Development of Visual Skills: Digital Photography as a Tool for Research and Teaching in Architectural Education

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Abstract. An architect's education requires a broad mastery of visual skills. Particularly in design courses, students must demonstrate the skills necessary for the use and production of images to achieve a competitive academic performance. However, the development of these skills in students and the evaluation of their work by faculty members are based mostly on subjective criteria supported by the faculty's experience. The research used digital photography as an object of research to understand the processes of learning in architectural design. The results help to establish new educational strategies for the development of visual skills to be used during the design process. The collaboration between faculty members and librarians of the School of Architecture at the University of Puerto Rico presented new partnerships that have enriched the planning process of different pedagogical activities for the advancement of knowledge with the development of visual literacy skills in students.

Keywords: Visual skills, digital photography, architectural education, visual methodologies, architectural design process, urban landscape.

1 Introduction

An architect's education requires a broad mastery of visual skills. Particularly in design courses, students must demonstrate the skills necessary for the use and production of images to achieve a competitive academic performance. However, the development of these skills in students and the evaluation of their work by faculty members are based mostly on subjective criteria supported by the faculty's experience. Seldom are pedagogical practices considered within the hegemony of the workshop culture and the architectural design process. One of the general practices in a design workshop is to concentrate on the formal and aesthetic aspects of the final product, instead of the design process itself [1]. Furthermore, this teaching strategy isolates the designer from the environmental considerations where the architectural work takes place [2].

The objective to this research is to recognize the use of photographs in architectural education, as a research tool in the study of urban landscape, as well as an object of research, to understand the processes of learning in architectural design. The research used digital photography, as an appropriate instrument of teaching to develop visual

S. Kurbanoğlu et al. (Eds.): ECIL 2014, CCIS 492, pp. 407–416, 2014.

thinking, needed by any student of architecture and as a mean to facilitate teaching. This study employs a case study method that examines the processes of teaching-learning mediated by visual artistic products, specifically to: make a diagnosis of the level of first-year design students in terms of image production; analyze the production and post-production of images taken in a place; and, analyze the visual results in the identification of problems throughout the design process.

The development of visual skills was conducted in the course *Architectural Design Fundamentals*, first year studio. The paper charts how we studied the experiences of the students at the beginning of their training as architects, specifically, of photographic activity by students when they interact with a place for the understanding of the urban landscape and the identification of problematic situations.

This process is addressed by the Visual Literacy Competency Standards for Higher Education, published by the Association of College and Research Libraries [3]. As a result, outcomes are established as a function of the student's capacity for creating photographic images using aesthetics and design choices to enhance effective representation and communication of concepts, narratives, and arguments arising from the analysis of a place, and, in turn, this visual product will be a useful tool for the definition of problems in the design process, which, in the context of the architectural teaching-learning process, has value for both, students and instructors.

1.1 First Year Design Course

The courses *Architectural Design Fundamentals*, ARQU 3131 and ARQU 3132, of the undergraduate program of the School of Architecture at the University of Puerto Rico, introduce the students to the factors that influence architectural design. The students confront the design process for the first time and have to organize their ideas to intervene and transform the surrounding environment. They must develop skills to conceptualize and organize the function program, and understand the concepts of function and form, along with the analysis and synthesis of context variables as well as the design, and development of constructible forms. They are introduced to the use of principles of spatial ordering and spatial sequence while being trained in the use of tools for architectural representation. They experiment with the role of materiality and its implications in architectural design, and the study of precedents in architecture. Mastery of these skills leads to asking questions, defining problems and finding solutions in the design process. In these courses, several criteria for accreditation set out by the National Architectural Accrediting Board [4] for design students, are met[1].

[1] A.2. Design Thinking Skills: Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test alternative outcomes against relevant criteria and standards. A.3. Visual Communication Skills: Ability to use appropriate representational media, such as traditional graphic and digital technology skills, to convey essential formal elements at each stage of the programming and design process. A.6. Fundamental Design Skills: Ability to effectively use basic architectural and environmental principles in design. A.8. Ordering Systems Skills: Understanding of the fundamentals of both natural and formal ordering systems and the capacity of each to inform two- and three-dimensional design.

Farivarsadri [5] highlights the importance of these introductory design courses, since they are the first confrontation by students with the representation and visualization skills, with the concepts of architecture, language and design thought. According to Konyk [6] the first year design course is a compressed version of a methodology for all subsequent years, hence it is important that from the beginning, students identify the design process as one individual process that will continuously evolve throughout their education. This process assumes, as a requirement, the acquisition of knowledge and the development of individual skills, since it uses critical and operational tools in each of its stages for the creation of the architectural object.

The learning method used in the course is based on a Problem Based Learning[2] approach. This method raises a very close and dynamic teacher-student interaction. It is common that education in the design studio will focus on the traditional relationship of master-apprentice. There is also a view that often the intention in studio is to transmit knowledge, not to encourage students to think for themselves [7]. Irrespective of the specific domain, some educational models in design education are based upon the replication of professional task performance [1]. Baum [8] points out that design workshops rely too heavily on mimetic learning, which uses architectural precedents and models to develop the ideas, rather than learning by focusing on the specific and the universal, the methods and processes, or in patterns and structures.

Previous studies by de la Harpe and Peterson [9] provide evidence that very few theories of learning are made explicit in art and design. As well as lacking a language with which to talk about teaching, and in many cases, struggling to describe a philosophy or approach, the interviewees also demonstrated little knowledge of research or theory on teaching and learning [10]. This result makes us wonder about design teaching in general and the pedagogical tools used by professors in the design studios.

The pedagogical commitment is to guide the students toward discovery, using critical tools to allow them to establish an effective, cognitive method to interpret and intervene with their surrounding environment [5]. Also, the aim is to cultivate their concurrent reflection on their design problem-solving skills, assisted by attitudes of systemic exploration of possibilities that allow them to understand their own cognitive process [1]. This process is dependent on visual expression; therefore the teaching of operative tools for representation is also required in this process. The visual means are intrinsic to the methodical and expressive part of the process; drawings, photographs, models, and two and three-dimensional representations constitute the visual skills of personal analysis and the exteriorization of mental visualizations, within the design process. Up to this moment, the School of Architecture has not applied the standards, performance indicators, and learning outcomes, as established by the ACRL for the development of students' visual skills.

[2] Problem Based Learning (PBL) is a teaching method in which student gains knowledge and skills by working to investigate and respond to specific design's problems. It includes processes for students to give and receive feedback and critiques of their work by the professor, leading them to make further reflections. These critiques are one-on-one interaction with the professor through personal dialogues and use of visuals representations that attempt to find solutions to design problems.

2 Visual Skills

Visual literacy, according to ACRL, [3] is: "…a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media. Visual literacy skills equip a learner to understand and analyze the contextual, cultural, ethical, aesthetic, intellectual, and technical components involved in the production and use of visual materials. A visually literate individual is both a critical consumer of visual media and a competent contributor to a body of shared knowledge and culture."

The standards established by ACRL [3] for visual and information literacy development [11] provide a guide for the comprehensive integration of these skills in the curriculum for architectural studies. The *Information Competencies for Students in Design Disciplines*, published by the Art Libraries Society of North America [12], are essential to verify the basic information skills that need to be developed by first year architecture students, as the case in the sample[3]. These standards provide a framework to develop in students the skills necessary for the production of effective visual materials, while stimulating the creativity and skills of analytical thinking through the production process. In addition, it would result in students trained to produce significant visual products for a variety of purposes, such as representation and communication concepts, narratives, arguments, and presentation of data and information properly represented. For this study, the aforementioned standard 6 was instrumental since it serves the production of images as an essential component of visual literacy. These basic skills should be taught deliberately [13-14].

For Hattwig et al. [14] in the participative academic culture, it is expected that students contribute toward research, learning and communication as sources of knowledge. Self-expression, through the creation of visual products, also helps students in their critical view, interpretation and evaluation of the work of others as experimenters, and in making decisions about the visual representation of their ideas. For all architects, visual communication skills are fundamental to her/his training as a student and later on [4-5], [15].

[3] With this publication, professors and information professionals have a series of standards, which can be referenced while teaching visual skills in the classroom. The seven visual skills from ACRL, that are aligned with the ACRL Information Literacy Standards, are: Determine the nature and extent of the visual materials needed; Find and access needed images and visual media effectively and efficiently; Interpret and analyze the meanings of images and visual media; Evaluate images and their sources; Use images and visual media effectively; Design and create meaningful images and visual media; Understand many of the ethical, legal, social, and economic issues surrounding the creation and use of images and visual media, and access and use visual materials ethically.

3 Digital Photography as a Tool for Research and Teaching in Architectural Education

In academia, architecture is one of the few disciplines in which the image, rather than the word, is the primary language of communication. In fact, visual representations in architecture are considered academic tools to root ideas, knowledge and reasoning [16]. Commitment to the visual is evident in the teaching of subjects such as history and technology, but is particularly important in the design workshop. Visual skills are directly inherent to the solution of problems and to critical thinking applied to the design processes. Architectural undergraduate education uses visual methods such as drawings/sketching, photography and models as a way of helping students perceive more accurately in three dimensions and to promote the development of spatial or visual thinking [16-17].

Architectural product requires skills of creation, interpretation, and evaluation, specifically those related to visual material. To be able to develop the ability to analyze, interpret, use, and produce photographic images to construct meaning, within the architectural curriculum, can reach a significant level in the critical conscience of the student. Visual literacy offers students a critical lens, so they are less likely to take pictures for their appearance and more likely to "read the world" [18].

Since the invention of the photographic process, cultural and sociopolitical studies have extended the use of photography for research [19]. Moreover, photographs have been used as visual artifacts that narrate behaviors, places, and experiences, making photography part of a “critical visual methodology” [20]. Furthermore, Sontag says that photography is not a true reflection of the photographed reality because it is accompanied by multiple meanings and great potential for interpretation [21]. From this perspective, the creation of pictures establishes close ties between the existing environment and its creator, allowing a constructive process as a result of the codification of experiences and meanings. Photography allows the architectural student to interact with and interpret the urban landscape, not only while taking photos, but also during the postproduction stage to highlight issues that later will be integrated into their design process. This method allows the students to see the place, not as passive observers, but as active participants in a construction and production process through photographic activity. Using photography intrinsically is considering it speech with notable aesthetic qualities, which not only presents, but simultaneously interprets, what is represented and therefore manages to ask questions in depth, describe situations, defend ethical positions or reach reasonable justifiable conclusions [22]. Images, visual thinking and aesthetic methods are important in knowledge production and have been significant in the interaction between art and science as it has been defined by Kemp [23].

In the case study presented herein, the authors are betting on the experience of photographing using aesthetic and composition resources, as well as artistic research methodologies, to provoke a wider and deeper understanding of the place. That is, there is an intentional effort (both inductive and deductive) to comprehend the sensory experience represented in the photo, coupled with awareness and accounting of the feelings, thoughts, memories and emotions which are stimulated through engaging with that experience [17].

4 Case Study: See and Intervene in Loíza Street

The final task leads to eleven students from the *Architectural Design Fundamentals* courses to investigate the urban landscape through the living experience at the Loíza street of Santurce in San Juan, Puerto Rico. It is expected that the visual record of this urban space, and its components, will educate students in the formulation and definition of architectural design problems. The visual record by the students, through photographic images of the place, produces new visual interpretations, through the use of compositional and artistic means. With this task, it is expected that the student will develop the skills and knowledge needed for sound decision-making during the architectural design process.

The task at hand can be divided into two parts. The first part is a visit from students and professors to the Loíza Street with the purpose of registering themes, situations, actions and objects, through digital photography. Once the site visit is concluded, students will select five photos that comply with the criteria established by the instructor: composition - volumes and leading lines, brightness and contrast, color, focus, framing and camera shots. In addition, the photographic sequence of the images selected by the students is evaluated, taking into account important aspects such as narrative logic, plot progress (time and space), and theme. The criteria to select and work on the photographic images are based on the concerns and interpretations that they have experienced in place. Thus, a work of image postproduction is required to effectively express the theme. Prior to performing this task, students attended lectures on principles of composition, drawing and handling of graphics editing programs. In addition, students received general instructions for the task, discussed the instructional objectives and the rubric, and suggested topics to guide their observations at Loíza Street: its components, inhabitants, physical, cultural and social aspects as well as considerations of time-space. Instructors offered them a lecture about grammatical cinema conventions. During their visit, they were told that the amount of photographic images would not be limited, as well as the way that the visit would be visually registered. This process was conceived to provide students with enough independence for experimentation and expression, with minimal intervention from the professor in the student's creation or selection process.

The second part of the task focuses on the design of an architectural object on a lot between parcels on the Loíza Street. Using a graphic, and oral exposure to peers and instructors, students: 1) define the preferences and needs of an imaginary client 2) determine potential uses and spatial functions (a part dedicated to housing and another one for the development of a specific and important activity in the life of the imaginary client, 3) develop the theme (concept) of the architectural object. These three components, a direct result of the experience of the place, are essential to initiate the design process of the architectural object.

For purposes of this study, we evaluate the photographic sequence and how it contributes to the design process. The criteria evaluated, according to the rubric are: 1) General image (photography), 2) Cinema conventions in photography, 3) Visual narratives of the photography, and 4) Spatial composition of the architectural object. The rubric was applied to four students who met all the requirements of final delivery of the task. However, the theme criterion was applied to all students in this section, since they all met it.

5 Findings

The work accomplished by the students show the following results. The following aspects are addressed in general image: composition-volumes and leading lines, brightness and contrast, and color. On the first aspect, students demonstrated expertise in creating balanced compositions using the leading lines or volumes in the image in the post-production stage. Students effectively applied the brightness and contrast technique to express atmospheres in accordance with the image's intention. The use of color was the most effective in all sequences submitted by students to establish visual narratives, highlight a theme or focus on urban elements.

In the cinema conventions of photographs, the criteria in which students showed lesser skills were angle and depth of field. Photographs of urban objects were taken parallel to the lens or in perspective at the level of the human eye. Even when students maintained a logical narrative about images, they did not show curiosity in exploring the techniques of angle and depth in field, as well as framing and camera shots. As to the selection of an object in particular as a focal theme of the investigation, two students focused on objects or architectural elements. All students developed the approach using postproduction techniques, altering the photographic image.

In the category of visual narratives, the following issues were discussed: theme, plot progress (time and space), and narrative logic (technique). Four students showed total command in expressing and maintaining the theme in a coherent manner, using objects and color repetitively, and by the postproduction techniques applied. Regarding the plot progress (time and space), only one student excelled when compared to the rest, due to the fact that he/she showed command in the three aspects: theme, plot and narrative logic. In other jobs, the concept of time remains unchanged. Space in each image is autonomous, i.e. does not need captured space on previous or future photos to be understood. The appearance of the narrative logic was effectively expressed by four students using post-production technical resources through the manipulation of the original photographic image.

In summary, in the first part of the task, students depended mostly on post-production techniques to express their concerns about the urban landscape and to address the aspects outlined in the task and in the rubric. Students' photographic sequences are an example of the visual expression of the initial design problems, identified by the students. In the visual materials produced by students, we could not observe consistently the incorporation of the cinema conventions, particularly in angle and depth of field, and framing and camera shots.

In the second part of the task, which consists of architectural design, new criteria were incorporated: the relationship of the architectural form with the theme, the hierarchy, the spatial richness, as well as the beginning and end of the architectural sequence. In all four cases, the architectural object clearly expressed the relationship between the architectural forms with the theme. The theme guided architectural strategies in the design process to define spaces, select materials, and define relationships between solid and voids, among others. During the process, some students distanced themselves from the theme, placing more importance on other variables of the design process to enhance the quality of the architectural product. Consideration of architectural precedents and critiques by the professors influenced change in the form-theme relationship chosen originally by students in the first part of the task. Some of

the critiques given by the professors were driven to address design problems, specifically related to the aspects of space and form.

Regarding the spatial quality criteria, hierarchy, spatial richness and space sequence, the students' work showed a great spatial richness and a clear understanding of the creation of spaces. Those spatial qualities responded to the theme developed by the students. For example, Figure 1 shows the photographic sequence of the student 2, and Figure 2 shows the design proposed by that student, from its original developed theme. In Figure 1, spaces of the Loíza Street are recorded from day and night, showing opposite conditions in the activities carried out: color, lighting and occupation. As a result of student work, it can be observed that the photographic sequence helped define the theme, based on contrasts and mutability. This process, in turn, facilitated the definition of problems and the formulation of design solutions.

Fig. 1. Photographic sequence from student 2 is shown, where the contrast from day and night at Loíza Street is observed.

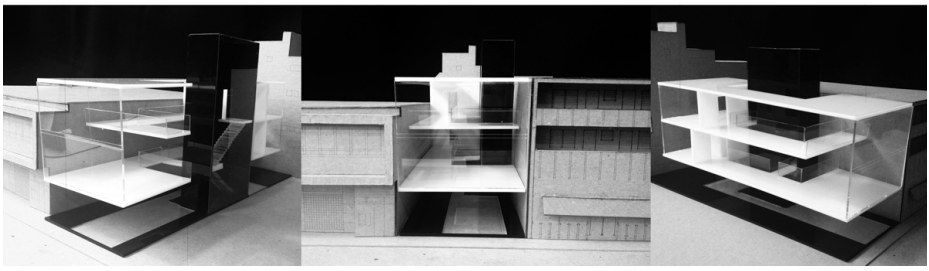

Fig. 2. Architectural design proposal from student 2, based on his original developed theme

The students' results showed that the photographic image served as a connector for the architectural design's final product. For all students, the photographs, product of the living experience in the Loíza Street, were used as the basis to identify a theme, develop an imaginary client, and define a program of spatial functions that would be reflected in the final design proposal.

6 Conclusions

The design process is complex, non-linear, with multiple variables that arise during its development to the extent that the designer is defining and solving problems. This process is challenging for a first year student of architecture who is still developing the skills and knowledge that may assist them. To define a theme, framed in the visual

register of the living experiences of a place, served as a starting point to the design process and exposed the students to real problems of the urban landscape. Visual literacy provided tools for development of the artistic, as well as an appreciation of the aesthetic. They were fundamental since most of the decisions taken during the design process included formal, proportional and composite considerations of the object, and hence, require aesthetic judgments.

In this case study, the integration of photography, as a visual tool for the development of visual skills for first-year architecture students was an appropriate instrument to facilitate teaching. The task of photographic production and postproduction allowed establishing a coherent and concrete relationship between what was discovered in the place and the final architectural product.

The assignment of a task, the creation of instructional objectives, and the implementation of a rubric for the measurement of specific criteria that are part of an architectural project, sets a first methodical approach for the development of the visual skills in the first year of design at the School of Architecture of the University of Puerto Rico. As a result of what they learned, the course students showed the skills necessary for the production and post-production of photographic images, which served as a starting point for their proposal of architectural design in their first academic year. As noted, we need to further develop the students' compositional, artistic and aesthetic skills. The results show the need to address, in a systematic and consistent way, visual skills in the curriculum of the undergraduate academic program, in design courses as well as the sequences of history, theory and technology.

Librarians must have a greater involvement in the integration of visual skills in the academic program, contributing to the creation of rubrics, establishing direct contact with the student in the workshop or classroom, and assisting in the selection of precedents, among others. Collaborative and interdisciplinary participation presents a great opportunity to enrich the visual products of the students.

On the other hand, the pedagogical training of instructors for the creation of adequate instructional resources to develop visual literacy in design courses deserves attention. The process of establishing instructional objectives, defining the task, creating instruments for the assessment of student learning, among others, should not begin with improvisation. It is important to assess the activities that were not as effective, according to the results presented by the students. Future studies will be required to explore in depth the development of these skills, as well as the implementation and evaluation of new strategies for teaching and learning in design courses. This concern leads to a move away from theory to the concrete implementation of educational practices that will allow measurable pedagogical results.

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