Models for Lighting Design Education

Salim A. Elwazani
Bowling Green State University

Introduction
While educators assure the need for equipping architecture and design students with lighting design knowledge, the nature of the teaching methods employed in imparting that knowledge is not easy to define. The mere number and diversified orientations of academic programs speak for the enormous proportions of such a task. However, lighting educators are familiar with one or more methods of instruction that contribute to developing students’ lighting design competency. Common among these methods are the traditional theoretical lecture, design synthesis, and field case studies. The lecture format is probably the most common, but the instructional practice of supplementing lecture with design exercises or with case study assignments can also be found. This situation engenders a look at the practiced teaching methods and the possible ways of combining them to forge viable models for lighting design education.

A set of models for teaching lighting design beyond the traditional lecture-only model are suggested. These models were developed and characterized by the author through performing three tasks: first, identifying three basic methods of teaching and producing a set of models by structuring distinct combinations of these methods; second, describing the application of the models in the context of the author’s teaching experience; and, third assessing the applicability of the models in educational settings at large.

Model development capitalized on the author’s lighting teaching experience at Bowling Green State University. In classes for undergraduate architecture, interior design, and construction students, the author planned and repeatedly taught lighting subjects in which a variety of lighting design teaching methods were used over the years. This first-hand experience provided the main body of data needed for the study.

Teaching Methods and Models
The teaching methods of interest for this study exhibit contrasting but complementary attributes. Lecture, representing the classic classroom type of activity, generates the lighting knowledge background necessary for interacting with design exercises. Lectures involve a narrative mode of delivery and employ examinations as one measure of student attainment. Design synthesis, representing a typical laboratory type of activity, develops the skills and abilities for producing lighting design solutions. Synthesis exhibits prescriptive and creative modes of work and expresses its outcome in such means as drawings and reports. Case studies emphasize analyzing and researching building lighting systems, both in the field and in the laboratory environment. Case studies exhibit exploratory, reflective modes of work and typically communicate outcome in terms of illustrations-supported reports. The emphasis on communicating the design and case study projects outcomes through graphical and written means supports not only the espoused notion that communication is an essential component of lighting curricula, but also reflects the value of communication in professional lighting practice.

A contemplated decision to utilize, through a robust plan of work, a combination of methods for teaching lighting design describes the concept of a teaching model. The viable
models that can be obtained from interfacing the three basic teaching methods are a) lecture/design (LD), b) lecture/case study (LC), and c) lecture/design(case study (LDC).

**Model Application**

The faculty of the Architecture/Environmental Design Studies Program at Bowling Green State University decided in 1991 to incorporate lighting and other environmental control subjects into a newly developed, second-year level, two-course sequence in building systems technology. Lighting, covered through lecture and laboratory sessions, was instituted as a segment of Building Systems Technology II (BST II), the second course in the sequence. Chronologically, lighting succeeded the segment on building electrical systems. In its lecture-laboratory format, BST II catered to architecture and interior design students in Spring Semesters 1992, 1993, 1994, and 1995; in Spring Semester 1995, it catered also to construction students. Fulfilling the requirement for an architectural drafting prerequisite course, students entered the course without prior lighting experience.

The decision of the faculty to adopt a lecture-laboratory format for the BST courses eliminated from the outset lecture as a sole model for teaching lighting design. This decision was based on the conviction that lecture-only courses invariably fail to engage fully the faculties and interest of students and that a laboratory is a more effective learning environment for preparing students for pertinent practices in architecture, interior design, and construction. A laboratory experience is probably the closest manifestation to an internship experience which is valued by employers.

In contrast to lecture only, the lecture-laboratory format provided fertile ground for applying the first model, lecture/design synthesis (LD). The planning of the design synthesis experience of this model necessitated a look at issues of significance, or defining parameters. As change in parameters occurred from one offering to another, so did the planning of design synthesis experiences. This practice can be seen by comparing the 1992 and 1993 offerings. The 1992 lighting laboratory assignment required the use of the prescriptive zonal cavity and the point techniques in solving design problems in a lecture room and a conference room respectively in an office work environment (see Figure 1). The 1993 assignment put much less emphasis on the point method, but placed importance on using the zonal cavity method in solving design problems in an architectural studio space and other associated spaces with different light requirements (see Figures 2 and 3). Besides the typical procedure of the zonal cavity method, the assignment supported the aim of exposing students to two creative (versus prescriptive) experiences. The first experience allowed students to make lighting design evaluations and decisions based on qualitative criteria such as comfort and aesthetics. This experience was a bold attempt at balancing the “scientific and technical base” with “quality and aesthetics in lighting design.” The second experience allowed students architectural space planning decisions and gave them the opportunity of integrating lighting systems with the architecture of the space. “Some of the best lighting designs are designs that are sublimated to the original concept of the building.”

Modifications introduced to the BST II course content necessitated the shrinking of the 1995 LD model design assignment to result in a plan appreciably different from the assignments of previous years. Calling for a lighting design solution for a computer laboratory using the zonal cavity method coupled with consideration for light quality (see Figures 4 and 5), the 1995 assignment was allocated only six weeks compared to eight weeks in 1992 and 1993 offerings. The saved time from shrinking the lighting design project—and also from shrinking the electrical system design project that year—was devoted to accommodating a laboratory analysis project on building accessibility.
Figure 2. Plan and section documenting a student group's solution for the 1993 lighting design project.
Figure 3. Isometric documenting the solution for the 1993 lighting design project which is also illustrated in Figure 2.
Figure 4. Plan documenting a solution for the 1993 lighting design project.
Figure 5. Sections and Elevations oblique documenting a solution for the 1995 lighting design project which is also illustrated in Figure 4.
The second model, lecture/case study (LC), has not been strictly practiced in any of the four offerings. Still, information about the model can be obtained because of the commonality of lecture with the other two models and the commonality of case study with LDC model. The information derived from a student opinion survey administered by the author also helped in characterizing the LC model.

As in the case of the first model (LD), the course lecture-laboratory format provided an appropriate environment for applying in 1994 the third model (LDC) combining lectures, a design synthesis project, and a case study project. The design project involved a uniform lighting solution for the lecture room of the office environment of the 1992 assignment. The case study project involved the research, analysis, and reporting on a predominantly uniform lighting system in a space of student choice (see Figures 6 and 7); the project also involved the analysis of the electrical system in the same space. For the lighting system of the project, students were asked to identify and describe by verbal, graphic, and photographic means an existing lighting system in aspects such as design standards, confirmed or speculated procedures followed in the design, fixture arrangement and layout, fixture specifications, and fixture switching and dimming controls. To obtain the data needed for analyzing an existing lighting system, students made necessary contacts with system designers, owners, and managers of the facility in which the system was installed.

The case study project for the LDC model posed unique challenges to the learners and the author. The challenge to students centered around the selection of a lighting system of an existing building and around the efforts to define the study scope in accordance with parameters established by the author—which by themselves were, by necessity, general in nature to accommodate diverse systems. The time dimension of contacts with professionals and owners for obtaining data, securing interviews, and arranging for facility visits proved to be arduous. For some groups, the pace of the interview was too slow or the information available was too limited, and they had to switch their efforts to another facility. Upon selecting the facility, students still had to focus on reducing the obtained data in such a way to define a manageable scope for the study. Students’ challenges readily translated into challenges for the author, a situation that demanded close supervision and direction of students’ work.

**Model Assessment**

In a strict sense, only the first model (LD) and the third model (LDC) have been applied by the author in teaching lighting design. However, since lecture, design synthesis, and case study teaching methods are accommodated by the applied models, an approximate assessment for the second model (LC) was still possible.

A number of criteria for assessing the applicability of teaching models came under consideration. Salient among these criteria are the nature of experience afforded the students, efforts for planning and managing the teaching process by the instructor, the time dimension of implementation, and the relevance of students’ experiences to their future professional practices. Each criterion affects the teaching applicability in some way.

As a criterion, the nature of experience afforded the students conveys the prevalent learning mode through which students interact and assimilate knowledge and skills. These include the prescriptive, the reflective, the creative, and the explorative modes. Prescriptive mode describes the use of scientifically established procedures and standards in solving lighting design problems, such as the use of the zonal cavity method for providing uniform illumination. The reflective mode denotes the opportunity for information assimilation through reflective means such as group discussions and problem solving. The creative mode expresses aesthetically-dominated bases for producing lighting design schemes.
Figure 6. Illustration from case study report highlighting lighting fixtures in a building.
**LS-LOBBY AREA:**

The lobby area, as you can see in figure 12, is an area that is obviously seen and used by both clients and employees. In the illumination of the lobby area sunlight must be a consideration in the calculations of illuminance. In this particular area it was decided that 2-40w U-Lamp 2x2 lay ins would be used. This fixture, made by Daybrite, is also a nine-inch deep cell with parabolic louvers. The louver finish is of low iridescence, semi specular, anodized aluminum which provides less glare to the eye and a better controlled work plane. Although this area has tasks that do not involve the most critical of illumination, this room still needs to present a positive image.

**Figure 12**

Scale $1/8" = 1'-0$

Figure 7. Illustration and text from a case study report analyzing fixtures in a building lobby.
explorative mode provides an opportunity for obtaining information that is not available otherwise through such means as lighting system field observation and surveys. However, the above learning modes are not mutually exclusive, for usually two or more modes are in operation at the same time. Further, the diversity of modes offers instructors an opportunity for tapping on teaching methods of choice, and ultimately shaping models applicable to their lighting design teaching environments.

Other criteria also play a role in assessing the applicability of models. The strenuousness of efforts required versus the efforts possible, for planning and managing the teaching process for a model, determines the degree of applicability of that model. The time dimension of implementation for a model in terms of a number of laboratory sessions, sanctions whether that model is appropriate under the ever-present constraints of time. The relevance of experience to professional practice of students’ majors measures the degree of compatibility between the type of knowledge and skills that the model would afford versus the knowledge and skills anticipated in professional practice.

Comparing the three models using the above criteria yields the results in Table 1.

Table 1: Comparing the three models using salient criteria for applicability

<table>
<thead>
<tr>
<th>Criteria</th>
<th>LD Model</th>
<th>LC Model</th>
<th>LDC Model</th>
</tr>
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<tbody>
<tr>
<td>Nature of experience</td>
<td>Prescriptive &amp;</td>
<td>Reflective &amp;</td>
<td>Prescriptive,</td>
</tr>
<tr>
<td></td>
<td>reflective, but</td>
<td>explorative</td>
<td>reflective, explorative;</td>
</tr>
<tr>
<td></td>
<td>could be creative</td>
<td></td>
<td>also could be creative</td>
</tr>
<tr>
<td>Managing teaching process</td>
<td>Demanding</td>
<td>Demanding</td>
<td>More demanding</td>
</tr>
<tr>
<td>Time required for implementation</td>
<td>Shorter</td>
<td>Shorter</td>
<td>Longer</td>
</tr>
<tr>
<td>Relevance to professional practice</td>
<td>Relevant</td>
<td>Relevant</td>
<td>Very relevant</td>
</tr>
</tbody>
</table>

It is clear from Table 1 that the LDC model is capable of employing the modes used in the LD and LC models combined, and that it bears the benefits of both. However, it is also clear that the superiority of LDC model comes at commensurate expense in managing the teaching process and in allocating prolonged time for implementation.

The advantages of the LDC model were further confirmed through a survey. Student views were solicited through a questionnaire distributed by the author at the conclusion of the Spring Semester 1994 course offering. That had been the offering in which the third model, LDC, was administered; thus, the survey, although conveying information about all models in general, emphasized information about the LDC. Thirty five out of 40 students responded to a set of questions on a scale of 1 to 5 where, in terms of significance of the questions attributes, 1 indicated the weakest level, 5 indicated the highest level, and 2.5 indicated the intermediate level.

The survey results concerning model effectiveness, ranked the LDC model first, LD model a close second, and the LC model third. Ordinarily, this result was compatible with a hypothetical ranking by the author made before completing the survey, as shown in Table 2. However, the survey model ranking differed appreciably in cardinal terms.
Table 2: Survey ranking and hypothetical ranking of model effectiveness

<table>
<thead>
<tr>
<th>Model</th>
<th>Survey Score</th>
<th>Hypothetical Score</th>
</tr>
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<tbody>
<tr>
<td>LD</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>LC</td>
<td>3.2</td>
<td>3</td>
</tr>
<tr>
<td>LDC</td>
<td>3.6</td>
<td>5</td>
</tr>
</tbody>
</table>

The survey also resulted in information about the relationship of the LDC triad, namely the lecture, the design project, and the case study project, as explained in the following statements:

- While the effect of lecture on the success of design project experience was definite (3.1 score), the effect on the success of the case study project experience was more emphatic (3.7).
- The effect of design project, which was completed first, on the success of case study project experience was confirmed (3.4). Also the desire for maintaining such sequential relationship between the two projects was confirmed.
- The time devoted to the two projects was tight (3.2).
- Obtaining and interpreting project information was much more difficult for the case study project (3.8) than for the design project. Also, the pleasantness of project experience was less for the case study project than for the design project.

Conclusions

A lighting design teaching model embodies two or more teaching methods implemented according to a preconceived plan. The interface of lecture, design synthesis, and case study teaching methods considered in this study resulted in three viable teaching models: lecture/design synthesis (LD), lecture/case study (LC), and lecture/design synthesis/case study (LDC). The characterization of the methods and the generation of the models were propelled largely by the author’s own teaching experience.

The course lecture-laboratory format is conducive to administering lighting design and case study projects, and thus is an environment where models can be utilized. This format also corroborates the universal value of lecture activities as means of the theoretical grounding needed for laboratory endeavors, being design or case study projects.

The fact that lecture, design synthesis, and case study have all been practiced as teaching methods made it possible to render assessment on the LC model, though the model itself was not strictly applied. The results of a student opinion survey also supported the assessment process.

The criteria used in assessing the teaching models were meant to address concerns that instructors may have in common. Therefore, the addressed areas of concern took on a universal disposition to maintain a commonality that would respond to diverse lighting design teaching requirements. It is conceivable, however, that interested instructors would contemplate refinements in the suggested criteria to respond more closely to their own circumstances.

Using the established criteria, the model assessment process resulted in defining advantages and limitations for each model, and hence the conditions under which the model is applicable. The results indicated that the LDC is the richest model for providing diversity of learning experiences and preparation for professional practice. However, the application of the LDC model is possible only if the highly stringent requirements for managing the
teaching process and allocating prolonged time for implementation are met. On the other hand, the results of the assessment process concerning the LD and LC models indicated applicability conditions opposite to those of the LDC model. That is, either LD or LC has less demand for managing the teaching process and for allocating time for implementation. However, the application of either model is possible if the lower level of learning experience diversity and preparation for professional practice is tolerated.

The results of the student opinion survey generally supported the findings concerning the comparative applicability of the models for lighting design education. Further, the results revealed information about the relationship among lecture, design projects, and case study projects within the LDC model. Such information would be helpful in refining the LDC model in particular, and all the models in general.

References


3 Ibid, 18.


Biographical Information

SALIM A. ELWAZANI is the coordinator of the Architecture/Environmental Design Studies Program at Bowling Green State University. Registered Architect in the State of Ohio, he holds a Ph.D. in Architecture from the Catholic University of America and M.S. in Architectural Engineering from the University of Kansas. He also holds a B.Arch and a B.Sc. in Planning. Dr. Elwazani teaches mechanical and electrical systems and architectural design. His research activities involve mechanical and electrical systems, building preservation and cultural architecture.