Educating Digital Designers: A Process-Oriented Approach

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Abstract. The new digital technologies clearly influence what we do in practice and teach in design studios. The study adopts a process-oriented approach to initiate digital design in the graduate design studio. It is found that the skills to develop the design process for integrating digital tools and information are critical for designers. The educational pedagogy, operation studies and discussion are presented.

Keywords. Digital design, design education, design process, information management.

Introduction

Digital design is becoming the trend in the information era for architectural design. During the last few years, digital tools including software and hardware are applied to the computer-aided design studios in major architectural institutions. Obviously, computers are useful for visualization and presentation. However, the emphasis of the digital design is not merely to utilize digital tools to represent the ideas or create digital models, but also it narrow the gaps of designer’s vision and the reality.

While digital design thinking affects both the real and virtual design, digital real projects are becoming important and influencing the practice as well as design research (Chiu, 2003). The focus on design studios is also shifted from the virtual design to digital real projects. One of the challenges to the design educators and researchers is how to educate future digital designers who are capable to realize the design concept and carry into practice with the assistance of the digital aids. Therefore, this paper depicts a process-oriented approach for educating digital designers at a graduate design studio. In the digital design process, there are two levels of design: thinking and making, or conception and implementation. The design process that can integrate both becomes critical for education. The pedagogy of this approach and the operational studies are described as follows.

Digital Design Pedagogy

During the last century, the function of conventional design studios is mainly to provide a place for exchange ideas and practicing design skills. The design methodology given by instructors becomes students’ guideline for performing tasks in the process, while the tools and environmental configuration seldom affect the design process. Recently, CAD/CAM (computer aided design and manufacture) is gradually emerged into the design process for better capability of modeling, representation, and data integration. The new digital technologies we use clearly influence what we do in practice and teach in design studios. Previous studies (Chiu et al, 2001) indicate that digital design is related to four facets: designers, design culture, design theory and methodology, and design environment and tools. Therefore, this paper attempts to explore the interactions between digital design and these four
facets through an analytic framework, Figure 1. Derived from design transformation from concept to realization, the studio implemented a process that starts from programming, defining elements and issues, adopting mechanism, generating alternatives, to evaluation.

The process consolidates a structure of problem solving. The goal of adopting digital tools is to facilitate designers who can perform design tasks in the process with more creative, affordable, efficient, and paper-free options. To achieve the goals in the proposed digital design studio, few steps are undertaken as follows:

1. Conduct theoretic and precedent studies: In order to study the relationship between digital design thinking and making, digital architecture projects are selected for exploring the process from conception to realization (Balmond, 2002; Berkel and Bos, 2002; Eisenman, 1999; Lynn 1999; MVRDV). For example, the animated form is often applied to visualize continuous evolution, Figure 2. These provide the basis for formulating the process and evaluating the design strategies.

2. Initiate conception or exploration of new ideas: Students adopt and develop ideas between the space-time relationship to generate dynamic forms driven by various design concepts such as the folding by Deleuze (1988).

3. Utilize digital tools: The exercises include the uses of CAD/CAM software and rapid prototyping tools (such as 3D scanner and 3D Printer) in design. The main focus is to generate three-dimensional models and deliver key information for supporting design exploration. In the process, skill acquisition in the use of digital media alternates with exploration of a set of design issues.

4. Integrate design and fabrication: Data generated from the modeling are transformed into digital models and physical mockups. Materials such as timber, glass, and steel are chosen for fabrication and structural assembly.

5. Manage the project deliver process: This step contributes mostly to the success of the project through collecting, posting, organizing, and exchanging information on the web.

6. Parallel teamwork through design collaboration with expertise: Although the design was developed individually, the final projects were worked collectively, and received remote reviews and feedbacks in the process. The studio has established permanent relationships with outside consultants to activate the exchange of up to date knowledge.

### Design Operational Studies

In order to evaluate the performance of the approach, each student is required to complete a project from digital model, scale model to physical mockups during the three-month exercises. Information is structured into the process, while each student has to define the mechanism and schedule. In the studio, each designer applies various concepts to their exercises and realizes the design project by digital tools. For example, Figure 3 illustrates a project that explores pedestrian behaviors through animating form by meatball, and converted into a scale model and full-scale mockups. Figure 4 and Figure 5 illustrate two projects that explore the skeleton and skins of free form by simulating standardized components respectively.
Figure 3. Digital Design by Animating Forms.

Figure 4. Digital Design – The Skin.

Figure 5. Digital Design – The Skeleton.
The above exercises raised the questions such as: Are designers beneficial from the process-oriented approach? What should future design studios be configured? Can the process-oriented approach integrated into the curriculum? The above studies provide the foundation for the following discussion.

Discussion

Digital design clearly becomes the trend for architectural design in the digital era. Both the new generation of designers and the design culture foster the atmosphere for adopting digital tools. The digital environment and tools also provide the impetus for redefining both the pedagogy and methodology applied to the design studio. Therefore, the discussion can be derived from the four facets of digital design education to examine the process-oriented approach:

1. Designers: From students' point of view, the digital tools clearly facilitate and foster new possibilities and creativities for both design and fabrication. Choosing the right tools and design process are critical for designers to reach their intention and foster the ideas to shape the characteristics of design.

2. Design culture: Students are more open to new ideas from multiple disciplines. It is found that new generation of designers are gradually getting used to the digital design approach and accept the value of this rationale.

3. Design theories and methodology: Through the introduction of design theories and methodology, designers are able to construct a systematic way to explore new and creative alternatives, and more importantly to evaluate the alternatives in a parallel way.

4. Design environment and tools: New development of digital environment and tools has opened a new way for designers to develop an affordable and efficient way to conceptualize and realize the vision, while the iterations between handmade and digital media still exist for the convenience. In addition, the web is becoming a repository of design information. The future design studios should be integrated with a networking environment for communication in addition to better electronic settings.

In conclusion, the shift from conventional into digital design studios requires the integration of design knowledge and resources (including expertise and tools) to support creative thinking and design. The process of this attempt in teaching digital design studio receives positive feedback from students and reviewers, because digital tools narrow the gap between the concept and reality more efficiently. In addition to learning new computer skills, the most valuable outcome for students is learning how to cope with the new digital design process from design conception to implementation based on information management. To balance the foci of the studio, it also becomes the need for new configuration of studio to bring in more than tools but expertise and experiences.

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