UTILIZING CAAD IN THE DESIGN STUDIO TO CONSOLIDATE WITH PROFESSIONAL PRACTICES

Pedagogical approach

EMAD H. RABBOH AND ALI A. ELMANSORY
Canadian International College (CIC), Egypt
emadeldin_hamdy@cic-cairo.com
Al Azhar University in Cairo, Egypt.
mansory74@yahoo.com

Abstract. Utilization of computer-aided architectural design CAAD in architectural design studio has its problems. Recently, CAAD has been over used within education, , and applied, presumably, more efficiently in professional contexts.. Noticeably, time available for the application of CAAD in architectural firms outweights that of academy. Consequently, it has to be utilized effectively and efficiently in the design studio. The current study proposes and discusses techniques to expand and consolidate CAAD utilization in the design studio by analysing stages of work of design professionals, as well as the utilization of CAAD in architectural firms, in the first phase. The second phase looks at the stages of work in the design studio academically. Later, we conduct a survey and categorization of the Egyptian schools of architecture, to identify the mechanisms of their CAAD applications. We aim to improve the synergies between academia and professional practice and, in this respect, we hold a comparison between the professional context and the academic context with emphasis on the pedagogical aspects of architecture in design studio. The third part makes proposals to bridge the gap between the professional practices in the applications of CAAD and academic practices via enhancement of architectural technology-based learning milieu. The proposed techniques are applied and examined in the design studio. They aim to establish the parallelism between academic objectives and professional and technological objectives.

1. Introduction

The Design Studio is the primary forming aspect of architecture students' mindset, where they pass successive stages relying on the nature of the

project.. Out of necessity, educational subject and techniques, and in particular, the design studio changes and adapts ever advancing technologies. There is no doubt that the design studio nowadays is facing vast challenges questioning the success of its role. On one hand, there are internal challenges. For instance, the design studio is influenced by tutors' varying skills and backgrounds, which must be coordinated between them in order to avoid varying feedbacks to students. Likewise, the challenging issues of architectural design education, particularly in the first year, are the diverse backgrounds, expectations, skills, and the level of the motivations of the students (Aktan A., 2008). On the other hand there are external challenges,. One of which is emergence of contemporary architectural trends, which requires continuous development and education on the part of studio teaching team to keep up with these trends. Accordingly, they should also propose development strategies for design studio's technical performance, as well as the techniques of critique. By contrast, there is a general resistance to development among seasoned academics who are comfortable in their ways. They prefer to apply their old methods and ways. The current architectural development dictates maximum utilization of CAAD and effective employment of it in the studio, to assist students' in acquiring skills and in applying the acquired skills. Hence the need for developing a contemporary pedagogical and technological development mechanism.

2. Background

Design studio evolution commenced in Italy, during the latter part of the 15th Century. A number of schools flourished based on the humanistic discourse. The *Academie Royale d'Architecture* was established in 1671. By the early part of the 18th Century, the *Academie* had become entrenched and unfashionable and, as a result, Blondels's *Ecole des Arts* was established in 1743 (Green *et al*., 2003). The *Beaux Ecole des Beaux Arts* in France started the idea of the arch-design studio in the 18th century. It had a particular teaching practice; theory in the classroom and design in the ateliers (studios) (Eigbeonan A., 2013).

As Lackney (1999) stated, the University of Oregon, architecture program, founded in 1914, was the first in the United States. The Bauhaus, formed in 1919, moved to its famous Dessau, Germany, location in 1925, but was closed down by the Nazis in 1933. In 1936, Walter Gropius came to the United States.

Recently, contemporary pedagogical methods emerged in design studio already depend on; 'learning by doing' (Uzunoglu & Quriesh, 2012), using CAAD in the design studio. Historically, the early eighties are to be regarded

as the period of first encounters with computers by larger proportions of people involved in architecture (Martens, 1999).

In the beginning, adding CAAD to the architectural studio curriculum faced strong rejection by studio Professors, thinking that CAAD skills would affect the student's willingness to acquire traditional drafting and design skills (Salman *et al*., 2008).

The next contemporary step introduced was 'using virtual design studio' (VDS) (Donath & Regenbrecht, 1995). Since 1993 schools of architecture all over the world, used various forms of Virtual Design Studio (Schnabel *et al*., 2001). 'Virtual Reality' (VR) started as an experimental tool to assess the impact of VR technology on design (Achten *et al*., 1999). Virtual Design Studio (VDS) paradigm focuses on the dynamic control of social aspects in the design process by the exploitation of technological possibilities (Donath *et al*., 1999), whereas, Bermudez discusses the Virtual Architectural Experiences (1994).

Clearly, other contemporary pedagogical methods emerged in the design studio, such as utilizing 'electronic studio' (E-Studio) (Al-Qawasmi, 2005). Similarly, 'paperless design studio' emerged initially in the early nineties (Reffat, 2007). The tools of Computer-aided design tools are nothing new; however, the emphasis shifted from *automation of* design tasks to *collaboration on* design tasks (Bojduj *et al*., 2008). Moreover, a great importance is placed on the use of information and communication technology in architectural education (Wang, 2009), resulting in the emergence of CAAD. Hence, the repetitive comparison between the use of manual design vs. design with computers (Şenyapili & Basa, 2005).

There are three main types of sketching modes—i.e. fully manual, mixed and fully digital (Ibrahim & Rahimian, 2010.). Without a doubt, the role and vision of design instructor in the design studio are highly critical in guiding students toward choosing the sketching type and to choose their own style (Cil & Pakdil, 2007). A vast proportion of students are turning to the use of CAAD. Hence, there is another debate about CAAD's impact on the architectural design process (Hanna & Barber, 2001). Moreover, various studies discuss the pros & cons of using CAAD in architectural design (Guney, 2015; Schmitt, 2004; Lawson, 2002).

3. Research Problem and Methodology

The architectural design process is passing through successive stages that require a variety of skills. The research problem is summarized in the lack of architectural skills of alumni to work in various stages of design. This is highlighted by the lack of work-based professional training and transferable skills such as the use of architectural software. Furthrmore, the process does not prepare them adequately for the marketplace demands, which has been observed in the Architecture, Engineering, and Construction (AEC),

Egyptian firms sine 2000 to 2016. Obviously, this lack of training leads to a decline in the level professional practice of architecture in Egypt. The research adopted the method of comparative analysis, to determine the reasons for the gap between the method of academic architectural pedagogy v.s. professional practice in Egypt, followed by proposing techniques to bridge the gap between them. This is followed by the application of these techniques in the design studio in the architecture department in Canadian International College (CIC) for 'architectural design 2' in the fall 2015 semester, 'architectural design 3' in the spring 2016 semester, 'working drawings 1' in fall 2015, and 'working drawings 2' in spring 2016. Ultimately, the proposed techniques were validated by a student survey made up of a questionnaire to measure the levels of satisfaction and the impact of overall outcome on the future employability.

4. Professional Architecture Design Phases

4.1. ARCHITECTURAL PROGRAMMING (BRIEFING) PHASE

Briefing phase has long been recognized as the critical activity that begins the building process, which the architect as a building designer must elicit the brief from the client before any design activity can begin (Cornick, 1991).

4.2. SCHEMATIC DESIGN PHASE

American Institute of Architects (AIA) identifies the first phase of services as schematic design. Schematic design establishes the general scope, conceptual design, and scale and relationships among the components of the project (Haviland, 1996.).

4.3. DESIGN DEVELOPMENT PHASE

Design development is the period in which the design itself achieves the refinement and coordination necessary for a really polished work of architecture. The decisions made in schematic design are worked out at a scale that minimizes the possibility of major modification during the construction document phase (Haviland, 1996.).

4.4. CONSTRUCTION DOCUMENTS PHASE

As work becomes more complex, more diverse skills are needed to accomplish it (Gray & Hughes, 2001). The construction documents show in graphic and quantitative form the extent, design, location, relationships, and dimensions of the work to be done. They generally contain site and building plans, elevations, sections, details, schedules, and diagrams.

5. Architecture Design Phases/CAAD in Egyptian Academia

A considerable sample of Egyptian universities demonstrates that architectural design programmes consist of specialised courses on the topic that range from 5 to 6 courses, in addition to the graduation project. We note that the curriculum barely addresses the schematic design phase and does not address the architectural briefing phase. by comparison, building construction and working drawings courses address the construction documents phase. The above suggests the presence of a failure in the architectural programming phase as well as the design development phase. The current research recommends that students should prepare the briefing phase and architectural schematic design phase as early as the second course of design 'design 02'. The design tutors set the project type and, subsequently, the students set architectural space programme and find the appropriate area for each space under the guidance of tutors. The current research offers a solution to students trained to the third phase. It suggests that they prepare the construction documents phase for students' projects they have designed earlier, and then demonstrate their ability to achieve the design development deliverables and apply them to the design before commencing the fourth phase.

A survey of CAAD use in Egyptian schools of architecture shows that schools allow the use of CAAD from 'design 5'. Some other, allow from 'design 2'. After surveying and evaluating the professional practices, it is recommended student training on the use of CAAD must be highly emphasised. While it is possible to develop manual skills in architectural design through independent freehand drawing curriculum, in order to graduate as an architect and inline with workplace demands requirements of the labor marketplace, the survey found that CAAD skills are form a pointo f dependency for the 50 architectural firms that formed our survey.

6. Techniques to Consolidate CAAD & Practices in Design Studio

The research suggests improving the use of CAAD within the professional practice by applying the following points:

- Divide students into groups according to their level in terms of the use of architectural drawing software, so that each group learn particular architecture software under the supervision of a tutor.
- Simplify the parameters that the student must learn to master the professional practice of the architectural software.
- The author holding a lecture to view different architectural software and the deliverables of each software and the pros and cons.
- Support the technologically-challenged students in the use of modern software, and demonstrate how to overcome self-resistance to work with

new methods. Clarify the possibility of error as well as the difficulty of the work at the beginning of the learning curve.

- Demonstrate the best practices of CAAD in the various phases of the design process through lectures using computer displays to resolve design problems using modern architectural software.
- Set bonus marks to increase the use of CAAD in the studio, to solve design problems through modern architectural software.
- Demonstrate contemporary architectural trends (parametric design-bionic architecture-Bio mimicry architecture ..... etc.) and its projects samples, and the connection between software and the production of the samples.

7. Discussion

The current search sheds some light on the mechanics of the professional practice of architecture; likewise, examines the academic context and attempts to foster the synergies between academia and professional practice, in an attempt to bridge the gap between both, so as to help graduates in commencing their professional carrer immediately. Further examination of the proposed techniques through a student questionnaire (Desing2-3, Working drawings 1-2) shows that the percentage of students using CAAD software increased from 13% before the proposed techniques to 87%. The results also highlighted the effectiveness of the role of the tutor in helping students acquire the skills. It also demonstrated how influential this role can be in developing the student's design personality and attitudes. It also guides students in their professional carrer path which could have a huge impact on the whole market by producing not only academically exceptional students, but also professional architects.

8. Results & Recommendations

Professional practice of architecture requires considerable training in the use of CAAD techniques. This study aims to explore ways of improving the use of CAAD among undergraduate students. The study examined the design studio as a key activity in architectural education, and noted its reliance on IT. The study indicates the further need for more research into how to increase students' interaction with CAAD. The study analyses design into and its different phases then surveys academic practice in these phases, then uses a questionnaire presented to students to report their opinion.
The study recommends the following:
- The increase of CAAD software utilization in design in order to break the psychological barriers of resistance from the beginning.
- Highlight the importance of student interaction with modern technology.

- Emphasize the role of design studio tutors in highlighting the importance of CAAD .
- Demonstrate modern trends, and software used to produce such trends.
- Present students with the new additions of CAAD software, and demonstrate its use and best practices.
- Deploying architectural professional practices in the design studio.
- Applying open-minded strategies with the students, and help them take advantage of their energy and creative potential.
- Show interest in and observing students behavioral trends and how they accesses creativity.
- Aplying contemporary educational methods in design studio to develop the creative capabilities of students of architecture.

Eventually, a variety of projects emerged based on the technique as shown in figure (1).

Figure (1) students' project samples after implementing the proposed techniques.

References

ACHTEN, H., et al. (1999). Virtual reality in the design studio: The eindhoven perspective. In Architectural Computing from Turing to 2000 [eCAADe Conference Proceedings/ISBN 0-9523687-5-7] Liverpool (UK) pp. 169-17.

AKTAN A., 2008. A Developmental Perspective for Architectural Design Education. Edinburgh Architecture Research, No. 31, 22-25.

AL-QAWASMI, J. 2005,. Digital media in architectural design education: Reflections on the e-studio pedagogy. Art, Design & Communication in Higher Education, 4(3), 205-222.

BERMUDEZ, J. 1994. Virtual Architectural Experiences. A First Reading of the Implications of a Representational Revolution; in Jeff Hartnett, Greg Herman, Murray Smart (eds.):

Proceedings of the 11th. National Conference on the Beginning Design Student. University of Arkansas Fayetteville. 1-5.

BOJDUJ, BRETT, et al. 2008 Computer aided architectural design: Wayfinding complexity analysis. Computer Supported Cooperative Work in Design, 2008. CSCWD 2008. 12th International Conference on. IEEE, 919-924.

CIL, E., & PAKDIL, O. 2007. Design instructor's perspective on the role of computers in architectural education: A case study. Metu JFA, 24(2), 123-136.

CORNICK, T., 1991. Quality management for building design. Butterworth-Heinemann.

DONATH, D., & REGENBRECHT, H. 1995. VRAD (Virtual Reality Aided Design) in the early phases of the architectural design process. In CAAD Futures (Vol. 95). 313-322.

DONATH, D., et al. 1999. Virtual Design Studio 1998-A Place2Wait. In eCAADe (Vol. 17, pp. 453-458).

EIGBEONAN A., 2013. Effective Constructivism for the Arch-Design Studio. International Journal of Architecture and Urban Development Vol. 3, No. 4, Autumn 2013, 5-12.

GRAY, C. AND HUGHES, W., 2001. Building design management. Routledge.

GREEN, LANCE N., et al. 2003. Studio-based teaching: history and advantages in the teaching of design. World Transactions on Eng. and Tech., 269-272.

GUNEY, D. 2015. The Importance of Computer-aided Courses in Architectural Education. Procedia-Social and Behavioral Sciences, 176, 757-765.

HANNA, R., & BARBER, T. 2001. An inquiry into computers in design: attitudes before– attitudes after. Design Studies, 22(3), 255-281.

HAVILAND, D.S., 1996. The architect's handbook of professional practice. Aia Pr.

IBRAHIM, R., & RAHIMIAN, F. P. 2010. Comparison of CAD and manual sketching tools for teaching architectural design. Automation in Construction, 19(8), 978-987..

LACKNEY, J., 1999. A history of the studio-based learning model." Educational Design Institute, Mississippi State., 5-12.

LAWSON, B. 2002. CAD and creativity: does the computer really help?. Leonardo, 35(3), 327-331.

MARTENS, BOB., 1999. Education in Computer Aided Architectural Design in Europe." Architectural Computing: The CAAD Education Web., 761-769.

RABEE REFFAT, K. F. U. P. M. 2007,. Revitalizing architectural design studio teaching using ICT: Reflections on practical implementations. International Journal of Education and Development using ICT, 3(1).

SALMAN, H., R. LAING, AND A. CONNIFF. 2008. The changing role of CAAD in the architectural design studio. The Built and Human Environment Review 1, 25-39.

SCHMITT, G. 2004. The impact of computer aided architectural design on physical reality. International Journal of Architectural Computing, 2(1), 31-41.

SCHNABEL, MARC AUREL, et al. The first virtual environment design studio. In Proceedings of the 19th ECAADE-Education for Computer Aided Architectural Design in Europe Conference., 1-6.

ŞENYAPILI, B., & BASA, I. 2005. Reconciling computer and hand: the case of author identity in design presentations. CAADRIA 2005-The Association for Computer-Aided Architectural Design Research in Asia: Digital Opportunities, 13-22.

UZUNOGLU, S. S., & QURIESH, A. 2012. A Method of Adapting Construction Education in Architectural design Education. Procedia-Social and Behavioral Sciences, 51, 546-552.

WANG, T. 2009. Rethinking teaching with information and communication technologies (ICTs) in architectural education. Teaching and Teacher Education, 25(8), 1132-1140.