ASSESSMENT OF PERCEPTIONS OF DESIGN EDUCATORS AND PROFESSIONALS REGARDING LIGHTING CONCEPTS FOR DESIGN EDUCATION

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PREFACE

This research assesses perceptions of design professionals and lighting educators regarding various aspects of interior lighting. The three major categories used in this assessment include: Acquisition and value of lighting knowledge, use and value of lighting related resources, and the importance of inclusion of various lighting concepts in interior lighting curriculum. Additionally, this assessment provides information that can be used as a tool for curricula developers in interior lighting.

The format of this dissertation deviates from the prescribed thesis format at Oklahoma State University. This deviation was considered to create manuscripts suitable for publication as well as to meet the requirements of the traditional thesis. Chapters I, II, and III use the Publication Manual of the American Psychological Association along with the Oklahoma State University thesis style. Chapter IV and V also follow the Publication Manual of the American Psychological Association as necessary for publication in the journal of Lighting Design and Application, and The Journal of Interior Design Education and Research respectively.

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TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

CHAPTER I

INTRODUCTION

The element of light has received a great deal of attention from the design community for an awareness of the affect of light on space and people. Lighting has evolved through the times. But today with growing and changing technology in light sources and lighting design, it is impossible for the professionals to keep up with these changes. Yet, there is an increasing need for the design professionals to be aware of the use of light and its application in the environments they design.

The history of lighting illustrates the evolution of lighting and the field of lighting design. Lighting design has evolved since the use of sunlight and oil burning lamps to the use of highly sophisticated artificial lamps and the emergence of specialized professionals in the field of lighting design. Feder, the father of lighting design (Masello, 1990) believes in spite of all the new technologies, 'we are really in the infancy of lighting' (p. 14).

Light is defined as a "radiant energy that is capable of exciting the retina and producing visual sensation. The visible portion of the electromagnetic spectrum extends from about 380 to 770 nanometers" (IES Lighting Ready Reference, 1985, p. 20). Simply put, without light, there is no vision. "Life may be said to begin with

light and be sustained by light. As man made environments increase in size and extent, man-made light sources acquire great importance, and demand new understanding and development" (Birren, 1982, p.10).

The visual sensation that is experienced when light or radiant energy hits the retina is very subjective. This sensation is more than just enhancing our vision. Light is an element of design that affects people in all walks of life. Smith comments,

> Light, we are beginning to learn, can be as important to our health and sense of well-being as the food we eat or the air we breathe. It can regulate our biological rhythm, damage or repair our genetic material, change our moods, improve our productivity and even be used to treat such diseases as jaundice in newborns, psoriasis, and some forms of depression and lukemia (Smith, 1986, p.32).

Birren (1982, p.10) comments "The day is already here in which lighting for biological purposes will supplant or at least supplement lighting for purposes of vision". Individuals are spending more time in the confines of the built environment where light conditions, color, interior temperature and several other factors are predetermined by the environmentalist. It seems natural that these professionals have a responsibility to know and understand these factors and their effects on humans.

Light and its psychological affects have also been studied. Early research centered around effects of natural light and artificial light (Collins, 1975). Individuals preferred day light versus artificial light in studies conducted by Wells (1965) and Markus

(1967). In a similar study conducted by Heerwagen and Heerwagen (1986), findings indicate that subjects rated daylight better and more important in their work environment than artificial light because of the psychological and health reasons more than for work reasons. Research of Flynn, Hendrick, Spencer, and Martyniuk,

> supports the theory that the experience of lighted space is, to some extent, a measurable experience. The findings tend to sustain the idea that lighting can be discussed and measured as a vehicle that alters the information content of the visual field - and we may now be able to document how this intervention affects impressions and sensations of well-being (1979, p.108).

Light affects our perceptions of space and architecture. Light has such extraordinary powers that it can transform all elements including color, texture, scale and form. The American Association of the Blind estimates that seven-eights of all our perceptions are through sight. Nuckolls comments,

> Obviously, there is no sight without light, so the way structures and objects in our world are illuminated makes a tremendous difference in the way they look to us and how we respond to them. It stands to reason, then that lighting is an essential design and building element (Nuckolls, 1983, preface).

From a historical perspective lighting design has moved from a purely quantitative emphasis to include the aspect of quality of lighting. It is necessary that the designers of interior environments understand the impact their designs will have on individuals using

the space. Goldberg with regard to light and its emotional association states,

> However much we can quantify light and talk of things like task lighting, footcandles, and wattage, light remains an emotional thing. It transcends the scientific, even as jobs as designers require more and more scientific knowledge everyday. The heart of the issue with lighting is still the emotional association it engenders, the way lighting "feels". For what changes in a room when lighting changes are not the hard facts, not the length or width or the height or where the door and windows are. It is the way the room feels (Goldberg, 1985, p.21).

Historically the 'science' of lighting has been studied in engineering programs. However, very few illuminating engineering programs exist at the present time. In such programs, the emphasis are on the quantifiable aspect of light. This is reflected in the history of lighting when lighting design in the early 1950's and 1960's was quantitative and dominated by engineers (Nuckolls, 1983). In recent years architectural and interior design programs are including the study of lighting as part of the curriculum. In these programs the 'quality' of light is introduced which is reflected in the history of lighting in the 1970's and 1980's.

Benya, (1988) a lighting professional believes lighting design is changing due to rapid technological advancements. Since 1975, new products and designs have revolutionized the lighting design field. Benya states "A lighting education five years or more old, unless bolstered by continuing education is obsolete" (1988, p.42).

Lighting education is in its infancy since lighting design is a new field. "All professors and lecturers teaching lighting are really pioneers, bringing with them the strengths and limits of their own academic and professional backgrounds" (Benya, 1988, p.43). 'The Illuminating Engineering Society' (IES) is working toward providing a sound educational foundation for a better understanding of lighting among design professionals as well as students enrolled in programs that deal with lighting.

A majority of the architectural and interior design projects today are utilizing the special effects of light to create functional and aesthetically pleasing environments. Associations such as IES, and 'International Association of Lighting Designers' (IALD) have provided funds, research grants, workshops, seminars, conferences and intern programs for students, design professionals and educators interested in the field of lighting to learn and understand lighting better. The design professional groups, 'The American Institute of Architects' (AIA) , and 'The American Society of interior Designers' (ASID), are including lighting and its applications as topics in national conferences, workshops and continuing education units. These activities indicate emphasis placed on lighting as a critical element in design.

Design professionals realizing the importance of lighting in their design are using lighting consultants to ensure sound lighting solutions to complement the overall design. Forbes, (1984) a prominent interior designer comments that a lighting consultant is used by her firm in all projects to make the lighting effects desired become a reality. Additionally the consultant's skills and talents

are used to create lighting designs that follow codes and are free of maintenance problems. Forbes believes in continuing education both at the school and the professional level.

Design professionals and lighting educators are becoming more aware of the importance of lighting and its impact on humans and the interior environment. But there is inadequate documentation of what these professionals consider vital in interior lighting as it relates to their profession. Questions needing study include: How did the design educators and professionals acquire their lighting knowledge? How valuable it is to their career? What resources do educators and professionals use in the field of lighting? What is its value to their career? What lighting variables do they consider important that might be incorporated in the interior lighting curricula? What is the educational background of the professionals and educators? What lighting trends do the professionals foresee in the future?

The results of such studies could enable an evaluation of interior lighting practices of both the design professionals and the lighting educators. Additionally, this information is important for educators to make necessary recommendations regarding lighting curriculum.

Purpose and objectives

The purpose of this study is to evaluate perceptions of design professionals and lighting design educators regarding components of

interior lighting practices and education. Specifically the objectives include:

1. To assess and compare perceptions of interior designers, architects, and the members of the lighting industry regarding lighting concepts.
    A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their careers.
    B. To assess and compare the perceptions of use and value of lighting related resources to their careers.
    C. To assess and compare the perceptions of importance of including various lighting concepts in interior lighting curricula.
2. To assess and compare perceptions of architecture and interior design lighting educators regarding lighting concepts.
    A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their teaching.
    B. To assess and compare the perceptions of use and value of lighting related resources to their teaching.
    C. To assess and compare the perceptions of importance of including lighting concepts in interior lighting curricula.
3. To assess and compare perceptions of lighting design professionals and lighting design educators regarding interior lighting concepts.
    A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their professions
    B. To assess and compare the perceptions of use and value of lighting related resources to their professions.

C. To assess and compare the perceptions of importance of including lighting concepts in interior lighting curricula.

4. To make recommendations for interior lighting curricula based on educational models and the findings of this study.

Definitions

The following definitions help to clarify some terms used in this research:

Light - Radiant energy that is capable of exciting the retina and producing visual sensation (IES Ready Reference, 1985, p.20).

Quality of light- Pertains to the distribution of luminance in a visual environment. The term is used in a positive sense and implies that all luminances contribute favorably to visual performance, visual comfort, ease of seeing, safety, aesthetics for the specific visual tasks involved (IES Ready Reference, 1985, p. 26-27).

Quantity of light - Luminous energy (IES Ready Reference, 1985, p. 27).

Lighting designer - One who plans lighting compositions, lays out hanging plans, directs the focussing of lighting units and determines the various intensities, color, and cues required in a production (Lighting handbook, GTE Sylvania 1977, p.117).

Assumptions

The following assumptions are included in the study:

1. The respondents understood and answered the self-administered questionnaire accurately.
2. The instrument used accurately measures acquisition of lighting knowledge, use of lighting related resources, and inclusion of lighting concepts in lighting curricula.
3. Lighting, interior designers and architects designing interior spaces have a greater awareness of light and its applications than other related design professions.

Limitations

The limitation affecting this study include:

1. Few open-ended questions were included in the questionnaire which might have limited the respondents opportunity to express further information regarding lighting components.

Summary

The two common approaches to lighting design have been, the quantitative and the qualitative. Regardless of the approach to lighting design, one is aware that light not only enhances one's vision but studies indicate that light affects the behavior, perceptions and also the biological and psychological aspects of the user. Realizing the importance of the element of light on interior environments and its users the design professionals and lighting educators are paying closer attention to this aspect of design. Currently there is a paucity of empirical studies which document the

aspects of lighting design considered important by the design professionals and lighting educators. The results of such studies could provide insights to lighting practices and education. Moreover, such information could provide a tool for curricula developers in interior lighting.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Studies of interior environments indicate that lighting affects the space as well as the user of that space directly and/or indirectly (Nuckolls, 1983; Taylor and Socov, 1974; Flynn and Spencer, 1977). Since lighting is an important element of design, it is essential that individuals dealing with shaping interior environments be aware of its potential. Mintz states, "I think of light as a building material . . . . You can do more with lighting to change the aspect of the room - whether the color, the size, or emphasis - than you can with any other traditional building material" (Wilson, 1974, p. 148). This review of literature will cover various aspects of light as it affects variables within the interior space, its effects on individuals using the space, as well as aspects of lighting design within the profession, and lighting education. Specifically, topics to be included are: History of light; lighting design, which includes trends and quality of light; lighting knowledge; lighting education and curricula development. The topics reviewed provide a better understanding of the importance of light and lighting design.

History

A brief history of lighting illustrates the evolution of lighting and lighting design. In the early ages, sunlight was used exclusively, then came candle light; next the oil burner and gas jet. In 1881, the first electric incandescent lamp was introduced to the world by Sir Joseph Swan of England and Thomas A. Edison of the United States. The use of an electric lamp in the interiors at this time was purely a functional one - to dispel darkness (Nuckolls, 1983).

As the use of and interest in artificial lighting grew the Society of Illuminating Engineers (IES) was started by Louis B. Marks in 1905. The beginning of IES, a professional group of illuminating engineers, indicates a concern for lighting. This was the first time a professional group became involved with lighting which gave a new meaning to the need for knowledge of lighting.

Nearly sixty years after the first incandescent lamp was invented the fluorescent lamp source was introduced in the 1940's. This lamp, which had the characteristic of high efficiency and long life when compared to incandescent, became an instant success. Fluorescent light sources were used everywhere. This was the age of abundance, where artificial light was available in plenty emphasizing the quantity of light (Nuckolls, 1983).

Later in the mid 1960's high intensity discharge lamps were introduced. During this period architects and interior designers entered the lighting field which had been dominated by engineers. This resulted in an explosion of creative use of light (Nuckolls,

1983). The interior design and architectural professionals who were interested in lighting formed a separate lighting organization called the International Association of Lighting Designers (IALD) in 1970. IALD members emphasized the use of light as a design element (Nuckolls, 1981).

In the mid 70's, due to the energy crisis, and high energy cost, the government set up strict rules limiting number of watts per square foot allowed for use in new commercial installation. Since energy was scarce, the light fixture and lamp manufacturers developed new and better light sources which were more efficient and had better color rendition. Quality of light, and the user of light gained importance during this period (Nuckolls, 1981; Willson, 1984; Grenald, 1986).

The developments of new light sources and interest from the architectural and design community in the lighting field led to the formation of support agencies such as IALD, IES, and the Lighting Research Institute (LRI). In 1981, IES and IALD joined forces and hosted the 'Lighting World International", which show cased new technologies in the industry (Designers West, 1989). Henderson (1988) says "Lighting World International has galvanized the lighting community. Lighting world has opened lines of communication between manufacturers and designers, has helped immeasurably in clarifying the significance of this expanding segment of the design industry" (p. 3). Recently, Lighting World International has been renamed as Lightfair.

Grenald (1986) suggests that historically great architects have understood natural lighting. This is apparent by the play of

sun and shadows on form, the expression of texture and color, as well as control of glare and contrast. Grenald believes that artificial lighting was not used as a tool until recently. Even though the concept of artificial light has existed for 8,000 to 10,000 years in the form of oil lamps, gas lamps and fluorescent lamps, the main use of these light sources was illumination - not the enhancement of form.

Both Nuckolls (1981) and Grenald (1986) suggest that in the last century nowhere other than the field of theater has the element of light been manipulated to create special effects of mood, illusion and drama. During this time the architects and engineers were beginning to incorporate their knowledge into formulas and rules which primarily dealt with function - that is illumination. It was in the theater that lighting was explored for its potential to enhance and manipulate the space. Lighting designers in the theater developed new sources that had good optical control as well as range of beam spread and good optical control system. Effects could be planned and repeated adding to the drama and often seeming as drama itself (Grenald, 1986).

The great fathers of theater lighting design, namely Stanley McCandless, Abe Feder, and Richard Kelly, used the theatrical lighting principals to design fixtures for buildings, and applied theatrical lighting to architecture (Grenald, 1986). In spite of all the new ideas generated by the theater industry lighting was still quantitative.

The history of lighting and lighting design indicates that the lighting industry has moved from a quantitative aspect of lighting

design to a qualitative aspect of lighting design. Architects, interior designers, engineers, and lighting professionals became more conscious of the element of light which led to the formation of new lighting design organizations.

Lighting Design

Nuckolls (Wilson, 1974) states, "Lighting design involves the selection of fixtures to produce an illumination effect that is suitable and stimulating for a particular environment, ... It involves the determination of design criteria and choice of appropriate techniques and equipment" (p. 152).

For Feder (1978), light like air is one of the basic elements, yet like air, people tend to take light for granted. To Feder a lighting designer is one who has a 'visual memory'. He says "you can't teach light. You can't talk it. You must see it, and you must learn to develop a light memory" (p. 134). The architect, the developer, the interior designer, anyone who makes decisions about lighting, has an impact on the uses of natural resources, the operating costs, and on the physical and psychological well-being of the people who's lives lighting touches (Shemitz and Walker, 1982a). Therefore, today lighting designers are introduced to the project at the initial stage of formulating the architectural footprint, and are part of the interdisciplinary design team.

Willson (1985b) believes that with the new awareness of the potential which lighting has to offer, as well as the wide variety of new lamps, fixtures and techniques which are becoming available,

lighting should be as creative a design tool as any used in bringing character to an interior. Wilson further comments, that "as in any creative medium, one cannot be truly creative with it until the disciplines of the medium have been learned and, with lighting this means learning how to control its possibilities and limitations" (p. 266-70). Marsteller's philosophy of light (1987) suggests that the designers approach to lighting should be generated from nature. The interplay of sun and clouds - such as brightness, shadowless light, shadows, and change of color through the day should be studied and these concepts should be incorporated in the design of interior environment.

In discussing the effects of light Marsteller highlights the thoughts of Richard Kelly who is considered a leader in the lighting field. Kelly separated light effects into three types namely, ambient luminescence (general overall lighting), focal glow (local or task lighting), and play of brilliance (accent lighting).

Kelly states:

> Ambient luminescence is ". . . a snowy morning in open country. . . twilight haze on a mountain top or a cloudy day on the ocean. . the light in a white tent at noon . . . . Ambient luminescence is shadowless illumination, it minimizes form and bulk. It reduces the importance of all things and all people. It fills people with a sense of freedom of space and can suggest infinity. It is usually reassuring and restful (Marsteller, Feb 1987, p.78-80).

Focal glow for Kelly is "light burning at the window or the welcoming gleam of the open door. . . . it commands attention,

creates interest, fixes the gaze, tells people what to look at. Focal glow separates the important from the unimportant . . . " (Marsteller, 1987, p.78-80).

Kelly describes accent light as,

> play of brilliants . . . Sunlight on a tumbling brook. Play of brilliants excites the optic nerves . . . stimulates the body and spirit and charms the senses. It creates a feeling of aliveness, alerts the mind, awakens curiosity and sharpness the wits. It quickens the appetite . . . heightens all sensations. It can be distracting or it can be entertaining (Marsteller, 1987, p.78-80).

Willson (1987, p.191) says "One must never lose sight of the fact that something as intangible and formless as light can have tangible impact on space". In discussing the importance of light in the interior environment, Willson believes balance and control are the two elements that form the foundation of creative lighting. To achieve balance, one must have control of four major factors: first, is the control of direction of light from a lamp or fixture. Second, is the control of the beam spread of light from its source - the size of the path of light emitted by a lamp or fixture. Third, is control of level of light - its intensity or brightness. Fourth, is the control of glare - which is the uncontrollable brightness from a lamp or fixture. Good lighting design needs to adhere to the above basics as well as the client's needs. Good lighting must be functional as well as make the use of a space a visual pleasure. In lighting design one needs to keep in mind the capability of light and its affects on color and materials. In discussing philosophies of light, Bell comments,

> Two courses are open to the designer. In the first place, he can have the whole space lighted uniformly, more or less approximating the effects of a room receiving daylight through its windows, or, throwing aside any purpose to simulate daylight in intensity or distribution . . . he can put artificial light simply where it is needed to serve the ends of art and convenience (Bell, 1912, p. 208).

Caminada (1983) believes that effective architectural lighting can be achieved by the lighting designer and architect working in close harmony, and by the application of a few, simple rules governing aesthetics. Several lighting design professionals suggest, that there should be good communication between the lighting designer and interior designer, for a project to be successful (Forbes and Ergas, 1980; Mintz, 1974; Wilson, 1974). Quigley, (King, 1989) a lighting designer, believes in collaborative effort with the environmentalist. Quigley adds "it is important to us that whatever we design should feel as if it came from the same mind, same hand and same team as the architecture and interior design" (p. 99). Nuckolls (1983) believes that lighting design is an inseparable part of environmental design. Light plays an important part in revealing the shape, form of objects and space in an environment. Nuckolls believes the initiative for creative lighting must come from an environmentalist, for it is this authority who assumes responsibility for the total structure even though this individual may have less experience than the lighting consultant. He comments the greatest designs are achieved when the

environmentalist creatively applies the information provided by the lighting consultant.

Lighting designs are often most effective when they are least noticeable. This follows the idea if an environment must form a unity the lighting must unify with the remainder of the space (Nuckolls, 1983; and Caminada, 1983). Grenald (1986) comments that architectural lighting can be used to enhance the quality of space, form and texture, and color in order to achieve the predetermined effect. Grenald adds that "experimental architecture is one which controls perception by dealing with the senses- primarily of which is seeing" (p.21-24). By controlling light, factors such as mood, scale, depth, and emotion can be altered or added.

Keeberg in an interview with Wilson (1986) discusses the process and purpose of lighting. Keeberg believes that once the purpose of light is identified, then the type of light should be selected, and finally this light should be used to modulate the entire comprehension and purpose of the building. Keeberg adds, that "it is not the volume of light that helps us to see well, but the quality of that light, We can no longer deal in footcandles and lumens - but in the purpose, attitude and safety" (Wilson, 1986, p. 30-33).

Forbes, and Ergas feel lighting design is a highly specialized technical profession. Forbes and Ergas state:

> Lighting is a rapidly changing field which is hard for an outsider to keep up with. Lighting designers bring us the technical expertise we interior designers need to meet lighting codes, understand lighting loads, and select hardware. With

today's emphasis on efficient energy utilization, we need such technical assistance more than ever (Forbes, and Ergas, 1980, p. 152).

Trends in lighting design: A review of recent lighting trends gives one an understanding of where the lighting industry is headed in the future. There are several trends that have emerged in the field of lighting design. Lighting designers, Benya, Mesh, Wheel and Munson (Mayer, 1989) believe that the present clients of lighting are sophisticated, smart, and knowledgeable about lighting. In addition the clients are more aware of what they want with regard to lighting.

Benya, (Mayer, 1989) says there is a trend towards more direct/indirect lighting, and not just the use of direct lighting in a space. Whitehead and Steffy (Mayer, 1989) see lighting designs becoming more 'humanistic' in approach which indicates designer's concerns for the people using the space.

Styne (1989) states,

> It is perhaps most significant that we are now more concerned with the behavior of people, their comfort and their productivity, than we were in the past. We know people respond to different stimuli from their surroundings, be it work place or play area. Lighting and color are definitely part of these stimuli (Styne, 1989, p. 102).

Further, Steffy (Mayer, 1989) comments that concern for maintenance is another trend that is gaining popularity. People are becoming more concerned with the operating cost than with the

initial cost of the lighting system and are willing to pay more dollars up front if the lighting system is good.

Styne (1989) believes that lamp manufactures are designing lamps that have higher efficiency, better color rendition and come in a variety of color temperatures. The miniaturization of lamps is another new trend which will have a direct impact on lighting design.

Smith (Brown,1989) feels that "as interior designers who specialize in habitability, the finger points to us to learn special skills in order to create the illusion of spaciousness" (p. 106). Smith adds, given the high cost of space and emphasis on productivity and satisfaction, designers are challenged to create the illusion of spaciousness. Impressions of spaciousness are profoundly affected by light (Flynn, Spencer, Martyniuk, and Hendrick, 1973).

Smith and Bertolone (1986) address contemporary issues that need special attention in lighting. They list: lighting for the aged and infirm; lighting for plants and landscape; and the medium of light used as art. As designers it is our responsibility to understand the needs of the end user and create environments that enhance their quality of life.

Grenald (1986, p.21-24) believes "if there is a distinguishing characteristic to the future of lighting design and architecture itself, it is the growth of understanding behavior. The seeds of the next major movement in architecture may lie in lighting design".

Quality of Light: One of the major emphasis in lighting design today is on the quality of light. During the late sixties and mid

seventies there was a move toward the 'qualitative' aspect of light which resulted in IES's recommendation that designers be concerned with the quality of light by taking into consideration the composition and mood of the space, as well as the visual comfort of the user. This approach was called the 'design' approach (Lighting Design and Application [LD+A] July 1971). A few years later the quantitative and qualitative aspect were combined into a 'unified' system approach. This approach takes into consideration the space, design, situation, psychological criteria and evaluation in order to come up with the quantity of light (LD+A, Sep 1972).

Later in 1974 the IES design practice committee printed an outline of factors that should be considered in developing a lighting design. The factors were based on the recommended practices of the society, namely: the purpose and objectives of the lighting design; environmental conditions and requirements; effects of structural features; lamp and luminaire selection and maintenance (Nuckolls, 1983). It is apparent that every step was taken to see that the lighting designers followed guidelines to consider the qualitative aspect of lighting.

Willson (1984) suggests that the term 'lighting controls' has usually meant dimming and switching systems to most engineers and lighting designers, and probably has meant little if anything to most interior designers until very recently. Willson says that, the control of light also involves the quality of light and how one uses it, just as much as how one dims or turns light on or off. Quality of light involves various factors such as color rendition, comfort, balance, glare control, light intensity, providing variety and

interest, light as it affects behavior, health and vision (Wilson, 1974; Willson, 1984).

The interior environment is a space filled with various colors of materials and finishes. It is critical that these colors appear true and acceptable under the artificial light to the human eye. It is also essential that these artificial light sources render the human skin flattering and acceptable since this has a direct impact on how individuals feel and perform in an environment (Willson, 1984; Nuckolls, 1983). Keeberg (Wilson, 1986) believes that attention needs to be directed in selecting colors under the right sources, since color is used to define purpose, products, planes, and shapes. Keeberg adds,

> we do not use color as art; we use color artfully. The art however is not in the color itself but in the definition of heightening of perceptual stimulation as the light strikes interlacing surfaces. Color is used to demystify a building by increasing its comprehension" (p. 32-33).

Comfort is another aspect of quality of light. Comfort can be achieved in a space by providing visual relief of contrast in light levels within a space. By providing a combination of light sources and by using levels of light within the space and also providing planned dimming and switching controls, one can achieve a comfortable environment as well as save energy thereby cutting down cost (Willson, 1984).

Light and its impact on vision are gaining importance in the present day due to the shift in the population to the older age group. The average age of the office worker is getting older. If seven

eighths of our perceptions are through sight, it becomes obvious that sight becomes even more important as other senses deteriorate (Nuckolls, 1981). If workers of all age groups both young and old are to function comfortably and efficiently in an environment, it is essential that special attention be directed toward the seeing problems. One needs light in order to see. The quality and quantity of light affect the seeing process.

The eye is affected by a number of normal aging processes such as coloring, fluid secretions, iris openings, lens changes, muscle structures, visual acuity (the eye's ability to perceive small detail), contrast sensitivity, hue discrimination, glare sensitivity, depth of focus, adaptation, and accommodation (Nuckolls, 1981). It is clear that older people need higher levels of illumination to do a task (IES Lighting Handbook, 1981) but are very sensitive to extremes in light intensity such as direct and indirect glare. Older workers also prefer task mounted lamps to overhead illumination (Nuckolls, 1981). In order to provide a comfortable environment for the older population one needs to pay special care to the needs of elderly by providing a safe, functional, easy to operate lighting design.

"After 110 years of existence and generation of our dependence upon it, man-made illumination is only now coming into its own as a serious design factor and not just a decorative element" (Torrice and Ro Logrippo, 1989). The authors say, there is more to light than just its looks. The wavelength compositions in artificial lamps are cause for concern to individuals using them as well as installing them.

In recent times several researchers are studying the effects of artificial light on health. Ott, has been studying the effects of full-spectrum light on living organisms for the past thirty five years. Some of Ott's studies indicated that fluorescent lighting lacked the ultraviolet rays as compared to sunlight. The lack of the full spectrum (inclusive of the ultraviolet rays) in the fluorescent caused ill effects on whatever life form it was illuminating. Ott's studies showed links between the use of standard fluorescent lighting and hypertension, headaches, insomnia, fatigue and decreased rate of calcium absorption. When full spectrum light sources were used in environments, there was an increase in the rate of intestinal calcium absorption of individuals using that space. Such an increase usually occurs when individuals are exposed to sunlight (Torrice, and Ro Logrippo, 1989).

Neonatal jaundice, seasonal affective disorder- which is a form of depression caused due to lack of sunlight during winter months, and some types of sleep disorders are being treated successfully by exposing these individuals to doses of full spectrum light (Smith, 1986). Fred Mendolson another proponent of full spectrum light for health feels it is the responsibility of designers and architects to take care of the ambient light quality in buildings which directly impacts the sick building syndrome. Ott compares light to food which is needed by our body for nourishment. He adds that the wrong kind of food can make us ill and the right type can keep us feeling good (Torrice and Ro Logrippo, 1989). Recently, questions about the validity of the full spectrum lights having any beneficial

aspects of ultra violet has been raised by government officials (Henkenius, 1990).

Just as light impacts health, studies also indicate that light affects behavior, thereby emphasizing the importance of light in the design of interior environments. Several studies have indicated that light can be used to manipulate perception and the resultant behavior. Research indicates that individuals are attracted to bright surfaces and gravitate to areas that are brightly lit. Taylor and Socov (1974) suggest that the light's involuntary attraction power depends on the degree of contrast. Flynn and Spencer's (1977) study suggests that observers who are unfamiliar with a space will move toward areas where color is predominant and toward areas of high levels of brightness. Nuckolls (1983) believes that strong light and color patterns that oppose the spatial information results in disorientation and spatial overload which results in distraction and inability to comprehend information cues. Additionally, communication improves as the intensity of illumination on people in moderately close proximity increases. As the intensity of illumination decreases between people and increases on areas surrounding them, separation increases (Nuckolls, 1983).

Based on the review of literature a good lighting design should meet several goals. These include: promote a sense of well being, provide for proper visibility and atmosphere, enhance object appearance, consider composition of the space, be conducive and compatible for optimal performance of task, and consider economic and maintenance factors. Further the designer should be aware of

how much light to provide for a specific activity in a space and understand how that light affects the behavior, health, and productivity of the user. Additionally in a rapidly changing field like lighting design, it is essential for the professional to keep up with the changes in the industry and/or get technical assistance from lighting designers who specialize in the use of light.

Lighting Knowledge

"Lighting design is based on a mobile technology and art" (Nuckolls, 1983, ch 24). Technical advances are made at an increasing rate in the lighting industry. If individual interior designers are to stay abreast of this information, it is necessary that they maintain a relationship with lighting manufacturers and distributors by attending lighting shows and demonstration facilities. The most important step to take in learning a visual vocabulary is to obtain and try new lamps and fixtures to see for oneself what effects they can or cannot produce (Willson, 1985a; Steffy and Brown, 1987).

"The problem with most designers, is that they lack the basic knowledge, the foundation of the modern tools of light and what their limitations are. There really is no big mystique to the subject" (Feder, 1978, p.134-139). Quigley (King, 1989) comments, it is a "personal defeat to find the perfect decorative fixture for a job after having designed a custom fixture for the same job. . . . professionalism is knowing the product that is out there and making it available to my design team" (p. 98-99).

Steffy (Steffy and Brown, 1987) suggests that solving a lighting design problem usually entails hard work. Steffy emphasizes that one needs to stay abreast of technology in the field of lighting as well as in other fields of technology to provide insights into emerging technologies and trends in the field of lighting. Additionally Steffy suggests discussion with colleagues to generate, evaluate, and re-evaluate ideas.

There are several resources suggested by Nuckolls (1978) to gain more knowledge on interior lighting and its application. Nuckolls considers the IES handbook as the bible of lighting designers and recommends that individuals dealing with light have one. IES publications give helpful hints on lighting for specific applications such as church, health care facilities, libraries, merchandising, office, school and residence. Some books listed as sources for lighting design by Nuckolls, are his book 'Interior Lighting for Environmental Designers'; Faber Birren's 'Light, Color and Environment'; Louis Erhardt's 'Radiation, Light and Illumination'; Lam's ' Perception and Lighting as Form givers to Architecture'; Phillip's 'Planning your Lighting'; and the classic text titled 'Architectural Lighting Graphics' by Flynn and Mills. A recent contribution to interior lighting was made by Kellog Smith and Bertolone through their book 'Bringing Interiors to Light'.

Lighting Design and Application (LD+A); International Lighting Review (ILR), are two publications that look at design oriented lighting developments both in products and research. Architectural lighting; and Lighting Dimensions are magazines that are more application and product oriented. The Journal of

Illuminating Engineering Society is oriented more toward technical research and product design. Several interior design, and architecture journals/magazines deal with the topic of light in most of the issues.

Nuckolls (1978) advises those interested in pursuing formal lighting education to contact departments within universities or colleges that teach interior design, environmental design, architecture, or consumer sciences. Mintz says,

> The best training is in the theater, because you do have to be technically competent, and by actual practice - by working with the lighting and manipulating with your bare hands, you get the aesthetic side. Once you have had the experience in the theater, it is very easy to translate it to architecture (Mintz, 1974, p. 96).

Nuckolls (1978) also suggests General Electric sponsored programs at Nela Park at Cleveland. Publications on basic lighting design by lamp manufactures such as Sylvania, Westinghouse, General Electric, Duro Test are reliable and useful. Information provided by lighting equipment manufacturers, sales agents, electrical utility companies, and lighting stores are useful but caution must be used in interpreting the free information, since most of the these individuals are familiar with only their products and are biased.

Shemitz and Walker (1982b) summarize that the most innovative designer is often limited by the lack of knowledge of what is available in the industry of lamps and fixtures. Knowledge of lamps and fixtures and their characteristics is essential to

manipulate light so that the right amount of light and the right shape of light is placed were it is needed.

Lighting Education

Education exists to facilitate and maintain a learned society (Kierstead, Schiller, and Van Avery, 1981). In a field like interior design the relationship between interior design education and professional practice is strong, but a closer look indicates there are philosophical differences between the two groups (Harwood, 1989). Harwood states,

> The educators goal is to develop the mind while expanding specific subject content. On the other hand, practitioners want students who are fully prepared upon graduation to work as practicing interior designers in the field. . . . . The practitioners goal is to produce work while using the mind for evaluation (Harwood, 1989, p. 42).

The relationship between the education and practice is recognized by Foundation for Interior Design Education Research (FIDER). In the 'Standards and Guidelines' a statement in the preamble regarding this relationship is made. "A sound curriculum for professional interior design education must provide a balance between broad cultural aspects of education on the one hand, and the specialized practical content integral to the profession on the other" (Foundation for Interior Design Education Research, 1988, preamble).

Thus, it is important to evaluate the professionals with regard to lighting, and what resources they use in their practice of lighting.

This evaluation could provide the current lighting educators an idea of what is considered important by the professionals, and some of these concepts could be included in the curricula.

The content units and achievement levels listed in the FIDER (1988) Standards and Guidelines, indicate content areas that are required in an interior design curricula, and also indicates the level of achievement that is expected for each of those areas. Achievement is measured at three levels: 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); and competency (a highly developed ability to apply concepts and information to specific tasks). The content of lighting appears in three sections as follows:

Residential Design: Design attributes of materials, lighting, furniture, textiles, color ---- Competency.

Non-Residential Design: Design attributes of material, lighting, furniture, textiles, color ---- Competency.

Technical knowledge: Building systems, i.e HVAC, lighting, electrical, plumbing, acoustics ---- Understanding.

Harwood (1989) compared Flaugher's (1988) list of twenty five knowledge areas from the interior design job analysis study; the FIDER Achievement Levels; and the National Council for Interior Design Qualification (NCIDQ) performance levels. The comparison showed categories of overlap. Lighting was one of the four knowledge areas that overlapped across the three lists, indicating that lighting was considered extremely important in both practice

and education. Approaches to teaching lighting are mainly quantitative, qualitative or a combination of both. Smith and Bertolone (1986) comment, that architectural engineering programs of the 1950's idealized the philosophy of uniformity with an energy efficient type of lighting design, which was neither attractive, exciting nor human. Smith and Bertolone further comment that designers of today try to incorporate aesthetics and utility in their design thereby making it more humanistic and efficient.

In the preface of their book 'Bringing Interiors to Light' (Smith, Bertolone, 1986), the authors state,

> We offer a simple, secure procedure that will enable professionals to weave lighting into the fabric of design concept and decisions. This procedure derives from a two-fold thesis: 1) The proper person to coordinate lighting designs is the interior designer or interior architect, and 2) lighting and finishes should be selected simultaneously. This thesis is based on Flynn's studies that have proven that human behavior and impression of a space are "cued" by surface brightness (p. 9).

In discussing lighting education, two schools - University of Kansas offering Architectural Engineering degree with an option in Illumination/Electrical, and Parsons School of Design offering a Masters (MFA) degree in Architectural Lighting Design, were cited in Lighting Design and Application (O'Mahony, 1985) as excellent programs who have two approaches to the same goal: quality lighting education. The curriculum in the Architectural Engineering program at Kansas is divided into three parts emphasizing core

courses in architectural engineering, and courses in electrical systems and illumination. Students in this program are also able to write software to solve lighting design and application problems. Lighting application and business practices are also emphasized in the curriculum. Helm, the director of the program is an advocate of students having access to a lighting laboratory in order to have practical, hands-on experience with the latest equipment and lamps. "Parson's approach to lighting education is humanistic or user-oriented . . . . The MFA program in architectural engineering emphasizes architectural applications rather than engineering criteria, although study is required in both disciplines" (O'Mahony, 1985, pp. 25-26). Nuckolls who was the director of the program stated,

> We start with the end user and move to the mechanics. students study the human seeing process first, followed by the psychological reactions to what is seen, the object being looked at, and the space in which the object is located. The environmental designer needs to know why and how technical information is applied. The art, as well as the science, of illumination is stressed (O'Mahony, 1985, p. 25).

Information and literature about the current state of lighting education is not readily available. But, in an interview conducted by LD+A (1986), young lighting designers who had formal education in lighting were asked: "What did you learn in school"? and "What do you wish you had learned"? The answers to these two questions give one an idea how young professionals with limited experience in industry cope in the lighting design world with the educational

background received in lighting. The professionals, realized upon graduation that they lacked the knowledge of the complex process of documentation and the transmission of information from consultants to architect to construction manager to general contractor to distributor to manufacturer. They believe their education prepared them with the science of illumination, and at work they are learning the art of illumination. Both the art and science of illumination are critical to lighting design. The lighting professionals wished that they had more exposure in the art of illumination.

It is apparent from the researchers interaction with other interior design educators at IDEC and other state and national meetings, that lighting is being offered or is being developed as a course to be included in the interior design curriculum. Benya (Ruffet, 1985) says,

> The teaching of lighting is extremely immature as a profession and as a educational curriculum. As 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. . . . many schools revert to the professional community (p. 37).

To meet the demands of educating students in the area of lighting, IES realized the need to have qualified lighting educators first. Thus, each year 18 scholarships are offered to lighting teachers to attend a two week lighting workshop. The researcher attended this workshop in summer of 1987. The workshop emphasizes various qualitative and quantitative aspects of lighting to increase the knowledge of the lighting educators, who at the end

of the workshop are more proficient in lighting. Teaching styles are not the emphasis of this workshop.

Changes and trends in the profession should be studied closely by educators so that education keeps pace with the technology and changes in the field. Ginthner (Ruffet, 1985) recognizes, that designers are realizing the importance of light and its affect on space and design elements, and are becoming more sensitive to light. This sensitivity has helped in the reemergence of lighting classes in different disciplines. In trying to stay abreast of technology lighting educators (Ruffet, 1985) believe, that it is the responsibility of the educational institution to provide as many experiences as possible to the student, to cope with the state of the art in the field. The students need to be exposed to the use of computers and lighting software for calculating quantity of light and graphically representing a lighting concept, since there is a movement in this direction. Further, students need to be exposed to major manufacturers, and their latest products. The lighting educator has a responsibility of keeping up with the latest technologies by attending seminars and conferences as well as reading current professional lighting literature and journals.

Interior designers may not be experts in the field of lighting design but basic competency is expected so that they may perform well in the demanding field of interior environment. Education must take into consideration the role of the interior designer in designing interior environments, and realize designers deal with lighting which impacts the atmosphere and individuals in a space.

It is a challenge for interior design education to meet the changing technologies and needs in the lighting field and provide quality education in lighting. Brandston (Wilson, 1974) states, "important means of achieving the best result from lighting is for the interior designer to generally become more aware of light, himself, and to discipline himself to be concerned with light and light levels at which he feels comfortable" (p. 156).

Curriculum Development

The researcher looked to the field of education to provide basic concepts of developing educational objectives and curriculum. Tyler (1949) addresses, four major questions that need to be considered in developing curriculum and instruction. They are,

1. what educational purpose or objectives should the school or course seek to attain ?
2. What learning experiences can be provided that are likely to bring about the attainment of these purposes ?
3. How can these learning experiences be effectively organized to help provide continuity and sequence for the learner and help him in integrating what might otherwise appear as isolated learning experiences ?
4. How can the effectiveness of learning experiences be evaluated by the use of tests and other systematic evidence-gathering procedures ? (pp. 391-407).

Since the researcher is primarily concerned with aspects of curriculum development, it must be clear that "the objectives are

the goals toward which the curriculum is shaped and toward which instruction is guided" (Bloom, 1956, p. 27). Thus, the formulation and classification of objectives are critical in the curriculum development process. Bloom (1956) comments, " by educational objectives, we mean explicit formulations of the ways in which students are expected to be changed by the education process. That is, the ways in which they will change in their thinking, their feelings, and their actions" (p. 26). Bloom (1956) suggests that the formulation of educational objectives is a conscious effort on the part of the teaching faculty, who might draw on past experiences and also consider several kinds of data. Further, Bloom states, there are three main sources for obtaining objectives:

> One type of source commonly used in thinking about objectives is the information available about the students. What is their present level of development? What are their needs? What are their interests? Another source for objectives is available from investigations of the conditions and problems of contemporary life which make demands on young people and adults and which provide opportunities for them. What are the activities that individuals are expected to perform? What are the problems they are likely to encounter? What are the opportunities they are likely to have for service and self-realization? Another source of suggestions for objectives comes from the nature of the subject matter and the deliberations of subject-matter specialists on the contributions their subject is able to make to the education of the individual (Bloom, 1956, p. 26).

The above criteria discussed by Bloom can form the basis for an evaluation of existing conditions in the field of study. Such an evaluation can offer concepts for the curriculum developers to formulate educational objectives.

Gronlund (1985), believes that although much has been written about instructional objectives in the past, some teachers still ask the question "Why use objectives in teaching?". Gronlund, categorizes specific answers into three purposes: "First, to provide direction for instruction. Second, to provide guidelines for testing. Third, to convey instructional intent to others" (1985, p.1). These purposes can be stated in educational objectives in different ways. A common way in which the educational objective is stated is in terms of what the teacher is going to do, thereby emphasizing the teaching-learning process rather than the learning outcome (Gronlund, 1985). Educational researchers are concerned with the changes produced in individuals as a result of educational experience (Bloom, 1956). "The learning experiences provided during the teaching-learning process are not ends in themselves but means to ends. The subject matter, the teaching methods, and materials used in instruction are to be viewed as tools to bring the desired learning outcomes" (Gronlund, 1985, p. 3).

There are numerous guides to develop instructional objectives in the field of education. A majority of the educational researchers still utilize the model of the 'Taxonomy of Educational Objectives', developed by a committee under the direction of Bloom (1956). The taxonomy provides a classification for educational objectives which consists of a set of general and specific categories which

encompass all possible learning outcomes from instruction. Bloom comments:

> We are of the opinion that although the objectives and test materials and techniques may be specified in an almost unlimited number of ways, the student behaviors involved in these objectives can be represented by a relatively small number of classes. Therefore, the taxonomy is designed to be a classification of the student behaviors which represent the intended outcomes of the educational process. . . . We are not attempting to classify the particular subject matter or content. What we are classifying is the intended behavior of students (Bloom, 1956, p. 12).

If the taxonomy is to prove a useful tool for teachers, it should provide a basis for suggestions as to methods for developing curricula, instructional techniques, and testing techniques (Bloom, 1956). The taxonomy is divided into three domains: (1) the cognitive domain, (2) the affective domain, and (3) the psychomotor domain. 'The cognitive domain includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills' (Bloom, 1956, p. 7). The affective domain includes those objectives that describe attitudes, interest, values, appreciation and methods of adjustment (Krathwohl, et. al., 1964). The psychomotor domain deals with the manipulative or the motor-skill area (Krathwohl, Bloom, and Masia, 1964). Each domain is subdivided into categories and arranged in hierarchical order, from the simple to complex outcomes. The cognitive domain starts with the simple category of

knowledge outcomes and proceeds to more complex categories of comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956). The affective domain starts with the simple receiving outcomes and proceeds to increasingly complex levels of responding, valuing, organization, and characterization by a value or value complex (Krathwohl, et. al., 1964). The psychomotor domain starts with the category of perception and proceeds to set (mental, emotional, and physical set), guided response, mechanism, complex overt response, adaptation, and origination (Simpson, 1972). Gronlund summarizes,

> A review of these categories and the illustrative objectives and action verbs accompanying them should aid in (1) identifying objectives for a particular instructional unit, (2) stating objectives at the proper level of generality, (3) defining objectives in the most relevant terms, (4) checking on the comprehensiveness of a list of objectives, and (5) communicating with others concerning the nature and level of learning outcomes included in a list of objectives (1985, p. 35).

The process of developing curricula and instruction can be summarized, as: first defining the purpose of education, second formulating objectives to achieve the right learning outcome, Third relating objectives to classroom instruction. Here the tools of instruction such as the content, teaching method, and materials used in instruction need careful attention if the desired learning outcome is to be achieved. The process of developing curricula should also

include using the instructional objectives in test preparation and evaluation of outcomes (Gronlund, 1985).

Bernecker (1983) used the educational models developed under the direction of Bloom (1956), to develop instructional objectives for lighting education within an architectural engineering curriculum. Bernecker's lighting curriculum was solely developed using the educational models.

Summary

The history of lighting design indicates that lighting design has shifted from a quantitative field to a qualitative field (Grenald, 1986; Nuckolls, 1981). The element of light has the potential of impacting the quality of the space as well as the behavior and impressions of the user of the space (Grenald, 1986; Nuckolls, 1983; Willson, 1984; Flynn, and Spencer, 1977). Realizing the potential light has on the space and people, architects and interior designers are paying more attention to the use of light in their design of environments (Mayer, 1989; Smith and Bertolone, 1986).

Additionally, design programs are including lighting coursework in their curricula. The importance of light is apparent in the standards and guidelines for FIDER (Foundation for Interior Design Education Research, 1988) which indicated the component of lighting as a requirement for a sound interior design curriculum. Further, the study by Harwood (1989) indicated that the component of light was considered important by both the design profession and education.

Technological advances and changes in the lighting field occur at a rapid pace. To stay abreast of lighting technology and trends it is essential for one to attend lighting related classes, workshops, conferences and seminars. Further, it is important to review product literature, visit lighting installations, and interact with lighting professionals and manufactures in order to be aware of lighting developments (King, 1989; Steffy and Brown,1987; Nuckolls, 1983).

Benya (Ruffet, 1985) believes that lighting instruction and curricula are in their infancy. Long (Ruffet, 1985, p. 31) comments, "I have noticed a significant change in the awareness of architects and interior designers to lighting design. This awareness is slowly being reflected in the school programs". In order to have a good education and a sound curricula, Bloom (1956) suggests that the purpose and educational objectives need to be specified clearly. Bloom also suggests sources for obtaining objectives are ' . . . available from investigations of the conditions and problems of contemporary life which makes demands on young people and adults and which provides opportunity for them . . . ' (Bloom, 1956, p. 26).

CHAPTER III

METHODOLOGY

Introduction

Chapter III describes the research design, methods and procedures for this study. Also discussed is the criteria used for the selection of the sample. The description of the instruments, the data collection method and types of analysis that were used in this study are discussed.

Research Design

This research is an assessment and an evaluation study. According to Best:

> Assessment is a fact-finding activity, describing conditions that exist at a particular time. No hypotheses are proposed or tested, no variable relationships are examined, and no recommendations for action are suggested (Best, 1986, p. 23).

Best states:

> Evaluation is concerned with the application of its findings and implies some judgement of effectiveness, social utility, or desirability of a product, process, or program in terms of

carefully defined and agreed-upon objectives or values (Best, 1986, p. 24).

Best believes that "In charting a course of action, several sorts of information may be needed. These data may be gathered through the process of assessment and evaluation methods" (Best, 1986, p. 102). According to Best (1986), there are three kinds of information needed in the process of assessment and evaluation . They are: information based upon 'present conditions'; information concerned with 'what we may want' (what conditions are desirable, or what do experts consider to be adequate or desirable); information that involves 'how to get there' (opinions of experts regarding how to reach the goal). Best believes that a study need not include all the steps in achieving the goal, "it may make a valuable contribution by clarifying only one of the necessary steps- from description of present status to the charting of the path to the goal" (Best, 1986, p. 103).

In this study the researcher assessed the conditions/status of certain aspects of lighting among the design professionals and lighting educators. Additionally, the study assessed what conditions are desirable in a interior lighting curriculum as viewed by the design professionals and lighting educators. Information from this assessment was evaluated and recommendations for interior lighting curricula in the design programs were made.

Description of the Sample

Design Professionals: The population for the design professionals in this study consisted of professional members of the American Society of Interior Designers (ASID); professional members of the American Institute of Architects (AIA); full members of the Illuminating Engineering Society (IES); and all members excluding the education members of the International Association of Lighting Designers (IALD). The membership for each group varied.

Since the population for the ASID, AIA, and IES groups was large, a sample was selected. "A sample is a part of the population under study selected so that inferences can be drawn from it about the population" (Neter, Wasserman, and Whitmore, 1982, p. 188). The total population of ASID was 20,000 and that of IES was 12,000 members. Since a national listing of the professional members of ASID, and full members of IES were not available for the public, the researcher purchased 2000 labels from ASID and 1000 labels from IES. The request for the labels was first initiated via telephone followed by a letter (Appendix A). In the letter the main purpose of the study was stated. The researcher requested that the sample be selected randomly by using the zip code in order to achieve a cross section of design professionals. A sub sample of 300 for each of the groups (ASID, IES) was chosen randomly from the larger sample. The AIA group was selected from the 1989 AIA Profile book which is available to the public. The population of both members and associate members of American Institute of Architects consisted of

53,755 as of December 1988. Six AIA members from each state in the United States were selected randomly for a sample of 300. The sample for the IALD group was taken from the 1990 national membership directory. Approximately 350 members were listed in the directory. Out of this 66 members were not considered for the study since they were either education, or international members (since this study was concerned with the US professionals). Therefore out of a population of 350, a sample of 284 lighting designers was selected.

Best (1986) comments, that large sample sizes should be used for survey type, and mailed questionnaire studies. Best adds that since the return rate for questionnaire studies are usually small, the researcher needs to consider a larger initial sample mailing to compensate for the sample size. Thus, a sample of 1184 was selected to compensate for return rate.

Design Educators: The population for the design educators consisted of the lighting educators in the architecture and interior design programs in the United States of America. In order to get a sample of architecture educators, a total of 114 schools which were listed in the 1988-1989, Association of Collegiate Schools of Architecture (ACSA) were considered. There were 102 full member schools and 12 candidate member schools which belonged to ACSA. Even though the ACSA directory identifies faculty names and the courses taught in each school, not all schools gave this specific information. Thus, a decision was made to send questionnaires to the chair-person of each member school, requesting him/her to forward the questionnaire to the lighting design faculty.

To achieve the sample for the interior design lighting educators, interior design programs with Interior Design Educators Council (IDEC) members were selected from the 1989-90 membership directory. Two hundred and eighteen programs were listed, out of which 12 programs were not considered for the study because they were extension or overseas programs. Therefore 206 programs were identified for the study. Since, a list of lighting educators for these programs was not available, questionnaires were sent to the Chair-person requesting him/her to forward it to the appropriate lighting design educator. A summary of the sample is provided in table I.

TABLE I

SAMPLE SUMMARY

	Population	Sample	Useable sample
Professionals:			
AIA	53,000+	300	245
ASID	20,000+	300	290
IALD	350	284	251
IES	12,000+	300	290
Educators:			
ARCH	114	114	114
ID	218	206	197

The Instrument

Two instruments (Appendix A) were developed for this study. One for the professional group and the other for the educators. Questions were formulated based on the objectives and purpose of this study. The questionnaire was developed to assess perceptions of design professionals and lighting design educators regarding lighting knowledge; lighting resources; importance of inclusion of lighting variables in interior lighting curriculum; and background information of design professionals and educators. The main difference between the two questionnaires was the background information section.

The questionnaire consisted mainly of closed ended questions, with a few open ended questions in order to assess opinions. The content of the questionnaire was pre-tested by a panel of design professionals and lighting educators. Clarity and the length of the questionnaire were of concern to individuals who participated in the panel. Based on the comments of the panel members the instrument was revised.

Data Collection

Data were collected from the lighting design professionals group in July 1990 and data from the lighting design educators were collected in September 1990. This decision was made since the educators are usually out for the summer semester and return to school during fall semester. A modified version of Dillman's Total Design Method was used to collect data (Dillman, 1978). The entire

package was mailed to all individuals in the sample and consisted of a cover letter, the questionnaire, and a postage paid return envelope. The cover letter (Appendix A), briefly explained the purpose of the study and its benefit in impacting the quality of lighting education. A follow up postcard was mailed to all professional members in the sample within 10 days (Appendix A). The postcard thanked individuals that had returned the questionnaire and acted as a reminder to those who had not responded. Since the names of education members in the sample were not available the questionnaires were sent to the chair-person who was requested to forward the package to the lighting educator. Follow up post cards were not sent to the education members since the follow up could not be directed to a specific individual. The survey method of collecting data yielded 335 usable questionnaires for the professional group for a total response rate of 31.1%. As for the educator group, the survey yielded 110 usable questionnaires for a total response rate of 35.3%. The individual group response rates for the professionals are shown in table II.

TABLE II

SAMPLE RESPONSE SUMMARY

	Useable sample (n)	Return Rate (n)	%
Professionals:			
AIA	245	50	20.4
ASID	290	83	28.6
IALD	251	105	41.8
IES	290	97	33.4
Total	1076	335	31.1
Educators:			
ARCH	114	38	33.3
ID	197	72	36.5
Total	311	110	35.3

Analysis

Analysis of the data involved several statistical procedures. Inter Item reliability for three major categories of the instrument was conducted. The three categories analyzed were: 'knowledge' (acquiring of lighting knowledge and its value to their careers); 'resources' (use of lighting resources and its value to their careers); and 'education' (importance of inclusion of lighting concepts in

interior lighting curriculum). Reliability for 'knowledge' was completed separately for the professionals and educators since, there was one question that differed. Reliability for 'resources' and 'education' were completed together for both the professional and educator groups since questions in both these categories were identical. The Cronbach Coefficient Alpha for standardized variables scores for the three categories was over .75 indicating high reliability (Table 111).

TABLE 111

RELIABILITY/CRONBACH COEFFICIENT ALPHA FOR STANDARDIZED VARIABLES

Category	Professionals	Educators	Both
knowledge	.759	.836	
resources			.780
education			.887

Other statistical analysis completed included analysis of variance, means, frequency and t-test. The t-test was conducted to compare means of various dependent variables such as knowledge, resources, and education between professional and educator groups. The t-test was also conducted to compare means

between architecture and interior design educators. Analysis of variances was conducted to compare means of various dependent variables such as knowledge, resources, and education among the professionals such as, architecture, interior design, and lighting professionals (IALD and IES). Additionally, post hoc analysis included the Duncan's multiple range test.

A SELECTED BIBLIOGRAPHY

Bell, L. (1912). The Art of Illumination (2nd ed.). New York: Praeger.

Benya, J. (1988, May). Should lighting designers be licensed. Architectural Lighting, 2(5), pp. 42-44.

Bernecker, C. A. (1983). Instructional objectives for lighting education within an architectural engineering curriculum. Lighting Design and Application, 13(11), 23-31.

Best, J. W. (1986). Research in education. New Jersey: Prentice-Hall, inc.

Birren, F. (1982). Light, color and environment. New York: Van Nostrand Reinhold.

Bloom, B. S. (1956). Taxonomy of Educational Objectives. New York: David McKay Company.

Brown, N. (1989, October). Fran Kellog Smith on illusions with light and color. Designers West, 36(13), pp. 106-107, 140-141.

Caminada, J. F. (1983). Lighting Design and Application, 13(8), 16-21.

Collins, B. L. (1975). Windows and people: Psychological reaction to environments with and without windows (NBS Building Science Series No. 70). Washington, DC: National Bureau of Standards.

Designers West (1989, October). Editor's comments. Designers West. 36(13), p. 64.

Dillman, D. A. (1978). Mail and telephone surveys: The total design method. New York, Ny: Wiley.

Feder, A. (1978, December). Views on light. Interior Design, pp. 134-139.

Flaugher, R. L. (1988). Report of job analysis of interior design. New York: National Council for Interior Design Qualification.

Flynn, J. E., Hendrick, C., Spencer, T., & Martyniuk, O. (1979). A guide to methodology procedures for measuring subjective impressions in lighting. Journal of Illuminating Engineering Society, 8(2), 95-120.

Flynn, J. E., & Spencer, T. J. (1977). The effects of light source color on user impression and satisfaction. Journal of Illuminating Engineering Society, 6(3), 167-179.

Flynn, J. E., Spencer, T. J., Martyniuk, O., & Hendrick, C. (1973). Interim study of procedures for investigating the effect of light

on impression and behavior. Journal of Illuminating Engineering Society, 3(1), 87-94.

Forbes, S. A. (1984). [Interview by Tony Naples]. Lighting Design and Application, pp. 21-24.

Forbes, S. A., & Ergas, J. M. (1980, April). Lighting consultants and how to work with them. Interior Design, pp. 152,154,156.

Foundation for Interior Design Education Research. (1988). Standards and guidelines/ first professional degree level. (FIDER Form 402). Grand Rapids, MI.

Goldberg, P. (1985). The relationship of light to architecture. Lighting Design and Application, 15(9), 14-24.

Grenald, R. (1986). Perception the name of the game- Architecture lives in the seeing. Lighting Design and Application, 16(7), 21-24.

Gronlund, N. E. (1985). Stating objectives for classroom instruction. New York: Macmillian Publishing Company.

Harwood, B. (1989). Patterns: A view of the relationship between Interior Design education and practice. Journal of Interior Design Education and Research, 15(2), 41-50.

Heerwagen, J., & Heerwagen, D. (1986). Lighting and psychological comfort. Lighting Design and Application, 16(4), 47-51.

Henderson, J. (1988, April). Lighting world special. Interiors, p. 3.

Henkenius, M. (1990, December/January). The right light, more than meets the eye. Practical Home Owner, pp. 28,29,64.

IES Lighting Ready Reference (1985). Illuminating Engineering Society of North America.

IES Lighting Handbook (1981). Application volume, Illuminating Engineering Society of North America.

Kierstead, F. D., Schiller, S. L., & Van Avery, D. (1981). The future in education: Problems, possibilities, and promise. (Special Topic Edition). Journal of Thought, 16(3).

King, C. S. (1989, October). Power play. Designers West, 36(13), pp. 98-101.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). Taxonomy of Educational Objectives Handbook II: Affective Domain. New York: David Mc Kay Company.

Lighting Design and Application (1986). Four young lighting designers speak out. Lighting Design and Application, 15(3), 10-12.

Lighting Design and Application (September, 1972). The unified approach to lighting design. Lighting Design and Application.

Lighting Design and Application (July, 1971). The design approach to lighting design. Lighting Design and Application.

Lighting Handbook . GTE Sylvania (1977). Sylvania Lighting Center, Danvers, Massachusetts.

Markus, T. A. (1967). The function of windows: A reappraisal. Building Science, 2, 97-121.

Marsteller, J. (1987, February). Philosophy of light- Recalling Richard Kelly's three functional elements. Interior Design, pp. 78-80.

Masello, D. (1990). A lighting maestro looks back and forward. Architectural Record Lighting (supplement to architectural Record). PP. 14, 15 & 41.

Mayer, L. (1989, October). [Interview with six lighting designers]. What's happening in contract lighting. Contract, 31(10), pp. 28,32.

Mintz, D. A. (1974, December). The role of the lighting consultant. Interiors, pp. 94-97.

Neter, J., Wasserman, W., & Whitmore, G. A. (1982). Applied statistics. Boston: Allyn and Bacon, inc.

Nuckolls, J. (1978, September). Help with lighting design. Interior Design , pp. 258-259.

Nuckolls, J. (1981, August). On sight. Interiors, pp. 22-29, 106.

Nuckolls, J. (1983). Interior lighting for environmental designers. New York: John Wiley & Sons.

O'Mahony, T. (1985). University of Kansas and Parsons School of Design - Two approaches to lighting education. Lighting Design and Application, 15(2), 24-26.

Ruffet, P. (1985). Lighting Education: An overview. Nine educators speak out on the current state of education in lighting. Lighting Design and Application, 15(2), 31-43.

Shemitz, S. R., & Walker, G. (1982a, May). Designing with light: First order of business- Negotiating the work letter. Interior Design, 53, pp. 256-259.

Shemitz, S. R., & Walker, G. (1982b, September). Designing with light. Interior Design, pp. 224-227.

Simpson, E. J. (1972). The classification of Educational Objectives in the Psychomotor Domain. Vol. 3. Washington: Gryphon House.

Smith, R. (1986). Light and health - A broad overview. Lighting Design and Application, 16(2), 32-40.

Smith, F. K., & Bertolone, F. J. (1986). Bringing Interiors to Light. New York: Whitney Library of Design.

Steffy, G., & Brown, J. L. (1987). A philosophy on the solving of

lighting design problems. Lighting Design and Application, 17(2), pp. 13-15.

Styne, A. F. (1989, October). [Interview by Designers west]. Color and Light. Designers West, pp. 102-103.

Taylor, L. H., & Sucov, E. W. (1974). The movement of people toward light. Journal of Illuminating Engineering Society, 3(3), 237-241.

Torrice, A. F., & Ro Logrippo,. (1989, October). An age of enlightenment. Designers West.

Tyler, R. W. (1949), Achievement Testing and Curriculum Construction. In E. G. Williamson (Ed.) , Trends in student personnel work (pp. 391-407). Minneapolis, MN: University of Minnesota Press.

Wells, B. W. (1965). Subjective responses to the lighting installation in a modern office building and their design implications. Building Science, 1, pp. 57-68.

Willson, D. W. (1984, November). The control of light. Interior Design, pp. 248-253.

Willson, D. W. (1985a, January). The control of light. Interior Design, pp. 296, 297.

Willson, D. W. (1985b, March). The control of light. Interior Design, pp. 266-270.

Willson, D. W. (1987, February). The control of light. Interior Design, p. 191.

Wilson, F. (1986). [Interview with Ron Keeberg]. Architecture, light color, form and function - Generating attitude and comprehension. Lighting Design and Application, 16(7), 30-33.

Wilson, J. (1974, May). Lighting the inner spaces. Interior Design, pp. 144-157.

CHAPTER IV

ASSESSMENT OF PERCEPTIONS OF INTERIOR DESIGNERS, ARCHITECTS, AND MEMBERS OF THE LIGHTING INDUSTRY REGARDING LIGHTING CONCEPTS

MANUSCRIPT FOR PUBLICATION

JOURNAL TITLE: LIGHTING DESIGN AND APPLICATION

ASSESSMENT OF PERCEPTIONS OF INTERIOR DESIGNERS, ARCHITECTS, AND MEMBERS OF THE LIGHTING INDUSTRY REGARDING LIGHTING CONCEPTS

Abstract: Research in lighting indicates both a direct and indirect relationship between lighting conditions in a space and its effect on the user's behavior, perception, and health. Professionals dealing with interior environments use the element of light to manipulate and enhance the quality of the space. This study evaluates perceptions of designers regarding lighting knowledge, resources, and education. The sample for this study includes professionals from interior design and architecture as well as the lighting industry. Statistical analysis on data from the design professionals, using analysis of variance, assessed the similarities and differences for variables under the three categories of knowledge, resource, and education. The professionals considered the majority of the concepts under the education category as important to include in today's interior lighting curriculum. The assessment also indicates several concepts in the three categories that all the professionals considered valuable or important to their careers and education.

Introduction

Studies of interior environments indicate that lighting affects the space, as well as the user of that space, directly and indirectly (Nuckolls, 1983; Taylor and Sucov, 1974; Flynn and Spencer, 1977). Since lighting is considered an important element of design, it is essential that individuals dealing with shaping interior environments are aware of its potential. Mintz states, "I think of light as a building material . . . . You can do more with lighting to change the aspect of the room - whether the color, the size, or emphasis - than you can with any other traditional building material" (Wilson, 1974, p. 148).

A majority of the architectural and interior design projects today utilize the special effects of light to create functional and aesthetically pleasing environments (Forbes, 1984). Associations such as Illuminating Engineering Society (IES), and International Association of Lighting Designers (IALD) foster professional growth activities. They sponsor funds, research grants, workshops, seminars, conferences, and intern programs for students, design professionals, and educators interested in improving their knowledge of lighting. Professional groups like the American Institute of Architects (AIA) and the American Society of Interior Designers (ASID) are including lighting and its applications as topics in national conferences, workshops and continuing education units. These activities indicate emphasis is being placed on lighting as a critical element in design.

Design professionals, who realize the importance of lighting

in their design, are using lighting consultants to ensure sound lighting solutions to complement the overall design. Forbes, (1984) a prominent interior designer, comments that her firm uses a lighting consultant in all projects to make the desired lighting effects become a reality. Additionally, the consultant's skills and talents aid the creation of lighting designs that follow codes and are relatively free of maintenance problems. Further, Forbes believes in continuing education for the professional in order to keep up with the technologies in the field.

Interior designers and architects are trained to use the elements of design to manipulate space to make it more livable, functional, and aesthetically pleasing. To manipulate an element, one needs to fully understand its potential. Just as the professionals are becoming aware of the use of light, curricula developers are introducing course work in light and lighting design in several architectural and interior design programs across the nation.

Like the other design professions lighting design is a practicing field in which the professionals keep pace with the ever changing technology and applications. It is an assumption that design professionals dealing with the element of light in their day to day professional practice are more aware of lighting factors, resources, and activities that are critical and valuable to the total design of the interior environment. However, there is inadequate documentation of what these professionals consider vital in interior lighting as it relates to their profession and education. Questions needing study include: How did the design professionals

acquire their lighting knowledge? How valuable is it to their career? What resources do professionals use in the field of lighting? Of what value are they to their career? What content areas in interior lighting do they consider important that might be incorporated in the interior lighting curricula? What is the educational background of the professionals? What are the lighting trends forecasted by the design professionals? The results of such studies could provide useful information regarding interior lighting practice of design professionals, and in turn serve the educators as a tool in formulating educational objectives in interior lighting curricula.

Purpose

The purpose of this study is to evaluate perceptions of design professionals regarding various aspects of interior lighting practices and education. Information from this evaluation could provide insights into the perceptions and opinions of the lighting design professionals regarding aspects of lighting which are helpful to developers of interior lighting curricula. Specifically, the objective includes:

1. To assess and compare perceptions of Interior designers, architects, and the members of the lighting industry regarding interior lighting concepts.
    A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their careers.
    B. To assess and compare the perceptions of use and value of

lighting related resources to their careers.

C. To assess and compare the perceptions of importance of inclusion of various lighting concepts in interior lighting curricula.

Research Design

Sample: The sample of design professionals consisted of professional members of ASID and AIA; full members of IES and members of IALD (excluding the education and international members). A proportional random sample of ASID and IES produced a cross section of design professionals from across the nation with a final sample of 300 from ASID and IES. Six AIA members from each state were randomly selected from the 1989 AIA profile book for a sample of 300. The sample for the IALD (n=284) group utilized the 1990 national membership directory.

Best (1986) comments that large sample sizes should be used for survey type and mailed questionnaire studies. Best adds that since the return rate of the questionnaire studies usually is small, the researcher needs to consider a larger initial sample mailing to compensate for the sample size. Thus a large sample of 1184 was drawn to compensate for a lower return rate.

Instrument: Based on the objectives and purpose of this study, questions were formulated to assess perceptions of design professionals regarding lighting knowledge, lighting resources, importance of inclusion of lighting variables in interior lighting curricula, and background information. The maximum possible

scores for the individual variables under each category was five with one being the minimum score. Inter-item reliability revealed a Cronbach Coefficient Alpha for standardized variables scores of over .75, indicating high reliability for each the three major categories 'knowledge' (acquisition of lighting knowledge and its value to their career); 'resources' (use of lighting resources and its value to their career), and 'education' (importance of inclusion of lighting concepts in interior lighting curriculum). The alpha level for each category was: knowledge = .759; resources = .780; and education = .887.

Data Collection: Data collection used a modified version of Dillman's Total Design Method (Dillman, 1978). The package, mailed to the sample, consisted of a cover letter, the questionnaire, and a postage paid return envelope. The survey yielded 335 usable questionnaires for a total response rate of 31.1%. The individual group response rates for the professionals are shown in table IV

Insert Table IV about here

Findings and Conclusions

Analysis using means and frequencies revealed the general characteristics of the sample (Table V).

Insert Table V about here

The majority (83.3%) of the professionals in the sample had college education. Most of the professionals practiced for a number of years ($\overline{X}$=15.41). The area of specialization for the majority (74.8%) of the professionals was commercial design.

The analysis of variance test compared means for each variable in the three major categories - knowledge, resource, and education, between professionals in architecture, interior design and lighting design (IALD and IES). The IES and IALD groups were combined since there was overlap of membership in both these groups. Additionally, post hoc analysis included the Duncan's multiple range test.

Knowledge, resource, and education scores were obtained by summing the responses to questions in each of the three categories. The maximum total score possible for each of the three categories varied due to the number of questions under each category.

The professionals considered the variables under the category of acquiring lighting 'knowledge' to be moderately valuable to their careers with a total score of 47.3 out of a possible score of 75. In the knowledge category (table VI), interior designers rated the acquisition of lighting knowledge through continuing education, workshops sponsored by professional groups, and visits to demonstrations and testing laboratories as significantly higher

than architects and lighting professionals. On-the-job training, and experimentation with new lamps and fixtures rated significantly different by the architects, interior designers and lighting professionals, with the lighting professionals rating them the most valuable.

Insert Table VI about here

Lighting resources (Table VII) received a total score of 17.4 out of a possible score of 35, indicating that the professionals consider the variables under this category to be of lesser value to their career than lighting knowledge. The use of light-level calculation software rated significantly different by the professionals, with the lighting professionals rating it higher than others. The professionals consider the use of colorimeter, and spectroradiometer of little value ($\overline{X}<3.0$) to their practice. This could mean that these resources are very specialized and used only in limited applications of lighting design.

Insert Table VII about here

Lighting 'education' (Table VIII) received a total score of 78.2 out of a possible score of 100. This indicated that professionals

consider these variables as important concepts to be included in today's interior lighting curricula. Participation in lighting competitions rated as less important ($\bar{X}$<3.0) by the professionals to be incorporated in the interior lighting curricula.

Insert Table VIII about here

Five major interior lighting design trends were projected for the future. These included: energy conservation, miniaturization of lamps, human factor/quality, energy efficient light sources with good color rendition, and sophisticated control systems. This could imply that regardless of all the lamps and fixtures currently available in the industry, designers wish to have access to better products in order to provide functional, efficient and comfortable environments.

Summary

The lighting concepts to include in interior lighting curricula that the professionals rated as valuable is of significant importance to lighting educators. Lighting educators can use these concepts as tools in formulating course objectives. The professionals rated formal education in lighting as moderately valued ($\bar{X}$=3.692) compared to on-the-job training ($\bar{X}$=4.618). Interaction with lighting professionals ($\bar{X}$=4.131) rated as the most

valuable variable to impact the design professionals acquisition of lighting knowledge. A possible conclusion could be that lighting is an evolving field in which one needs to keep abreast of current changes in the field. It could also mean that formal education did not provide these professionals the training needed to practice the use of light.

TABLE IV

SAMPLE OF DESIGN PROFESSIONALS

Group	Sample	Useable Sample (n)	Return Rate (n)	%
AIA	300	245	50	20.4
ASID	300	290	83	28.6
IALD	284	251	105	41.8
IES	300	290	97	33.4
Total	1184	1076	335	31.1

TABLE V

BACKGROUND INFORMATION OF DESIGN PROFESSIONALS

	Frequency	Percentage
Educational Degree		
BS/BA/BARCH	280	83.8%
MS/MA/MARCH	69	20.7%
PHD	4	1.2%
Area of Specialization		
Commercial	249	74.8%
Residential	119	35.6%
Institutional	79	23.7%
Industrial	56	16.8%

(Note: Since respondents could check all applicable responses, the frequency indicated in the table does not match the total n=335, and the percentage does not equal 100%).

TABLE VI

ANALYSIS OF VARIANCE PROCEDURE FOR ACQUISITION AND VALUE OF LIGHTING KNOWLEDGE TO THE DESIGN PROFESSIONALS

Variable	Mean Score				F value	Pr > F
	Total	Architecture	Interior Design	Lighting		
Formal education	3.692	3.489	3.847	3.685	1.49	.2276
Continuing edu	3.640	3.418(b)	4.068(a)	3.521(b)	8.47	.0003
Job training	4.618	4.019(c)	4.544(b)	4.803(a)	28.76	.0001
Self training	3.796	3.607	3.802	3.843	0.99	.3716
Workshops	3.704	3.609(b)	4.026(a)	3.594(b)	5.63	.0040
Demonstration labs	3.932	3.833(b)	4.275(a)	3.838(b)	4.33	.0141
Test labs	3.099	2.711(b)	3.600(a)	3.031(b)	6.15	.0025
Professional journals	3.374	3.600(a)	3.246(b)	3.361(ab)	2.35	.0973
Technical journal	3.176	3.175	2.913	3.253	2.32	.0998
Trade shows	3.479	3.326	3.491	3.513	0.68	.5076
Interaction with DSGN professionals	3.874	3.620(b)	3.794(ab)	3.969(a)	3.12	.0456
Interaction with LTG professionals	4.131	4.120	4.115	4.140	0.03	.9720
Use audio tapes	2.292	2.161	2.627	2.210	2.61	.0763
Use video tapes	2.847	2.907(ab)	3.326(a)	2.671(b)	5.69	.0039
Experiment with new lamps/fixtures	3.800	3.186(c)	3.635(b)	4.010(a)	11.20	.0001

Note: * Means with different letter are significantly different based on Duncan's Multiple Range test.

* Means scores are on a scale of 1 (little value) to 5 (most valuable).

TABLE VII

ANALYSIS OF VARIANCE PROCEDURE FOR USE AND VALUE OF LIGHTING RESOURCES TO THE DESIGN PROFESSIONALS

Variable	Mean Score				F value	Pr > F
	Total	Architecture	Interior Design	Lighting		
LT calculation software	3.587	3.285(b)	2.848(c)	3.782(a)	13.4	.0001
Computer simulation	3.271	3.290	3.121	3.300	0.35	.7024
Computer light plan	3.142	3.242	3.194	3.110	0.25	.7801
Pocket lgt meter	3.722	3.447(b)	3.319(b)	3.875(a)	6.97	.0011
Hand-held brightness meter	3.406	3.300	3.285	3.458	0.61	.5447
Colorimeter	2.682	3.142(a)	2.945(a)	2.503(b)	6.02	.0029
Spectroradiomet	2.232	2.407	2.281	2.180	0.67	.5153

Note:* Means with different letter are significantly different based on Duncan's Multiple Range test indicates.

* Mean scores are on a scale of 1 (little value) to 5 (most valuable).

TABLE VIII

ANALYSIS OF VARIANCE PROCEDURE FOR IMPORTANCE OF INCLUSION OF LIGHTING CONCEPTS IN INTERIOR LIGHTING CURRICULA BY THE DESIGN PROFESSIONALS

Variable	Mean Score				F value	Pr > F
	Total	Architecture	Interior Design	Lighting		
Art of light	4.214	4.340	4.225	4.178	0.64	.5269
Color & light	4.539	4.529	4.662	4.492	1.71	.1825
Field trips/labs	3.817	3.408(c)	4.125(a)	3.794(b)	7.57	.0006
Interaction with LTG professionals	4.164	4.120	4.172	4.171	0.09	.9181
Internship in LTG design firm	3.981	3.520(b)	3.691(b)	4.212(a)	13.42	.0001
Lamp character	4.293	3.920(b)	4.329(a)	4.373(a)	6.26	.0021
Light application	4.332	4.140	4.365	4.367	2.13	.1207
Light & behavior	3.939	3.980	4.097	3.864	2.09	.1254
Light control (balance/glare/intensity)	4.379	4.254	4.390	4.407	1.01	.0365
Light & energy	3.836	3.560(b)	3.792(ab)	3.924(a)	3.31	.0377
Fixture function	4.129	3.784(b)	4.219(a)	4.181(a)	5.38	.0050
Light & health	3.612	3.673(b)	4.012(a)	3.434(b)	10.97	.0001
Light layout	4.207	3.942(b)	4.487(a)	4.160(b)	7.62	.0006
Light source spc	3.981	3.541(b)	4.097(a)	4.040(a)	7.18	.0009
Maintenance	3.630	3.204(b)	3.451(b)	3.809(a)	9.53	.0001
Membership in lighting organizations	3.046	2.437(b)	2.679(b)	3.345(a)	22.26	.0001
Participation in lighting competitions	2.762	2.375(b)	2.740(a)	2.860(a)	3.96	.0200
Quality of light	4.427	4.307(b)	4.197(b)	4.552(a)	7.57	.0006
Quantity of light	4.027	3.921	4.123	4.015	0.82	.4409
Work dsgn/team	3.731	3.469(b)	3.654(ab)	3.828(a)	2.49	.0848

Note:* Means with different letter are significantly different based on Duncan's Multiple Range test.

* Mean scores are on a scale of 1 (unimportant) to 5 (important).

Bibliography

Best, J. W. (1986). Research in education. New Jersey: Prentice-Hall, inc.

Dillman, D. A. (1978). Mail and telephone surveys: The total design method. New York, NY: Wiley.

Flynn, J. E., & Spencer, T. J. (1977). The effects of light source color on user impression and satisfaction. Journal of Illuminating Engineering Society, 6(3), 167-179.

Forbes, S. A. (1984). [Interview by Tony Naples]. Lighting Design and Application, p. 21-24.

Nuckolls, J. (1983). Interior lighting for environmental designers. New York: John Wiley & Sons.

Taylor, L.H., & Sucov, E. W. (1974). The movement of people toward light. Journal of Illuminating Engineering Society, 3(3), 237-241.

Wilson, J. (1974, May). Lighting the inner spaces. Interior Design, pp. 144-157.

CHAPTER V

EVALUATION OF PERCEPTIONS OF DESIGN PROFESSIONALS AND EDUCATORS REGARDING LIGHTING CONCEPTS: A TOOL FOR CURRICULA DEVELOPMENT IN INTERIOR LIGHTING

MANUSCRIPT FOR PUBLICATION

JOURNAL TITLE: JOURNAL OF INTERIOR DESIGN EDUCATION AND RESEARCH

EVALUATION OF PERCEPTIONS OF DESIGN PROFESSIONALS AND EDUCATORS REGARDING LIGHTING CONCEPTS: A TOOL FOR CURRICULA DEVELOPMENT IN INTERIOR LIGHTING

Abstract: Currently studies dealing with the element of light and its impact on the interior environment and its user is receiving a great deal of attention. But there is inadequate documentation of what the design educators and professionals consider important in interior lighting. This study evaluates the perceptions of the design educators and professionals on the following topics: Acquisition and value of lighting knowledge to their careers; use and value of lighting resources to their careers; and importance of inclusion of lighting concepts (education) in interior lighting curricula. Such an evaluation provides insights to the lighting perceptions of the educators and professionals. Further, these concepts can be used by educators as a tool in the development of interior lighting curricula. The t-tests indicate that the educators and professionals rated the use of lighting resources as less valuable to their careers than concepts of lighting knowledge acquisition. A majority of the concepts in the lighting education category rated high, indicating that the professionals and educators considered these concepts important components in the interior lighting curricula.

Introduction

Light is an important element of design and is important to shaping interior environments. Mintz (Wilson, 1974) says, "I think of light as a building material . . . . You can do more with lighting to change the aspect of the room - whether the color, the size, or emphasis - than you can with any other traditional building material" (p. 148).

The relationship between interior design education and professional practice is strong, but a closer look indicates there are philosophical differences between the two groups (Harwood, 1989). Harwood states,

> The educators goal is to develop the mind while expanding specific subject content. On the other hand, practitioners want students who are fully prepared upon graduation to work as practicing interior designers in the field. . . . The practitioners goal is to produce work while using the mind for evaluation (Harwood, 1989, p. 42).

Education exists to facilitate and maintain a learned society (Kierstead, Schiller, and Van Avery, 1981). In a field like interior design, the information students receive is application oriented. The educator, when preparing the curricula, needs to pay special attention to the factor of preparing students who will be able to practice in the field as interior designers upon graduation.

The relationship between education and practice is recognized by the Foundation for Interior Design Education

Research (FIDER). A statement in the preamble of its 'Standards and Guidelines' makes this relationship clear. "A sound curriculum for professional interior design education must provide a balance between broad cultural aspects of education on the one hand, and the specialized practical content integral to the profession on the other" (Foundation for Interior Design Education Research,1988, preamble).

The purpose of this study is to evaluate the perceptions of the design professionals and lighting educators towards lighting concepts. Information from this evaluation can provide insights to important aspects of interior lighting which serve as tools for curricula development of interior lighting. Specifically, the objectives include:

1. To assess perceptions of the design professionals and lighting educators regarding interior lighting concepts.
    A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their professions.
    B. To assess and compare the perceptions of use and value of lighting related resources to their professions.
    C. To assess and compare the perceptions of importance of inclusion of various lighting concepts in interior lighting curriculum.
2. To determine interior lighting educational objectives based on the results of the study and models of educational objectives used in the field of education.

The content units and achievement levels listed in the FIDER (1988) Standards and Guidelines indicate content areas that are

required in an interior design curricula, along with the level of achievement expected. Lighting is considered an important content unit in the guidelines. Lighting appears in three sections as follows:

Residential Design: Design attributes of materials, lighting, furniture, textiles, color (competency).

Non-Residential Design: Design attributes of material, lighting, furniture, textiles, color (competency).

Technical knowledge: Building systems, i.e HVAC, lighting, electrical, plumbing, acoustics (understanding).

Harwood (1989) compared Flaugher's (1988) list of 25 knowledge areas from the interior design job analysis study to FIDER Achievement Levels, and National Council for Interior Design Qualification (NCIDQ) performance levels which indicated categories of overlap. Lighting was one of the four knowledge areas that overlapped across the three lists, indicating that lighting was considered extremely important in both practice and education. Therefore lighting is a major concept which should be incorporated in design curricula.

Information and literature about the current state of lighting education is not readily available. In an interview conducted by Lighting Design and Application (March, 1986), young lighting designers who had formal education in lighting were asked: 'What did you learn in school'? and 'What do you wish you had learned'? The answers to these questions give one an idea of how young professionals with limited experience in the industry cope in the lighting design world with the education received in

lighting. These professionals, realized upon graduation that they lacked the knowledge of the complex process of documentation and the transmission of information from consultants to architect to construction manager to general contractor. They believed their education prepared them with information about the science of illumination, and at work they were introduced to the art of illumination.

Lighting is being offered or developed as a course to be included in the interior design education in many design curricula across the nation. Benya illustrates the level of lighting education with the following:

> The teaching of lighting is extremely immature as a profession and as a educational curriculum. As 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. . . . Many revert to the professional community (Ruffet, 1985, p. 37).

Changes and trends in the profession must be studied closely by educators to allow introduction of current technology and changes in the field. Ruffet in an interview with nine lighting educators discussed the current state of education of lighting. The discussion included the following comments: Long (Ruffet, 1985, p. 31) comments "I have noticed a significant change in the awareness of architects and interior designers to lighting design. This awareness is slowly being reflected in school programs". Ginthner (Ruffet, 1985) recognizes that designers are realizing the importance of light and its affect on space and design

elements, and are becoming more sensitive to light. This sensitivity has helped in the reemergence of lighting classes in different disciplines. In trying to stay abreast of technology, lighting educators (Ruffet, 1985) believe that it is the responsibility of the educational institution to provide as many experiences as possible to the student, to provide an awareness of the state of the art technology in the field. The students need to be exposed to the use of computers and lighting software for calculating quantity of light and graphically representing a lighting concept. This is important since a majority of the design firms are moving towards the use of computers in all the phases of design. Further, students need to be exposed to major manufacturers, and their latest products. The lighting educator has a responsibility to keep up with the latest technologies by attending seminars and conferences as well as reading current professional lighting literature and publications. These comments are the perceptions of nine educators regarding lighting. Currently, there are limited empirical studies which document the perceptions of both educators and practitioners regarding the use of light and its practice.

Curriculum Development: In order to provide good lighting education it is essential to understand curriculum development. The field of education provides basic concepts for the development of educational objectives and curricula. Tyler (1949) considers the following issues in developing a curriculum: Formulation of educational purpose and objectives, development of learning experiences to achieve the objectives, and evaluation.

In the curriculum development process the formulation and classification of objectives are critical. Bloom (1956) comments "by educational objectives, we mean explicit formulations of the ways in which students are expected to be changed by the education process. That is, the ways in which they will change in their thinking, their feelings, and their actions" (p. 26). Further, Bloom states there are three main sources for obtaining objectives,

> One type of source commonly used in thinking about objectives is the information available about the students. What is their present level of development? What are their needs? What are their interests? Another source for objectives is available from investigations of the conditions and problems of contemporary life which make demands on young people and adults and which provide opportunities for them. What are the activities that individuals are expected to perform? What are the problems they are likely to encounter? What are the opportunities they are likely to have for service and self-realization? Another source of suggestions for objectives comes from the nature of the subject matter and the deliberations of subject-matter specialists on the contributions their subject is able to make to the education of the individual (Bloom, 1956, p. 26).

Based on the above criteria, the evaluation of interior lighting concepts among design professionals and lighting design educators provides a tool for the curricula developers to formulate educational objectives.

Although there are numerous guides to develop instructional objectives in the field of education, a majority of educators use objectives based on the 'Taxonomy of Educational Objectives', developed by a committee under the direction of Bloom (1956), and Krathwohl (Krathwohl, Bloom, Masia, 1964). The taxonomy provides a classification for educational objectives which consists of a set of general and specific categories which encompass all possible learning outcomes from instruction.

If the taxonomy is to prove a useful tool for teachers, it should provide a basis for developing curricula, instructional techniques, and testing techniques (Bloom, 1956). The taxonomy is divided into three domains: (1) the cognitive, (2) the affective, and (3) the psychomotor. "The cognitive domain includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills" (Bloom, 1956, p. 7). The affective domain includes those objectives that describe attitudes, interest, values, appreciation and methods of adjustment (Krathwohl et al., 1964). The psychomotor domain deals with the manipulative or the motor-skill area (Krathwohl et al., 1964).

Research Design

Sample: The sample from the design professionals consisted of professional members of American Society of Interior Designers (ASID) and American Institute of Architects (AIA); full members of Illuminating Engineering Society (IES); and

members (excluding education and international members) of the International Association of Lighting Designers (IALD) was selected. These groups were chosen for the study since these professionals dealt with the aspect of light in their professional practice. The random sample of ASID and IES, utilized zip code which produced a cross section of design professionals with a final sample size of 300. Six AIA members from each state were randomly selected from the 1989 AIA profile book for a sample of 300. The sample for the IALD group (n=284) utilized the 1990 national membership directory and included all members.

The population for the design educators consisted of architecture and interior design lighting educators in the United States. The population of architecture educators included 112 schools that were listed in the 1988-1989 Association of Collegiate Schools of Architecture (ACSA). Interior design programs with Interior Design Educators Council (IDEC) members were selected from the 1989-90 membership directory. Two hundred and six programs were identified. Questionnaires were sent to the chair person of each of the programs requesting him/her to forward it to the appropriate lighting design educator.

Instrument: Two instruments were developed for the study, one for the professional group and the other for the educators. Questions were formulated to assess lighting perceptions regarding value of lighting knowledge acquired, use and value of lighting resources, importance of inclusion of certain lighting concepts in the interior lighting curriculum, and background information of the lighting design professionals and educators.

Inter-item reliability revealed a Cronbach Coefficient Alpha for standardized variable scores of over .75, indicating high reliability for each of the three major categories 'knowledge' (acquisition of lighting knowledge and its value to their career), 'resources' (use of lighting resources and its value to their career), and 'education' (importance of inclusion of lighting concepts in interior lighting curriculum). The alpha level for each category was: Knowledge = .759 (professional group); .836 (educator group); Resources = .780 (both groups); and Education = .887 (both groups).

Data Collection: Data were collected in July, 1990, and September, 1990 for the professional and the educator groups respectively using a modified version of the Dillman's Total Design Method (Dillman, 1978). The package which was mailed to the sample consisted of a cover letter, the questionnaire, and a postage paid return envelope. Three hundred and thirty five usable questionnaires for the professional group were received for a total response rate of 31.1%. The survey yielded 110 useable questionnaires for the educators with a response rate of 35.3% (Table IX).

Insert Table IX about here

Findings and Conclusions

The t-test was conducted to compare the means of the dependent variables between professionals and educators in the categories of knowledge, resources, and education. Within each of the categories, variables were rated on the scale of 5 (most valuable/important) to 1 (little value/unimportant).

In the category of knowledge (table X), the overall mean was 47.6 out of a maximum score of 70.0. This indicated that the professionals and educators rated the variables in the knowledge category as more valuable than the concepts in the resource category. Variables namely: on-the-job training; visits to demonstration labs; and interaction with lighting professionals were rated as most valuable ($\overline{X}$=> 4.0) in acquiring lighting knowledge by both the professionals and educators. In spite of the high rating of the variable on-the-job training, the t-test indicated a significant difference between the means of the two groups with the professionals considering on-the-job training more important than the educators. This may be due to the nature of a practicing professional where most of his/her knowledge has been acquired each day on the job. From the educators perspective the implications would be that internships and hands on experience are important aspects in acquiring lighting knowledge. The t=test also indicated a significant difference between the means of the professionals and educators in the acquisition of lighting knowledge through formal education, participation in workshops, and visits to demonstration labs

which where rated more valuable by the educators. This could imply that since a majority of the educators spend less time in the practice of design there is a need for organized learning experiences in order to acquire lighting knowledge.

The use of audio tapes was rated as the least valuable by both the professionals and educators. The use of video tapes received the second lowest rating by both the groups. Yet the t-test indicated that there was a significant difference between the mean of professionals and educators in rating the value of acquiring lighting knowledge through the use of video tapes in which the educators valued it much higher than the professionals. This could imply that the educators consider exposure to visual learning experiences as more valuable since they are removed from the job sites and design installations on a day to day basis which provides infinite learning possibilities.

Insert Table X here

The overall mean (17.6 out of a maximum possible score of 35.0) for the lighting resource category (table XI) was lower than that of the knowledge and education category. Use of colorimeter and spectroradiometer were significantly different between the professionals and educators. Even though the variables had a low overall mean, the professionals rated them lower in value than did the educators. This could be because

professionals might use these instruments in specialized applications whereas the educators use them in the classroom setting to educate students. The use of a pocket light meter was valued the highest by both the educators and professionals.

Insert table XI about here

A majority of the concepts in the education category (table XII), were rated at 4 or above, with the overall mean at 89.7 out of a possible score of 100. This indicated that the professionals and educators considered these variables as important concepts to be included in today's interior lighting curricula. Color and light, and quality of light were considered the most important concepts by the educators and professionals for inclusion in the curricula.

The two concepts that received the lowest overall rating in the education category were participation in lighting competition ($\overline{X}$=2.799), and membership in a lighting organization ($\overline{X}$=3.009). This suggests that these concepts were considered less important to be incorporated in lighting curricula. It could also mean that less emphasis must be given to these concepts in the curriculum since the professionals and educators realize that the use of light must not be isolated but incorporated with other design aspects. Additionally, student membership in lighting related organizations might be considered as less important by

the professionals and educators since the emphasis in such organizations is specialized. It might be more important that the student participate in an organization in the major field which is broader and of more value to the student's level of development.

Concepts such as lamp character, light application, light and behavior, and light control were rated important ($\overline{X}$=>4.0) by the educators and professionals, with the educators rating these concepts as more important than the professionals. The t-test indicated significant differences in the means of these variables between the two groups. Overall, it is important to note that both the professionals and educators considered the qualitative aspects of lighting as important or valuable concepts. The results of the survey document the shift of emphasis from the quantity of light to quality of light.

Insert table XII about here

Implications and Summary

Quality of light, pertains to the distribution of luminance in a visual environment. The term is used in a positive sense and implies that all luminances contribute favorably to visual performance, visual comfort, ease of seeing, safety, and aesthetics for the specific visual tasks involved (IES

Lighting Ready Reference, 1985, p.26-27).

Teaching the above qualitative aspects of light is not an easy task, since it involves developing sensitivity to the factors of visual comfort, and aesthetics of light which cannot be quantified. The field of theater has incorporated the qualitative aspect of light for centuries in order to create the mood and emotions for a particular scene. In many respects interior environments can be compared to the various stage settings in theater since the designer's primary task is to provide the right mood and setting for his/her client. But, unlike the field of theater, interior design and interior architecture have not emphasized the emotional, and the qualitative use of light. In interior design and interior architecture, the lighting curricula, needs to incorporate more of the qualitative aspects of light in the design process. A majority of the qualitative aspects of light are based on a subjective evaluation of space. However, it is also necessary for the curricula developers to incorporate learning objectives in the psychomotor domain with special cognizance of the affective domain.

Based on the results of the survey, several concepts in the knowledge, resource and education category were considered important or valuable by the professionals and educators and are identified in the tables. The researcher of this study is assuming that the concepts that were considered important and/ or valuable to the professionals will be given serious consideration for incorporation into curricula. These concepts belong either in the cognitive, affective or psychomotor domain.

The concepts were listed without making specific inferences regarding how the educator should include them in the curricula. The concepts are to be used as tools in formulating the learning objectives. The specifics of how the educator wishes to execute the objectives must be the educators choice depending on the teaching audience, time, circumstances, and limitations if any.

Objectives for interior lighting education were developed based on the model of 'Taxonomy of Educational Objectives' developed by Bloom (1956), Krathwohl (1964), and Simpson (1972) and responses to this study. Concepts of Bernecker's (1983) 'Instructional Objectives for Lighting Education within an Architectural Engineering Curriculum' were also incorporated. In order to develop educational objectives, the purpose must be stated. The purpose of lighting education in the undergraduate interior design programs is to develop individuals who are knowledgeable in the practice of lighting design as it impacts the interior environment and the user. Keeping this educational purpose in mind the objectives were developed (table XIII).

Insert table XIII about here

There seems to be a heightened awareness of lighting among the design professionals and lighting educators. Additionally, it is encouraging to study the parallels between the perceptions of lighting value and its importance among the design professionals

and lighting educators. But, since light is an element of design that impacts all aspects of the space and the user, it cannot be isolated in its teaching and application only in lighting classes. The aspect of lighting design needs to be included in all design studios in order for the student to understand the complete scope of his/her design. Thus, implying that all educators dealing with interior design, and interior architecture should develop a sensitivity to the use of light and its impact so that proper lighting concepts can be shared with students in both theory as well as in studio classes. This is essential if both the lighting and design curricula developers wish to provide quality education to future designers. A follow up study of all interior design and architecture educators regarding their perceptions of lighting importance and its value might help provide a realistic picture of the current conditions of lighting education.

TABLE IX

SAMPLE RESPONSE SUMMARY

	Useable sample (n)	Return Rate (n)	%
Professionals:			
AIA	245	50	20.4
ASID	290	83	28.6
IALD	251	105	41.8
IES	290	97	33.4
Total	1076	335	31.1
Educators:			
ARCH	114	38	33.3
ID	197	72	36.5
Total	311	110	35.3

TABLE X

T-TEST PROCEDURE FOR ACQUISITION AND VALUE OF LIGHTING KNOWLEDGE AMONG DESIGN PROFESSIONALS AND EDUCATORS

Variable	Mean Scores			T value	Pr > |T|
	Total	Professionals	Educators		
Formal education	3.811	3.694	4.152	-3.978	.0001
Continuing educat	3.695	3.645	3.848	-1.696	.0917
Job training	4.540	4.618	4.282	3.420	.0008
Self training	3.784	3.795	3.750	0.362	.7174
Workshops	3.781	3.709	4.000	-2.943	.0036
Demonstration labs	4.070	3.936	4.438	-5.387	.0001
Test labs	3.174	3.102	3.397	-1.915	.0577
Professional journals	3.448	3.381	3.648	-2.602	.0100
Technical journal	3.224	3.178	3.360	-1.398	.1639
Trade shows	3.457	3.482	3.376	0.840	.4021
Interaction with DSGN professionals	3.846	3.878	3.747	1.190	.2355
Interaction with LTG professionals	4.108	4.133	4.028	1.108	.2689
Use of audio tapes	2.371	2.303	2.552	-1.568	.1193
Use of video tapes	3.023	2.853	3.475	-4.221	.0001

Note: mean scores are on a scale of 1 (little value) to 5 (most valuable)

TABLE XI

T-TEST PROCEDURE FOR USE AND VALUE OF LIGHTING RESOURCES AMONG DESIGN PROFESSIONALS AND EDUCATORS

Variable	Mean Scores			T value	Pr > |T|
	Total	Professionals	Educators		
LT calculation software	3.538	3.594	3.355	1.740	.0843
Computer simulation	3.321	3.273	3.465	-1.312	.1918
Computer light plan	3.175	3.149	3.260	-0.815	.4162
Pocket light meter	3.778	3.727	3.913	-1.554	.1218
Hand-held brightness meter	3.514	3.415	3.772	-2.865	.0047
Colorimeter	2.865	2.701	3.343	-4.814	.0001
Spectroradiometer	2.376	2.245	2.750	-3.283	.0014

Note: mean scores are on a scale of 1 (little value) to 5 (most valuable)

TABLE XII

T-TEST PROCEDURE FOR IMPORTANCE OF INCLUSION OF LIGHTING CONCEPTS IN INTERIOR LIGHTING CURRICULA AMONG THE DESIGN PROFESSIONALS AND EDUCATORS

	Mean Scores				
Variable	Total	Professionals	Educators	T value	Pr > |T|
Art of light	4.208	4.219	4.174	0.449	.6534
Color & light	4.576	4.542	4.681	-2.176	.0305
Field trips to labs	3.879	3.824	4.045	-1.987	.0483
Interaction with LTG professionals	4.088	4.169	3.844	3.424	.0008
Internship in LTG design firm	3.952	3.984	3.853	1.154	.2499
Lamp character	4.362	4.298	4.559	-3.361	.0009
Light applications	4.409	4.336	4.627	-4.030	.0001
Light & behavior	4.009	3.942	4.211	-2.657	.0086
Light control (balance/glare/intensity)	4.425	4.383	4.554	-2.419	.0160
Light & energy	3.927	3.843	4.181	-3.647	.0003
Fixture function	4.167	4.135	4.263	-1.531	.1271
Light & health	3.671	3.618	3.834	-1.925	.0558
Light layout	4.244	4.211	4.345	-1.320	.1885
Light source spc	4.034	3.987	4.175	-1.761	.0800
Maintenance	3.601	3.638	3.490	1.305	.1934
Membership in lighting organizations	3.009	3.054	2.872	1.589	.1136
Participation in lighting competitions	2.799	2.769	2.889	-0.995	.3200
Quality of light	4.466	4.431	4.572	-1.894	.0595
Quantity of light	4.070	4.033	4.183	-1.574	.1168
Working in design team	3.680	3.736	3.522	1.817	.0708

Note: mean scores are on a scale of 1 (unimportant) to 5 (important)

TABLE XIII

INSTRUCTIONAL OBJECTIVES FOR INTERIOR LIGHTING CURRICULA

OBJECTIVES:

COGNITIVE: (Bloom's model)

A. Knowledge:

1. Knows the historical developments of light and the profession.
2. Knows common terms of interior lighting.
3. Knows light sources both natural and artificial and their characteristics.
4. Knows basic principles of electricity.
5. Knows basic concepts of the seeing process.
6. Knows luminaire types and their characteristics.
7. Knows types of instrumentation such as light meters etc

B. Comprehension:

1. Understands impact of light on materials and finishes.
2. Understands relationship of light and color.
3. Understands basic concepts of light control (reflection, absorption, refraction etc.)
4. Understands concepts of brightness
5. Understands relationship of light and health.
6. Interprets spectral distribution energy, and candle power distribution charts.
7. Translates basic principles of electricity to workable formulas.

C. Application:

1. Applies concepts of light control in luminaire and lamp selection.
2. Applies concepts of photometric in lighting design and luminaire selection.
3. Demonstrates proficiency in estimating average illumination for interior spaces by using IES charts and ratio standards.
4. Demonstrates proficiency in calculation of illumination of interior spaces using point by point and zonal cavity method.
5. Solves lighting economic problems.
6. Demonstrates proficiency in use of computer programs to calculate light levels and lighting costs; and to create models simulation and light plan.
7. Demonstrates proficiency in use of charts, graphs ,tables and manufacturers data sheet.
8. Interprets lighting studies pertinent to the interior environment.

D. Analysis:

1. Recognizes differences in lighting design solution based on specific interior needs and application.
2. Recognizes implication of factors such as brightness, and color on the human behavior, perception and impression.
3. Recognizes the need for integration of light with other

TABLE XIII (continued)

variables in the interior environment.

E. Synthesis:

1. Writes lighting design concepts.
2. Integrates learning from different areas to plan interior lighting.
3. Integrates learning from different areas to solve interior lighting problems.

F. Evaluate:

1. Judges the functional value of a lighting design as it impacts the interior environment.
2. Judges the aesthetic value of a lighting design as it impacts the interior environment.
3. Judges the integration of the element of light in the overall design of the interior environment.
4. Judges the overall value of the lighting design such as economic, maintenance, function and aesthetics.

AFFECTIVE: (Krathwohl's model)

A. Receiving:

1. Listens attentively to class lectures.
2. Attends closely to class activities such as guest lectures, video , audio messages.

B. Responding:

1. Completes assigned homework.
2. Participates in class discussion.
3. Presents lighting topic of special interest to class.

C. Valuing:

1. Appreciates good interior lighting design.
2. Recognizes the importance of proper use of light in interior environments.
3. Recognizes the importance of the lighting profession.

D. Organization:

1. Understands his/her role in lighting as an interior designer.
2. Recognizes the need for balance between the qualitative and quantitative aspect of lighting in the interior environment.
3. Recognizes the role of interior designer with other design professionals such as architects, lighting designers and individuals of the lighting related areas.
4. Recognizes the role of programming in solving lighting problems.

F. Characterization by a value or value complex:

1. Uses objective approach in solving lighting problems.
2. works confidently on individual and group projects.
3. Displays confidence in dealing with lighting problems.
4. Demonstrates awareness of limitations in the area of lighting.

TABLE XIII (continued)

PSYCHOMOTOR: (Simpson's model)

A. Perceptual Abilities:

1. Discriminates visually moods depicted by different types of lighting/light sources in slides.
2. Develops visual memory to be used to recall and recreate a lighting environment.
3. Develops proficiency in communicating lighting design ideas two or three dimensionally.

Bibliography

Bernecker, C. A. (1983). Instructional objectives for lighting education within an architectural engineering curriculum. Lighting Design and Application, 13(11), 23-31.

Bloom, B. S. (1956). Taxonomy of Educational Objectives. New York: David McKay Company.

Dillman, D. A. (1978). Mail and Telephone Surveys: The total design method. New York, NY: Wiley.

Flaugher, R. L. (1988). Report of job analysis of interior design. New York: National Council for Interior Design Qualification.

Foundation for Interior Design Education Research. (1988). Standards and guidelines/first professional degree level. (FIDER Form 402). Grand Rapids, MI.

Gronlund, N. E. (1985). Stating Objectives for Educational Classroom Instruction. New York: Macmillian Publishing Company.

Harwood, B. (1989). Patterns: A view of the relationship between Interior Design education and practice. Journal of Interior Design Education and Research, 15(2), 41-50.

Kierstead, F. D., Schiller, S. L., & Van Avery, D. (1981). The

future in education: Problems, possibilities, and promise. (Special Topic Edition). Journal of Thought, 16(3).

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). Taxonomy of Educational Objectives Handbook II: Affective Domain. New York: David McKay Company.

Lighting Design and Application (1986). Four young lighting designers speak out. Lighting Design and Application, 15(3), 10-12.

Ruffet, P. (1985, February). Lighting Education: An overview. Nine educators speak out on the current sate of education in lighting. Lighting Design and Application, 15(2), 31-43.

Simpson, E. J. (1972). The Classification of educational Objectives in the Psychomotor Domain. Vol. 3. Washington: Gryphon House.

Tyler, R. W. (1949). Achievement Testing and Curriculum Construction. In E. G. Williamson (ED.), Trends in student personnel work (pp. 391- 407). Minneapolis, MN: University of Minnesota Press.

Wilson, J. (1974, May). Lighting the inner spaces. Interior Design, pp.144-157.

APPENDIXES

APPENDIX A

QUESTIONNAIRE AND CORRESPONDENCE

June 18, 1990

IES
345 East 47th Street; 9th floor
New York, New York 10017

Dear Celeste Picco:

This letter comes as a request for purchasing labels of professional members of IES. The professionals listed will be contacted via mail to answer a questionnaire that will evaluate their perceptions, awareness, needs, and knowledge base of interior **lighting design.**

The information received from this study will give the researcher valuable information about lighting design that can be incorporated in the lighting curriculum in Interior Design, and Architecture Programs across the nation. The other professional members that will be surveyed include the American Society of Interior Designers (ASID), American Institute of Architects (AIA), and International Association of Lighting Designers (IALD).

The researcher is requesting the following information:

** Professional Members only
** 1000 labels
** Random selection of 1000 members from the national listing.
(Zip code or every nth name on the list)
** Sticky back on labels if applicable

I sincerely appreciate the support of IES in providing better education to future designers. If you have questions please contact me at (918) 742-5950 or at the number listed above. Thank you for your time and consideration.

Sincerely,

Asha Hegde-Niezgoda

Home Address:
2663 East, 20th Street
Tulsa, Oklahoma 74104

June 18, 1990

ASID Service Corporation
1430, Broadway; 8 th, floor
New York, New york 10018

Dear Sheela Etheridge:

This letter comes as a request for purchasing labels of professional members of ASID. The professionals listed will be contacted via mail to answer a questionnaire that will evaluate their perceptions, awareness, needs, and knowledge base of interior **lighting design.**

The information received from this study will give the researcher valuable information about lighting design that can be incorporated in the lighting curriculum in Interior Design, and Architecture Programs across the nation. The other professional members that will be surveyed include the Illuminating Engineering Society (IES, American Institute of Architects (AIA, and International Association of Lighting Designers(IALD).

The researcher is requesting the following information:

** Professional Members only
** 2000 labels
** Random selection of 2000 members from the national listing.
(Zip code or every nth name on the list)
** Sticky back on labels if applicable

I sincerely appreciate the support of ASID in providing better education to future designers. If you have questions please contact me at (918) 742-5950 or at the number listed above. Thank you for your time and consideration.

Sincerely,

Asha Hegde-Niezgoda

Home Address:
2663 East, 20th Street
Tulsa, Oklahoma 74104

OSU

Oklahoma State University

COLLEGE OF HOME ECONOMICS
Department of Housing, Interior Design
and Consumer Studies

July 8, 1990

Dear Professional:

As a lighting design educator, I am conducting a survey of design professionals in relation to lighting practices and background. I would appreciate your help in this process.

The objective of this study is to assess current interior lighting practice among architects, interior designers, and lighting consultants This survey will be most helpful to educators who teach interior lighting , because it can offer concepts for inclusion in the lighting curriculum.

Anonymity of respondents will be maintained in the study. The research findings will be available at Oklahoma State University. Please take time to fill the questionnaire , which takes approximately 10 minutes, and return it in the enclosed , stamped self addressed envelope by JULY 20. Your response is vital to the study, since you are part of the small sample representing your profession.

Thank you for taking the time to respond to the survey and helping in the process of providing better lighting education. If you have questions please contact me at (405) 744 - 5048. Thank you once again.

Sincerely,

Asha Hegde-Niezgoda

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LIGHTING STUDY

LIGHTING KNOWLEDGE:

Questions # 1 - # 24 deal with acquiring lighting knowledge, and use of resources Please use a scale of 1 - 5 , and circle your choice 1 being little value, and 5 being most valuable Use 0 if you had no opportunity to use

	little value				most valuable	not applicable
1 Formal education for academic credit	1	2	3	4	5	0
2 Continuing education course work (not for academic credit)	1	2	3	4	5	0
3 On the job training	1	2	3	4	5	0
4. Self training	1	2	3	4	5	0
5 Workshops/seminars sponsored by ASID, AIA, IES, IBD, IALD	1	2	3	4	5	0
6 Visits to demonstration labs such as General Electric lighting institute In Nela Park	1	2	3	4	5	0
7 Visits to Testing Laboratories	1	2	3	4	5	0
8 Use of professional journals/magazines (e g LD+A, Architectural Lighting)	1	2	3	4	5	0
9. Use of technical journals (e g I E S journal, Lighting Research & Technology)	1	2	3	4	5	0
10. Visits to trade related shows (e.g. Lighting World)	1	2	3	4	5	0
11. Interaction/discussion with colleagues of architectural and design profession	1	2	3	4	5	0
12. Interaction/discussion with lighting consultants and/or lighting engineers	1	2	3	4	5	0
13 Use of Audio Tapes	1	2	3	4	5	0
14 Use of Video Tapes	1	2	3	4	5	0
15. Experimentation with new lamps and fixtures	1	2	3	4	5	0
16 _____ Other (please specify)	1	2	3	4	5	0

LIGHTING RESOURCES:

17 Light-level calculation software	1	2	3	4	5	0
18 Computer Model Simulation	1	2	3	4	5	0
19 Computer generated light plans	1	2	3	4	5	0
20 Pocket Light Meter	1	2	3	4	5	0
21. Hand-held Brightness Meter	1	2	3	4	5	0
22. Colorimeter (to measure light source color)	1	2	3	4	5	0
23. Spectroradiometer (to measure light source wavelength)	1	2	3	4	5	0
24 Other _____ (please specify)	1	2	3	4	5	0

LIGHTING EDUCATION:

Please rate Question # 25 - # 44 with regard to its importance in incorporating them in today's interior lighting curriculum Use a scale of 1 to 5 , and circle your choice 1 for unimportant, and 5 for important

	Unimportant				Important
25 art of light	1	2	3	4	5
26 color and light	1	2	3	4	5
27 field trips to lighting labs	1	2	3	4	5
28. interaction with lighting professionals	1	2	3	4	5
29 internships in lighting design firms	1	2	3	4	5
30. lamps and their characteristics	1	2	3	4	5
31. lighting applications	1	2	3	4	5
32. light and behavior	1	2	3	4	5
33 light control (balance, glare, intensity)	1	2	3	4	5
34. light and energy	1	2	3	4	5
35. light fixture and function	1	2	3	4	5
36. light and health	1	2	3	4	5
37 lighting layout	1	2	3	4	5
38 light source specification	1	2	3	4	5
39 maintenance (upkeep/operating cost)	1	2	3	4	5
40. membership in lighting organizations	1	2	3	4	5
41. participation in regional/national lighting competitions	1	2	3	4	5
42. quality of light	1	2	3	4	5
43. quantity of light	1	2	3	4	5
44. working in design teams	1	2	3	4	5

Questions # 45 to # 57 are general questions regarding lighting in the profession and education.

Question # 45 - # 47 please use a scale of 1 - 5 and circle as appropriate

45. Knowledge of Interior lighting among Design Professionals to perform their jobs satisfactorily is.
Inadequate ___1___ ___2___ ___3___ ___4___ ___5___ Adequate

46. Attention to the element of light in the design of interior environments today, is
Inadequate ___1___ ___2___ ___3___ ___4___ ___5___ Adequate

47. Design education today prepares students in interior lighting design
Inadequate ___1___ ___2___ ___3___ ___4___ ___5___ Adequate

48. Who is responsible for the lighting design, for projects in your firm? (check all applicable)
_____ Architect _____ Lighting Engineer
_____ Interior Designer _____ Manufacturer's representative
_____ Lighting Designer _____ Other _____ (please specify)

49. Are you responsible for the lighting design, on projects in your firm?
_____Yes _____No (if No, go to question # 51)

50 What stages of lighting do you deal with? (check all applicable)

_____ Lighting plan
_____ Electrical plan
_____ Luminaire specification
_____ Lamp specification
_____ Other _____ (please specify)

51 What percentage of responsibility, out of 100%, should the following have on a project with regards to lighting?

Architect	_____%
Engineer	_____%
Interior Designer	_____%
Lighting Consultant	_____%
Owner	_____%
Other _____ (specify)	_____%
TOTAL	100%

52. With whom do you consult regarding interior lighting issues (Check all applicable)

_____ Architect
_____ Engineer
_____ Interior Designer
_____ Lighting Consultant
_____ Fixture/Lamp manufacturers rep
_____ Other _____ (please specify)

List the three most helpful reference books you use for lighting information

53 _____
54 _____
55. _____

56 In the field of lighting design what trends do you see in the future Please comment

_____ _____
_____ _____

57. With regard to interior lighting what are your major strengths and weakness Please comment

Strengths	Weakness
_____	_____
_____	_____
_____	_____

BACKGROUND INFORMATION:

58. Check one that best describes your occupation.

_____ Architect
_____ Illuminating Engineer
_____ Lighting Designer
_____ Fixture/Lamp Manufacturers Rep
_____ Interior Designer
_____ Other _____ (please specify)

59 What is your main area of specialization

_____ Commercial
_____ Industrial
_____ Residential
_____ Other _____ (please specify)
_____ Institutional

60 Length of practice in years _____

61. Degree(s) held — Emphasis of degree

_____ Diploma	_____
_____ BS/BA/BFA	_____
_____ MS/MA/MFA	_____
_____ PHD	_____

62. Are you a member of any lighting organization (check all applicable)

_____ IES (Illuminating Engineering Society)
_____ IALD (International Association of Lighting Designers)
_____ Other _____ (please specify)

Thank you for your time and comments

OSU

Oklahoma State University

COLLEGE OF HOME ECONOMICS
Department of Housing, Interior Design
and Consumer Studies

September 4, 1990

Dear Educator

As a lighting design educator, I am conducting a survey of lighting educators in relation to lighting practices and background. I would appreciate your help in this process

The objective of this study is to assess aspects of interior lighting education among architecture and interior design programs This survey will be most helpful to educators who teach interior lighting, because it can offer concepts for inclusion in the lighting curriculum.

Anonymity of respondents will be maintained in this study. The research findings will be available at Oklahoma State University. Please take time to fill the questionnaire, which takes approximately 10 minutes, and return it in the enclosed stamped self addressed envelope by SEPTEMBER 17. Your response is vital to the study, since you will be representing your profession.

Thank you for taking the time to respond to the survey and helping in the process of providing better lighting education. If you have questions please contact me at (405)744-5035. Thank you once again.

Sincerely,

Asha Hegde-Niezgoda

CENTENNIAL
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LIGHTING STUDY

LIGHTING KNOWLEDGE:

Questions # 1 - # 24 deal with acquiring lighting knowledge, and use of resources Please use a scale of 1 - 5 , and circle your choice 1 being little value, and 5 being most valuable Use 0 if you had no opportunity to use

		little value				most valuable	not applicable
1	Formal education for academic credit	1	2	3	4	5	0
2	Continuing education course work (not for academic credit)	1	2	3	4	5	0
3	On the job training	1	2	3	4	5	0
4	Self training	1	2	3	4	5	0
5	Workshops/seminars sponsored by ASID, AIA, IES, IBD, IALD,IDEC	1	2	3	4	5	0
6	Visits to demonstration labs such as General Electric lighting institute in Nela Park	1	2	3	4	5	0
7	Visits to Testing Laboratories	1	2	3	4	5	0
8	Use of professional journals/magazines (e g LD+A, Architectural Lighting)	1	2	3	4	5	0
9	Use of technical journals (e g I E S journal, Lighting Research & Technology)	1	2	3	4	5	0
10	Visits to trade related shows (e g Lighting World)	1	2	3	4	5	0
11	Interaction/discussion with lighting educators	1	2	3	4	5	0
12	Interaction/discussion with lighting consultants and/or lighting engineers	1	2	3	4	5	0
13.	Use of Audio Tapes	1	2	3	4	5	0
14	Use of Video Tapes	1	2	3	4	5	0
15	IES summer workshop for lighting teachers at New Hampshire	1	2	3	4	5	0
16	_____ Other (please specify)	1	2	3	4	5	0

LIGHTING RESOURCES:

17	Light-level calculation software	1	2	3	4	5	0
18	Computer Model Simulation	1	2	3	4	5	0
19.	Computer generated light plans	1	2	3	4	5	0
20	Pocket Light Meter	1	2	3	4	5	0
21.	Hand-held Brightness Meter	1	2	3	4	5	0
22	Colorimeter (to measure light source color)	1	2	3	4	5	0
23	Spectroradiometer (to measure light source wavelength)	1	2	3	4	5	0
24.	Other _____ **(please specify)**	1	2	3	4	5	0

LIGHTING EDUCATION:

Please rate Question # 25 - # 44 with regard to its importance in incorporating them in today's interior lighting curriculum Use a scale of 1 to 5 , and circle your choice 1 for unimportant, and 5 for important

		Unimportant				Important
25	art of light	1	2	3	4	5
26	color and light	1	2	3	4	5
27	field trips to lighting labs	1	2	3	4	5
28	interaction with lighting professionals	1	2	3	4	5
29	internships in lighting design firms	1	2	3	4	5
30	lamps and their characteristics	1	2	3	4	5
31	lighting applications	1	2	3	4	5
32	light and behavior	1	2	3	4	5
33	light control (balance, glare, intensity)	1	2	3	4	5
34	light and energy	1	2	3	4	5
35	light fixture and function	1	2	3	4	5
36	light and health	1	2	3	4	5
37	lighting layout	1	2	3	4	5
38	light source specification	1	2	3	4	5
39	maintenance (upkeep/operating cost)	1	2	3	4	5
40	membership in lighting organizations	1	2	3	4	5
41.	participation in regional/national lighting competitions	1	2	3	4	5
42	quality of light	1	2	3	4	5
43	quantity of light	1	2	3	4	5
44	working in design teams	1	2	3	4	5

Questions # 45 to # 57 are general questions regarding lighting in the profession and education

Question # 45 - # 47 please use a scale of 1 - 5 and circle as appropriate

45 Knowledge of Interior lighting among design educators to perform their jobs satisfactorily is
Inadequate ___1___ ___2___ ___3___ ___4___ ___5___ Adequate

46 Attention to the element of light in the design of interior environments today, is
Inadequate ___1___ ___2___ ___3___ ___4___ ___5___ Adequate

47. Design education today prepares students in interior lighting design
Inadequately ___1___ ___2___ ___3___ ___4___ ___5___ Adequately

48. In your department 'Lighting' is taught (check all applicable)
_____ as a seperate course _____ as part of theory course
_____ as part of studio course _____ other _____ (please specify)

49. In your department is a course in 'Lighting' required by all majors?
_____Yes _____No

50 Which term best describes the department in which you teach (check one)

_____ Architecture _____ Interior Design
_____ Architectural Engineering _____ Other _____ (please specify)

51 What percentage of responsibility, out of 100%, should the following have on a project with regards to lighting?

Architect	_____%
Engineer	_____%
Interior Designer	_____%
Lighting Consultant	_____%
Owner	_____%
Other _____ (specify)	_____%
TOTAL	100%

52 With whom do you consult regarding interior lighting issues (Check all applicable)

_____ Architect _____ Engineer _____ Interior Designer
_____ Lighting Consultant _____ Fixture/Lamp manufacturers rep
_____ Other _____ (please specify)

List the three most helpful reference books you use for lighting information

53 _____
54 _____
55 _____

56 In the field of lighting design what trends do you see in the future Please comment

_____ _____
_____ _____

57. With regard to interior lighting what are your major strengths and weakness Please comment

Strengths	Weakness
_____	_____
_____	_____
_____	_____

BACKGROUND INFORMATION:

58 Check one that best describes your occupation

_____ Architecture Educator _____ Interior Design Educator
_____ Architect _____ Interior Designer _____ Illuminating Engineer
_____ Lighting Designer _____ Other _____ (please specify)

59 Length of teaching experience in years _____

60 Are you involved in professional practice? (check all applicable)

_____ Yes as an Architect _____ Yes as a Lighting designer
_____ Yes as an Interior Designer _____ Yes as _____ (please specify)
_____ No

61. Degree(s) held Emphasis of degree

_____ BS/BA/BFA/BARCH _____
_____ MS/MA/MFA/MARCH _____
_____ PHD _____

62 Are you a member of any lighting organization (check all applicable)

_____ IES (Illuminating Engineering Society)
_____ IALD (International Association of Lighting Designers)
_____ Other _____ (please specify)

Thank you for your time and comments

September 4, 1990

Dear Director:

Please direct this survey to the person most closely associated with teaching lighting in your school or department. Your prompt attention is greatly appreciated.

As a lighting educator, I am conducting a survey of lighting educators in relation to lighting practices and background. The objective of this study is to assess aspects of lighting education in architecture and interior design programs. This survey will be most helpful to educators who teach interior lighting, because it can offer concepts for inclusion in the lighting curriculum. Anonymity of respondents will be maintained in the study.

Thank you for helping in the process of providing better lighting education. If you have questions please contact me at (405)744-5035.

Sincerely,

Asha Hegde-Niezgoda

July 23, 1990

Dear Professional:

A lighting study questionnaire was recently sent to you. If you have returned the questionnaire, your effort and time is greatly appreciated. If you did not complete the questionnaire, would you take a few minutes to do so and drop it in the mail today.

Your input is vital, if the study is to accurately represent your profession, and provide concepts for inclusion in the interior lighting curriculum. Thank you for your cooperation.

Sincerely,

Asha Hegde-Niezgoda

APPENDIX B

OBJECTIVE TWO AND ANALYSIS

Objective two: To assess and compare perceptions of architecture and interior design, lighting educators regarding lighting concepts.

A. To assess and compare the perceptions of acquisition and value of lighting knowledge to their teaching.
B. To assess and compare the perceptions of use and value of lighting related resources to teaching.
C. To assess and compare the perceptions of importance of including lighting concepts in interior lighting curricula.

The t-test was conducted to compare the means of the variables in the categories of knowledge, resources, and education between architecture and interior design educators. Within each of the categories, variables were rated on the scale of 5 (most valuable/important) to 1 (little value/unimportant).

In the category of lighting knowledge (table XIV), both the architecture and interior design educators rated job training (total $\overline{X}$= 4.282) as a valuable means of acquiring lighting knowledge. In spite of high rating of job training the t-test indicated a significant difference between the means of the two groups. This difference indicated that the interior design educators considered job training more important than the architecture educators. The other variables that were considered as valuable by both the groups were formal education; attending workshops and demonstration labs; interaction with lighting design professionals, and attending the IES teachers lighting workshop ($\overline{X}$=>4.0). Acquisition of lighting knowledge through the use of audio tapes was considered as the least valuable by the educators ($\overline{X}$=<3.0). This could imply that lighting is a visual field and learning experiences that deal

with this aspect are more important than audio tapes.

A majority of the resources (table XV) were considered as moderately valuable in its use by the educators ($\overline{X}$ = between 3.0 and 4.0). This could imply that most of the lighting resources are considered specific in its use and therefore has less universal value. The use of a pocket light meter, and hand-held brightness meter were considered as the most valuable resources in this category.

In the education category (table XVI), a majority of the concepts were considered important to be included in interior lighting curriculum by the educators. The concept of light and energy was considered important by the educators with a total X = 4.181. In spite of its importance the t-test indicated that the architecture educators considered light and energy more important than the interior design educators.

Concepts such as: field trips to lighting laboratories, lamp characteristics, lighting applications, lighting layout, and light source specification, were considered important ($\overline{X}$=>4.0) to be included in interior lighting curriculum by the educators. Although these concepts were rated as important, the t-test indicated significant differences between the means of the architecture and interior design educators in which the latter rated it more important. A possible explanation is that interior lighting educators are becoming more aware of the current needs of the profession. Today, majority of the interior designers are involved in lighting design, and use the element of lighting to influence the space and its user positively. The notion of lighting design as a

purely technical field which only the architects and engineers dealt with is soon disappearing. This perception is reflected by the interior lighting educators in indicating a higher level of importance for inclusion of these concepts in the interior lighting curriculum than the architecture educators. This could also imply that the interior design educators are paying more attention to the aspect of interior lighting and are emphasizing these components in the curriculum.

Additionally, concepts such as color and light, light control and quality of light were considered as important ($\overline{X}$=>4.5) by the educators. The two concepts that were considered the least important by the educators were membership in lighting organizations, and participation in lighting competitions. This could imply that the educators consider participation in lighting organizations and lighting competitions to be too specific. It might be more important that the student participate and compete in the major field such as interior design or architecture which is broader and of more value to the student at their level of development.

TABLE XIV

T-TEST PROCEDURE FOR ACQUISITION AND VALUE OF LIGHTING KNOWLEDGE AMONG INTERIOR DESIGN AND ARCHITECTURE LIGHTING EDUCATORS

Variable	Mean Scores			T value	Pr > |T|
	Total	Architecture	Interior Design		
Formal education	4.152	4.081	4.234	-0.782	.4360
Continuing educat	3.848	3.724	3.924	-0.892	.3758
Job training	4.282	3.914	4.450	-2.978	.0039
Self training	3.750	3.783	3.698	0.377	.7065
Workshops	4.000	3.812	4.059	-1.405	.1650
Demonstration labs	4.438	4.312	4.483	-1.174	.2444
Test labs	3.397	3.142	3.468	-1.197	.2358
Professional journals	3.648	3.611	3.632	-0.118	.9063
Technical journal	3.360	3.382	3.290	0.396	.6926
Trade shows	3.376	3.250	3.473	-0.971	.3347
Interaction with DSGN professionals	3.747	3.882	3.676	0.990	.3257
Interaction with LTG professionals	4.028	3.885	4.119	-1.339	.1846
Use of audio tapes	2.552	2.500	2.595	-0.346	.7304
Use of video tapes	3.475	3.275	3.622	-1.433	.1567
IES workshop	4.163	3.947	4.325	-1.207	.2364

Note: Mean scores are on a scale of 1 (little value) to 5 (most valuable).

TABLE XV

T-TEST PROCEDURE FOR USE AND VALUE OF LIGHTING RESOURCES AMONG INTERIOR DESIGN AND ARCHITECTURE LIGHTING EDUCATORS

Variable	Mean Scores			T value	Pr > |T|
	Total	Architecture	Interior Design		
LT calculation software	3.355	3.343	3.463	-0.490	.6257
Computer simulation	3.465	3.517	3.500	0.065	.9484
Computer light plan	3.260	3.080	3.409	-1.251	.2174
Pocket light meter	3.913	4.028	3.907	0.584	.5614
Hand-held brightness meter	3.772	3.838	3.792	0.205	.8382
Colorimeter	3.343	3.173	3.428	-1.119	.2692
Spectroradiometer	2.750	2.681	2.820	-0.461	.6472

Note: Mean scores are on a scale of 1 (little value) to 5 (most valuable).

TABLE XVI

T-TEST PROCEDURE FOR IMPORTANCE OF INCLUSION OF LIGHTING CONCEPTS IN INTERIOR LIGHTING CURRICULA AMONG INTERIOR DESIGN AND ARCHITECTURE LIGHTING EDUCATORS

Variable	Mean Scores			T value	Pr > |T|
	Total	Architecture	Interior Design		
Art of light	4.174	4.342	4.134	1.198	.2342
Color & light	4.681	4.631	4.705	-0.648	.5185
Field trips to labs	4.045	3.526	4.294	-3.642	.0006
Interaction with LTG professionals	3.844	3.552	3.985	-2492	.0149
Internship in LTG design firm	3.853	3.631	3.985	-1.690	.0952
Lamp character	4.559	4.351	4.660	-2.230	.0292
Light applications	4.627	4.368	4.750	-2.772	.0075
Light & behavior	4.211	4.236	4.164	0.386	.7001
Light control (bal/glare/intensity)	4.554	4.578	4.544	0.286	.7752
Light & energy	4.181	4.473	4.029	2.997	.0035
Fixture function	4.263	4.078	4.352	-1.865	.0658
Light & health	3.834	3.842	3.835	0.029	.9769
Light layout	4.345	3.815	4.617	-4.223	.0001
Light source specification	4.175	3.729	4.462	-3.484	.0010
Maintenance	3.490	3.263	3.676	-1.988	.0507
Membership in lighting organizations	2.872	2.789	2.926	-0.659	.5117
Participation in lighting competitions	2.889	2.947	2.925	0.101	.9191
Quality of light	4.572	4.605	4.573	0.258	.7964
Quantity of light	4.183	4.108	4.294	-1.137	.2588
Working in design team	3.522	3.552	3.567	-0.067	.9464

Note: Mean scores are on a scale of 1 (unimportant) to 5 (important).

2

VITA

ASHA HEGDE-NIEZGODA

Candidate for the Degree of

Doctor of Philosophy

Thesis: ASSESSMENT OF PERCEPTIONS OF DESIGN EDUCATORS AND PROFESSIONALS REGARDING LIGHTING CONCEPTS FOR DESIGN EDUCATION

Major Field: Home Economics

Biographical:

Personal Data: Born in Mangalore, India, November 24, 1960, the daughter of Subbaya Hegde and Nalini Hegde.

Education: Received Bachelor of Arts degree in English Literature from University of Madras, India in May,1981; received Bachelor of Science degree in Interior Design from Florida State University in August, 1984; received Master of Science degree in Housing, Interior Design, and Consumer Studies from Oklahoma State University in December,1985; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in May,1991.

Professional Experience: Assistant Professor, Design, Housing, and Merchandizing Department, Oklahoma State University, August, 1989 - present; Instructor, Housing, Interior Design, and Consumer Studies Department, Oklahoma State University, January, 1986 - July,1989.