the building. You have mentioned very little about what you thought. Do you propose a relation between the opening and the function underneath?
St: I have some light in the atrium.
J3: Then you have to show that. Skylight is something extremely effective. Have you been to "Turk Tarih Kurumu" Library? You have to see that building and its skylight since you are designing a library. The important thing is, you have to establish a relation between the skylight and the function that takes place below. We cannot determine such a relationship in your project. Which skylight do you utilize and how it is being utilized is a big question.

Project 2
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: Have you think anything regarding the skylights?
St: The spaces under the skylights are stacks and the exhibition. They are illuminated by the skylights.
J3: What about the stacks over there? (Indicates the ones far from the projection of skylights) Is there another approach for lighting those ones?

St: Well, I mean there is actually nothing. But I have lighting system for lighting the shelves of stacks.
J3: Ok. Can you explain what does that lighting at the very bottom of the stack serve for?
St: It lights the floor not the books. Somehow it disconnects the stack from the floor.
J3: Have you been to the Vakko Store in Armada Mall? A similar lighting design approach can be seen at the shelves in that store. They are just like yours (explains from the drawings). When I look at the upper shelves I see the light sources beneath the sills. You are tall so it may not disturb you. But you have to consider human dimension while designing such things.
…
J2: You have an exhibition space over there, right? What you exhibit there? Ancient maps, writings?
J3: And how do you illuminate them?
St: There is light coming from skylights.
J3: Nothing else?
St: I think at nights there won't be intense study in the library.
J3: Nowadays sun sets around 5pm, right? (It was December 30th, 40degrees northern latitude)
St: … (no comment)
J3: Have you thought anything else regarding lighting?
St: No
C.Y: Why?
St: I did not have time.
…

Project 3
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: How do you illuminate this space?
St: I have thought of it although I do not have reflected ceiling drawings.
J3: Do you have anything else about lighting on your drawings?
St: (explains her ideas by indicating the spaces on plans) There is lighting between these stacks and here over the circulation desk… I mean lighting is always from the topside.
J3: Can we see them on your drawings?
St: Well (looks at the drawing sheets), you cannot see.
J3: Anything else?
St: There is lighting installed on the stacks that I have designed. It is designed for lighting the books rather than the space.
J3: Where do you install the lamp on the stack, how do you mount the luminaire?
St: I am thinking to install it through the plexiglass element. (Not shown on drawings, just explains by words)
J3: Anyway, there are lots of things here that you have to consider. There is an exhibition space, an art section, reading rooms and spaces, carrels and a café. These all have distinct characteristics and have different lighting requirements.

However, regarding lighting design, you propose nothing for those spaces. How do you utilize the skylights?
St: They light here and here (shows on plan).
J3: Unless you draw, we cannot see and understand. The only thing you have drawn about lighting is a lamp on the ceiling of head office Right? And I really can not understand why you have designed it like that. I don't want to talk about the quality of your perspective drawings and the way you describe the space, but I cannot find any relationship between the lamp and the space defining elements – the backside wall- and also between the lamp and workspace -tables and armchairs.
St: (no comment)…
J3: You have given this structure and you design it as a library and tell us that it is an art library. How can we understand that this is such a library while we are walking on the street? Again you can utilize lighting as a definer. The thing I want you to bear in mind is the importance of the subject of lighting in design. Both in interiors and outdoors. You cannot just say I had no time to think about it. It is not something to be left to the latter stages in design process.
…

Project 4
Reflected ceiling plan: drawn
Skylight: presented incorrectly

St: (while explaining the project indicates a diffuser design as his main lighting design idea) It is manufactured by an Italian Firm. There are recessed spots behind it and it acts as a diffuser.
Inst1: Do you have an example or a sample?
St: (Shows its picture from the material board)
…
St: I have lighting between those elements on the wall.
J3: (gives him a pencil) Can you draw it for me?
St: (draws and explains)…
…
St: There are fluorescents in working spaces.
J3: Can you again draw and illustrate how you design and mount them?
St: (draws and explains)
J3: Ok you have thought several things but you have not them. Look at here. (indicates the space by a pointer) You have also used that diffuser thing in here. But these spaces are very different than each other. One of them is somehow a constant one, but you need flexibility in the other space and its function (continues explanation by drawing).
…

Project 5
Reflected ceiling plan: none
Skylight: presented incorrectly

…

J3: What did you think about lighting this space, besides signage lighting at the stacks?
St: I have made an illuminated beam for giving direction.
J3: What kind of a beam is that?
St: It is a fake beam, not a structural one, and it is made of plexiglass.
J3: Lets assume that it is made of glass. What's its length?
St: 8-9 meters.
J3: And you have lamps inside that box.
St: Yes.
J3: In case of a failure how can we change a lamp located at the mid-portion?
St: Well, I did not consider that.
J2: What about the cables? I guess they will be visible and distort the appearance.
J1: Even if we don't see the cables I think we will perceive its structure.
…
J1: The problem I generally observe is students' lack of interest in making research related with the project.

Project 6
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: (finishes explaining the project)
J3: Ok what else can you tell about the project?
St: Well, lighting is… Stacks are illuminated by cove lighting and I also provide a kind of general lighting as the ceiling is high. There are lighting units in study units and carrels as well.
J3: Which ones are carrels?
St: (points out from the plan) As there are computer screens there is a different lighting approach in here.
…
St: I have tracks beneath skylights and I have installed high intensity discharge lamps on those tracks.
J3: Can we see them?
St: My reflected ceilings are not descriptive so I did not hang them.
J3: Can you draw it somewhere here?
St: (Brings her reflected ceiling drawings) I do not know whether they are correct. These are spots and here are the cove lighting units.
J3: What about lighting for reading and studying?
St: Lights directed from walls won't be adequate, maybe it would be better to have built in luminaries. I already have task lighting. (continues to explain other lighting ideas) There are lamps with yellow color temperature located at different heights.
J3: It's good to see that you have thought many things regarding lighting.
…

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

…

St: My special section is for history books.
J3: We have a similar section in our library, have you seen it?
St: No.
J3: Research part of the projects is extremely poor. Don't take it personal, it is a common problem of the class.
…
St: (while explaining the project) …[A]nd there are antique books located in glass boxes.
J3: How can I perceive those objects in the glass boxes? Do you illuminate them?
St: Maybe with those tiny LEDs from the top.
J3: What do you mean by top? Have you drawn anything to explain this idea?
St: No I didn't.
J3: Do you have anything else for lighting this space? The only thing I can see are those two lamps. What else?
St: Well, I do not have anything else about lighting.
J3: Any ideas?
St: Can I just tell?
J3: Go on.
St: Stacks are plexiglass and I install Leds behind the plexiglass planes.
J3: I have two questions. Why Led? Why plexiglass?
St: I don't want to make glare so I used sand blasted plexi. Another reason for using sand blasted plexi is making the light source unnoticeable.
J3: You could have installed another type of source then, why led?
St: Well I don't know…
J3: When you are proposing a design idea you have to thing its whys and hows. How do you illuminate the history section, I mean the aged-books. They are very valuable and important and it is forbidden to touch them, right?
St: To obstruct the light coming from the skylight I have made a suspended ceiling.
J3: You know, those writings are very important assets and cannot be restored in case of serious deterioration.
St: I protected them from sun.
J3: Ok but how did you illuminate them? (asking 3rd time)
St: Walls are bright and there are lights inside the box.
J3: I am asking again, what are you using to illuminate them?
St: I may say led but I really do not know.
J3: You have to draw these ideas in order to make them come alive.
…

Project 7
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
St: (while explaining the stacking system)
J3: How do you illuminate the stacks?
St: From the top.
J3: How?

St: By wall washing. (???)
J3: Using?…
St: Fluorescent
…
St: I designed the windows as strips according to the height of stacks. And made wall washing under the openings. That kind of lighting I believe will serve like fenestration.
J3: I cannot establish a relation between your windows and stacks over there (indicates by pointer).
St: I could not align them in here but in other spaces the furniture are designed according to the openings.
Inst1: If you are not able to align them, then you could have suggested some other units that would provide a linear relationship and unity. There are many tricks you could propose as an interior architect.
J3: Lets see your reflected ceiling plans.
St: The existing skylight is something like this. But I have closed some portions according to my design beneath, using sand blasted glass. I am installing daylight type fluorescents there with low color temperature values.
J3: So daylight has a lower color temperature?
St: Sorry it was my mistake. They turn on automatically with sun set.
J3: (to the other jurors) So she changed the existing skylight according to her suggested function, closed some portions. Many things she thought.
(no respond from the others)
J3: OK. Lastly, could you please tell us how do you illuminate those two spaces? Meeting room and the managerial room.
St: I did not draw but it may be positioned like this (shows from the plan). I did not think the other one.
…
J1: I fell that the jury system has been abolished. There is no one listening to us in the studio. I am talking about the same things 3 or 4 times and I do not want to tell the same things to all students anymore. Then they believe that they had a good jury session and say “the instructors said and asked nothing to me, my project is great”.
…

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J1: Can you tell us how do you light this space? I believe the wall that you expose from the entrance is not something appealing. At least utilizing one design element can you explain how you made it attractive?
St: I do not have any special idea on lighting. I just have some ideas for book stacks and the space where the posters are hanged.
J1: Then from the entrance we perceive a dark space.
St: It is not my intent to admit people to a dark space.
J1: What kind of a lamp will you use then? Where are you going to place them?
St: Honestly I haven’t thought of lighting but if I were to, I would use spot lights.

J1: You are lighting those posters. Isn't it sufficient for lighting the entry?
St: No it is not.
J1: Can you explain the functions and the spaces you allocate at the entrance. Is there a cloakroom for instance?
St: Yes.
J1: If you illuminate that space, some light will be reflected to the entrance as well, right?
St: (no answer)…
J3: We discuss these things during the lecture, why don't you use them in design project.
…
J3: What about skylights?
St: My idea is to…(explains by words)
J3: Beautiful but you have not drawn it.
…

Project 9
Reflected ceiling plan: none
Skylight: presented correctly

…
St: (while explaining the project) I am using barisol for lighting this space.
J1: Can you show it on section?
St: Some portion of it can be seen on section B-B.
…
Inst1: What about your stacks?
St: (explains) and I have designed a lighting unit on the corner to reveal the signage.
…
J3: (regarding the placement of desks) You have to reconsider the positioning of those desks. Half of the desk leans against the wall and the other half to the window.
…
(the student has made an opening on the wall and placed a light source behind)
J3: You may suggest such openings but contrast level will be excessive. At least install a diffuser to avoid it ok?
(discusses other lighting proposals and approaches)
J3: Such an approach would be very ordinary.
J1: Sorry, which one?
J3: (to the instructors) We were talking about his lighting choices. There are better solutions and I was giving some clues about those.
…

Project 10
Reflected ceiling plan: none
Skylight: presented incorrectly

J3: (Discusses the project and asks her lighting ideas)

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: How do you illuminate that space?
St: With skylight during the daytime and at night… well I did not draw…
…
St: (explains carrels and their lighting) And also these are for illuminating stacks. But I know the units must be located little further.
J3: This is a common mistake done by the whole class. Like wall washing it should be located at a certain distance to illuminate book spine.
…
J3: What about skylights?
St: They are located at the central part.
Inst1: But you do not show it on plan.
…

Project 12
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
While explaining his stack design, the student indicates that they are illuminated with LEDs.
St: I used Barrisol for general lighting. There are overlapping units on the first floor and I've placed lighting between them.
J3: What is the material of those units?
St: Gypsum board.
J3: Using that light where do you illuminate?
St: (shows on plan) These surfaces.
J3: All I see about lighting is that you illuminate spaces with the sources placed behind Barrisol. Besides that the only different approach is this one right? (the one which the student mentioned)
St: Yes.
J3: Your lighting approach can be considered as correct from a single point that is the way you position them. However, all these spaces are functionally different. Why are you using same type in every space in your library? Just have a look at this studio, remember the corridors. The fluorescents in here do not exist in the corridors. The atrium is somewhat more different, right? Then what was your reason in designing the same thing for whole space?
St: (no answer)…
J3: Each space has is own quality and atmosphere.
Inst1: Even the director's room and its corridor are same.
J1: Also you have to design spaces within a unity. How can you place a lamp saying that "because there was a table there"?
…

Project 13
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: To accentuate my rising concept I am lighting the wall with up lighting, to make longer shadows. (but she has not drawn this idea)
Inst1: The lighting should be homogenous, otherwise there won't be such an effect.
…

Project 14
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: You are talking about an exhibition space. What is the spatial quality, how it's being illuminated?
St: (no answer)…
…
J3: Any ideas about lighting?
St: The two main walls are lighted. On the suspended ceiling there are spots like this type (shows from the material board).
J3: Can you show these ideas on your drawings?
St: They don't exist on the drawings.
…

First Jury Day

Section without the implemented constructivist lighting pedagogy
Jury Members:
Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Architect
Studio Instructor 3: Architect
Juror 1: Architect (prior experience in studio teaching and also in practice)
Juror 2: Architect (practitioner)
Juror 3: Architect (prior experience in studio teaching, lighting course instructor) (was present only in the first student's jury

Project 1
Reflected ceiling plan: none
Skylight: presented incorrectly

J3: There are some lighting details you have drawn. Where are they used?
St: In these parts. (showing on plans)
J3: In reading areas?
St: Yes.

J3: And the other design, where do you use it? Can you show please?
St: (cannot show as did not draw) In the entrance, circulation desk, in all the places that are having ceiling, I used such system.
J3: Where is the ceiling on that drawing?
St: (no answer)…
…
J3: Each space is different. Director's room is different from other spaces but you are suggesting the same type of lighting. Lighting is very important for a library, sometimes people spend a whole day time there.
St: There are lamps on working desks and tables.
J3: But I cannot see any of those on your drawings. And your approach for lighting maps is somewhat doubtful.
…

Project 2
Reflected ceiling plan: drawn
Skylight: presented incorrectly

St: (while explaining his design, underlines the glass chimneys he has proposed for natural and artificial lighting)
…
J3: Do you have a drawing showing the lighting wells you have designed?
St: (tries to show from the section, nothing on perspectives)
…
J3: You have drawn reflected ceilings…
St: (lays over the plans) I want my information box more shiny. (means he is suggesting different lighting levels for spaces)
…
J3: Is that the circulation desk?
St: Yes.
J3: I really want to understand where are the lighting units. In your reflected ceiling drawings there are lots of lamps in that area, where did you put them all? I mean I see tens of circles there.
St: They are spots for music performance.
J3: It isn't shown on any of your drawings. Are they directly installed on the ceiling or is there something like a suspended ceiling? Did you draw it?
St: No.
J3: What type of a lighting you have here? (points out the reading area)
St: Fluorescent (shows from the material board)
J3: Why did you choose this type of lighting but not another type?
St: This is not much place needed for these.
J3: Where are you using them can you show?
St: (indicates on plan)
J3: The ceiling is not very high there, right?
St: There is view on that level. I wanted them to show themselves. (he means that there is a visual connection between the floors and people can see and feel each floor through the opening.)
J3: It can be chosen according to the concept Ok, but I want to underline the type of lighting you achieve using these fixtures.

…
J3: I cannot see any relation of space with the skylight.
St: (no comment or explanation)…
…
J3: How do you illuminate the shelves or the stack area or the stacks?
St: I do not have something social.
J3: There are two main functions right? Reading and browsing… Each space has its own lighting requirement, ok?
…

Project 3
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J3: Can you explain your reflected ceilings.
St: I used something like this (shows the ceiling of classroom/studio) I have spots.
J3: Where are the spots, are they all around the space?
St: …
J3: What else? Where are you using these fixtures? (the ones on the material board)
St: (no answer)
J3: At night what do you have under the skylight? What type of lighting you have at that space? (cinema section) Cove lighting? Wall washing? Can you see what I mean?
St: (does not answer any of these questions)…
…

Project 4
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: What about the lighting of those spaces
St: I thought but I did not draw. I have lighting elements for my stacks.
…
J3: Do you have ay relation of the skylight with the function underneath?
St: yes, I have skylight over the study areas.
J3: I am looking for a functional relation as well. I cannot see the relation. Did you show the boundaries of skylight on plan?
St: No.
…
J2: On the ground floor you could have opened the windows to the floor level so that people would see the environment. The relation between skylight and the space under it, I believe is not so important as Cengiz Bey said. They are existing; they (students) take the building and make another function. They cannot destroy it.
J3: I do not agree with my friend. Some of the skylight will be lower some of them will not be. Some spaces will get daylight, some will not. There will be a mix of a

lot of things. Especially at night there will be fixtures hanging and some part of the skylight will interfere with other space. Though they are existing you have to take necessary steps to utilize them.
…
J3: I wish you have shown us what you think about lighting. You cannot use the space without it.
…

Project 5
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J2: Why this building is so introverted, I mean everything. Why this building does not have natural light, besides skylight. I do not have any chance to see environment. There is nothing on the site to see as well.
St: (no comment)…
…
St: I put a light under my wall to make it look light.
J3: where is it? What type of light?
St:… Well I did not draw.
…

Project 6
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: There is the skylight over that place, right?
St: I used the skylight for the working space and these small windows are for books.
…
J3: Have you thought anything for lighting of this library? Stacks, reading areas, circulation desk…
St: When we look at the perspective, there is a huge lighting system through the long table. When we look at the mezzanine floor the lighting system is on the table again.
…

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: I am lighting the panels with suspended ceiling. As the panels are tilted, light is more diffuse. The diffuser hides the rectangular form of skylight and diffuses the light. I used organic forms for lighting as well.
…
J3: How do you illuminate the shelves, the stacks…
St: At the mezzanine I use the skylight, there is also florescent.

J3: Where is it?
St: I forgot to draw. There is cove lighting on the other floor. I hurried while drawing and neglected it.
J3: what about the tables? Reading?
St: I have designed tables for the library.
J3: I am asking for their lighting.
St: I didn't do.
J3: By using this type of lighting what are you going to gain? Is there anything corresponding to this kind of lighting? Is there any relation with the function?
St: I just wanted to make an organic form.
J3: But do you understand what I mean?
St: yes…
J3: How do you illuminate the conference room?
St: I use wall washing and cove lighting.
J3: Which one?
St: Sorry, cove lighting.
…

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: This is a reflector wall for daylight and it is aginst the movement of the sun, it becomes a light source.
J3: What is the material of it?
St: Barrisol
J2: Is there sufficient light coming from skylight to reflect it and use it as a light source?
St: There is also artificial lighting.
J2: IS there enough light in the afternoon for example?
St: It is a white surface I think it will reflect.
…
J3: Do you have another type of lighting other than this wall with barrisol?
St: I have light for tables. I have lighting on the top of stacks.
J3: When you have the books it won't be coming, right? (the student has drawn empty stacks and the juror means as the stacks will be loaded with books it won't be possible to light to the books from the top shelf)
St: No only from the upper part. I thought it would reflect from the ceiling.
J3: With this type of lighting you cannot use the surface as light emitter. (draws how it should be) Secondly, this type of lighting cannot be used for general lighting. They are using these type of lighting on the name labels where there is a carving on the surface of the material.
St: (no comment)
J3: When we come to your wall, I am not talking about the material, barrisol or whatever… If you are reflecting the light towards inside what about the backside of the wall, will it be dark? You have said that you did not make any openings and closed all the windows, so here it will be very dark, right?
St: (no comment)

J3: And lastly, it is very good to use the skylight but you have to consider summer conditions as it will be very hot in inside. I want you to consider these. Anyway it is the first time I see a student dealing with daylight. I wish you have thought it in more detail.
…

Project 9
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J3: What are all these circles?
St: Some are for artificial lighting, some are just similar shapes to make a pattern.
J3: There is the lighting system but some does not have lamps, right?
St: Yes.
J3: Each function has a different requirement, but you have the same type of lighting for everything.
St: (no answer)…
J3: Is it really acceptable or right? With these four lighting fixtures which are exactly the same you light different spaces.
St: (no comment)…
…

Project 10
Reflected ceiling plan: Drawn
Skylight: presented incorrectly

…
St: I am placing warm color lighted fluorescents over the L-shape spaces that I wanted to define.
…

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: Sunlight comes and reflects downwards.
J3: What is reflection? It will reflect upwards.
St: (No answer)…
…
J3: How do you light the exhibition?
St: I illuminate the posters from backside.
J3: Did you draw them?
St: No
J3: How would I know what you have thought? Have are you going to illuminate the shelves? Do you have any drawings for that?
St: I light from top of shelves.
…
J3: Will you graduate this year?

St: Yes.
J3: This is something like your graduation project then. You have one project left before graduation but I see that you have thought nothing about lighting.
St: I did not have enough time.
J3: Leaving the lighting issue to the last minute is the main problem. It should progress with the project. You cannot add it like a patch afterwards.
…

Project 12
Reflected ceiling plan:drawn
Skylight: presented incorrectly

…
St: I put the lighting around the skylight.
J3: Can you show me from the section?
St: (cannot show as not drew) …
…

Project 13
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
St: (talking about reflected ceiling) Here I use spotlight
…
J2: What about natural lighting?
St: I could have designed a better ceiling but we were not allowed to open the slab. Therefore, I could not make it.
…

Project 14
Reflected ceiling plan: none
Skylight: presented incorrectly
…
J3: Did you think anything about lighting?
St: Actually yes, I have cove lighting.
J3: Can you show it from the drawings?
St: Here, on the section.
J3: Can you show the place of that light source on plan?
St: It is placed next to the benches.

Second Jury Day

Section without the implemented constructivist lighting pedagogy

Jury Members:
Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Architect
Studio Instructor 3: Architect
Juror 1: Architect (prior experience in studio teaching and also in practice)
Juror 2: Architect (prior experience in studio teaching, expertise in CAD)
Juror 3: Architect (first year basic design instructor)

Project 1
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J2: You don't have reflected ceiling plan, right? The way you introduce texture, color, sound isolation are missing in your project.
St: (No comment)…
Inst2: Actually, it is one of the few plans showing skylight.
J2: You have to talk more about the existing building. I observe this more in the other section. Because when you are talking about skylights, how your new architectural elements are related with the existing ones. Such as your opening (means the opening on the slab). Are you covering the ceiling? These are the things I want to note…

Project 2
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: Some of the stacks are open (????) and are like lighting fixtures, taking natural light inside.
J3: It is very straight geometric light source (talking about skylight) and how does it relate to your design?
St. While working on my plan, I tried to frame the skylight. I used the staircase to direct people to here…
J3: It is a very important decision and I cannot see it as a reflected condition on your floor plans.

Project 3
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 4
Reflected ceiling plan: none

Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 5
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 6
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J1: We cannot see how is your space related with the skylight. It cannot be seen in the sections.
St: (no comment, starts talking on another issue)
…

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: There are special lighting elements. (shows from elevation)
…
St: There is same logic in both stacks and carrels. (material wise) There is the same type of lighting.
…
St: For linearity there is up lighting and skirting lighting.
…
St: Light is coming from the basement, from the pool…
J1: Light is an architectural element, illuminating pools, stairs, etc.
St: Yes, it is the general idea of my project.
J1: What you have then?
St: For carrels there are special concealed lights, for the stacks there is up lighting, for lighting books and for offices there is cove lighting and for the stairs there is light on risers.
J1: So can we see them on section?
St: No.
…

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 9
Reflected ceiling plan: drawn
Skylight: presented incorrectly

…
J3: We do not see to much about artificial lighting in the projects. Maybe that is completely complex subject in a project.
Inst3: Yesterday actually we had more.
J3: I think we need to see more individual… err well
Inst2: Task lighting
J3: Yes, task lighting. Overall general lighting, maybe ambience. And there was one more (tries to remember) general, ambience, what was it? I'd like to see task lighting in here. I really imagine them. I remember a library having similar study areas, I remember its task lighting now. I was somewhere around … Washington maybe…
…

Project 10
Reflected ceiling plan: drawn
Skylight: presented incorrectly
…
TK: Can wee see the reflected plans?
St: I have cove lighting in the ground floor.
TK: But it lights only this area, but not this. Let's forget about your reflected ceilings.
…

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 12
Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: There is lighting inside the stacks.
J1: For each shelf?
St: Yes, otherwise lower shelves won't get enough light.
…

Project 13

Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 14
Reflected ceiling plan: none
Skylight: presented incorrectly

J3: The whole space is very dark, light absorbing.
St: The tables are dark to prevent light reflection.
J1: Aren't they shiny? The reflection will be more…
St: I think lighter shiny colors would reflect more to our eyes.
J1: Then why did they do it like that in the whole world? Did you take history of art?
St: (no answer)
J3: We, the architects... Why are we making our tables white then?
J1: It could be white and absorbing.
St: I have chosen black for the atmosphere of my space.
…

Project 15
Reflected ceiling plan: none
Skylight: presented incorrectly
…
St: I have put street lighting units.
J1: This choice is not good.
J2: Those are exterior lighting fixtures
St: Yes. (he made it intentionally actually)
…
St: (hang the reflected ceiling plans)
J1: Are they required?
Studio instructors: No.
St: (explaining lighting from the reflected ceilings) for stacks I have fluorescents. There are some lights for wall washing in the conference.

Third Jury Day

Section without the implemented constructivist lighting pedagogy

Jury Members:
Three studio instructors, three visiting jurors
Studio Instructor 1: Architect
Studio Instructor 2: Architect
Studio Instructor 3: Architect
Juror 1: Architect (prior experience in studio teaching and expertise in architectural discourse)
Juror 2: Architect (prior experience in studio teaching, expertise in CAD)
Juror 3: Architect (third year design studio instructor)
Juror 4: Interior Architect (third year design studio instructor)

Project 1

Reflected ceiling plan: none
Skylight: presented incorrectly

…
J3: … and you also don't care about the existing skylight. It should work together with your design, but it doesn't.
…
J3: How are you using light in that space?
St: I use barrisol
J3: Can we see it somewhere?
St: (shows from the perspectives) And I have lighting above the stacks.
J3: How come they can be same light? One for books and the other for general lighting. If this is translucent, then light will come down.
St: … (no comment)
…
J3: You did not draw reflected ceiling.
Inst3: We did not want it, they could show on perspectives.
J3: But sometimes there is level difference on the ceiling so we cannot see. Did you consider any north light for the library?
St: There are trees to prevent access light.
J3: That's north, it will be dark then. So you don't care any orientation fr light. You should have to consider windows. They can't sit and read anything there, it will be hot and shiny there.
St: (no comment)…
…

Project 2

Reflected ceiling plan: none
Skylight: presented incorrectly

…
St: I started my openings from eastern part, there are less opening on south, and western part is completely closed.
J3: The number of openings are lesser then?
St: On the south, yes. I put the exhibition part to west so I can arrange lighting system. (she has not drawn it)

Project 3
Reflected ceiling plan: none
Skylight: presented incorrectly

…
J4: Can you explain what you think about lighting? We can see some of your ideas in the perspectives but all of those are related with computer and reading activity. What about the other spaces, the gallery?
St: I use neon lights on the wall. (not seen on drawings) I did not want a white, sparkling library. I wanted a dim space. It has enough light during daytime.
J3: No way, you hate daylight.
J4: Of course natural light will help but I agree with my friend. In a library natural light will not be enough, in such a building. In the core of the building and in exhibition I mean.
St: I want to use spot lights in exhibition. (not drawn just expresses her ideas)
…

Project 4
Reflected ceiling plan: none
Skylight: presented incorrectly
…
Tijen: Main problem is actually you do have a lot of details but all of a sudden there is two dimensional things. When you are putting these elements they start to define the third dimension (talks about the mobile-like units hanged from the ceiling)
…

Project 5
Reflected ceiling plan: drwan
Skylight: presented correctly

…
St: I used orange color plexiglass so there is some kind of yellow light coming through.
…

Project 6
Reflected ceiling plan: none
Skylight: presented incorrectly
…
J4: What about you lighting ideas?
St: Daytime I'm using daylight and night time I'm using the same feature. I'm using lights from the same place of skylight. I'm also lighting the shelves. There is lighting units (showing sketch), indirect lighting.
J4: What about task lighting? Do you have something for task lighting or do you think that indirect lighting will be enough?
St: Yes, it won't be enough. I will have special light for working (nor drawn).
J4: What do you think of that curved wall and the rectangle? Because that wall is reaching to the ceiling, right?

St: Yes. (There is single reflected ceiling plan) Same light is for the ground floor because we can see the skylight from the ground floor.
J3: This is the only part that will se light.
…

Project 7
Reflected ceiling plan: none
Skylight: presented incorrectly
…
St: In the morning I get light from skylight. For ambient light I use some diffusers and fluorescents and reflectors to reflect light to down part. I divided it into three parts. I add another grid to make a sunglass. I diffuse the light this way (shows from perspective) in these parts.
…

Project 8
Reflected ceiling plan: none
Skylight: presented incorrectly
…
J4: You have to provide something in that wall.
St: It has I beam structure and it is translucent.
J4: With light?
St: Yes, but… (not drawn)
J4: It is a lighting wall then, OK.
…
St: On the tables there are lighting fixtures and the fixtures are falling on the niche.
J3: Do you know what a niche is?
All jury: Making discourse on the definition of a niche.
…

Project 9
Reflected ceiling plan: drawn
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 10
Reflected ceiling plan: drawn
Skylight: presented incorrectly
…
J1: Do you have any architectural reference in designeing the spaces?
St: All reference is from the ceiling plan. As we have skylights here, here and here (shows from plan). I left the books under the closed area as books need less light and I put reading area under skylight.
…

Project 11
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 12
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.
…
J1: You should take opening into consideration. People want visual relationship with outside. Daylight is something and nature is something, ok?
St: Ok.
…

Project 13
Reflected ceiling plan: none
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.

Project 14
Reflected ceiling plan: drawn
Skylight: presented incorrectly

Nothing asked, discussed and mentioned about artificial lighting and/or daylighting.