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RESEARCH ARTICLE

Cultural schema and design activity in an architectural design studio

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Abstract
Research on the cognitive activities and on the structure and quality of knowledge flow involved in architectural design education is increasing. These studies generally focus on the interaction between student and instructor, including processes such as producing ideas, solving display problems, and integrating design strategies. These studies commonly include computational evaluations and confirmation of the coding of knowledge. They may also include the determination of designer's thoughts and cognitive actions of design process, as well as the analysis and digitization of verbal protocols during the design process. In most of these studies, the designer's cultural and psychological components are not considered. Accordingly, research on the effects of designers' cultural schema on design activity in design studios is limited. This study aimed to solve this problem by analyzing the relationship between design activity and the designer's cultural schema in a design studio. We performed an experimental study based on a specific conceptual framework and a research model aimed at identifying the relationships among cultural schemas, the architectural design process, and design studios.

1. Introduction

Empirical studies on the cognitive activity of design in architectural design education are increasing slowly but steadily. Many researchers have investigated action analysis, working memory, imagery reinterpretation, and mental synthesis of designers (e.g., Suwa et al., 1998; Gero and Neill, 1998; Purcell and Gero, 1998; Goldschmidt, 1994; Casakin and Goldschmidt,

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1999; Goldschmidt, 2013). In most of these studies, the transmission of knowledge is considered to be a cognitive process, and learning is regarded as one of the most active factors. Such studies are based on computational models and generally examine the coding of knowledge and the effect of coding on design solutions. In addition, these studies have been developed to analyse designer's formal behaviors during problem solving and to determine the cognitive features of the design process and the designer's thoughts. The studies commonly investigate several cognitive levels including physical, perceptual, functional, and conceptual.

However, the importance of integrating culture into the design process is rarely emphasized. In these kinds of studies, design education is generally admitted as one of the most preferred research areas, as it is the locus knowledge transmission that shapes the teaching and learning of design, where design activities can be monitored and investigated.

Design education is not a structure that is focused on a single-dimensional and uniform teaching/learning process. On the contrary, design education requires a structure that directs the student designer toward multi-dimensional and dynamic thought processes and "ways of knowing as a designer" (Cross, 2006).

The studio, as the core element of this educational system, is acknowledged as a cognitive and social system, including knowledge and formation of knowledge structures with social interactions, where creativity is the most important part. Creativity, the cognitive design process in the studio, has a direct relationship with students' cognitive and cultural schemas. As Engeström (2001) explained, the source of creativity is not found inside a person's head but emerges from the interaction between a person's thoughts and his/her sociocultural context. Culture affects the way we think and act and how we classify people into social groups based on their cultural imprint (Gautam and Blessing, 2007). Many studies concern how personal characteristics, such as motivation, emotional stress, and regression (the behavior of escape when facing difficult problems), have an effect on the design process (Gautam and Blessing, 2007; Razzaghi, 2009; Röse, 2004). However, fewer studies focus on the relationship between cultural components (which this study discusses under the concept of cultural schema) of designers and the design process.

The social aspect of the design studio is another important asset of design learning. The American Institute of Architecture Students (AIAS) describes this feature as "the experiences, habits, and patterns found within the architecture design studio that make up what we have termed 'studio culture.'" They declared, in the report of AIAS Studio Culture Task Force, that, to design a healthy studio culture, five essential values need to be considered: optimism, respect, sharing, engagement, and innovation. Every school has its own qualities and needs that will ultimately govern how it creates a more successful studio culture (AIAS Studio Culture Task Force, 2016). According to Lueth (2008), architectural design studio culture is partially generated by a student culture that encompasses teaching pedagogy, as well as the actions of and interactions among students.

From this perspective, the goal of the design studio can be defined as the acquisition of design knowledge through explaining cultural schemas, knowledge structures, and global strategies in design thinking. Through constructing representations of design thinking, as Cross (2006) stated, the students gradually improve their ability to think in "designerly" ways.

To fill the gap in the focus of scientific research on design activity and design education in relation to cultural studies, this study tries to develop a scientific approach based on cognitive-behavioral theories, to analyse whether a relationship exists between designers' cultural schema and their design activity in the design studio environment. To achieve this goal, this study presents the conceptual framework, a model, and an experimental study to investigate the relationship between design activity and designer's cultural schema in the design studio. The conceptual framework consists of the interaction among cultural schema, design studio, and architectural design process. It consists of three components, which further consist of subcomponents. These components are cultural schema (subcomponents: normative meanings, values, and cognition as part of the behavioral process), architectural design process (subcomponents: conceptual design and creative cognitive process), and design studio (subcomponents: cognitive modeling, knowledge, reasoning, representation, and learning styles in the relationship between instructor and student).

As the first component, the cultural schema plays a crucial role in this interaction system. Although cultural features affect an individual's perception, knowledge, decision-making, and learning, they are also the basic source of the individual's normative meanings, such as their lifestyle, worldview, and customs. Cultural schemas are conceptual structures in which the individual's normative meanings are coded and interpreted by cognitive processes. Moreover, a cultural schema is the system that affects the individual's learning. Thus, in an investigation of design cognition, the cultural schema should be addressed as the first component of this study's conceptual framework.

As the second component, the architectural design process is evaluated as a form of creative problem solving. This process consists of the conceptual design process, in which conceptual ideas first emerge, and includes the generation of "preinventive" structure and "preinventive" exploration and interpretation (Smith et al., 1995). In addition, the conceptual design process consists of creativity, which is a cognitive and social process that involves the generation of new ideas or concepts and new associations between existing ideas or concepts.

As the third component of the conceptual framework, the design studio is the medium in which cognitive activities occur (Onal, 2010). Interaction between learning and teaching is another factor of these cognitive activities. This interaction supports the awareness and understanding of cognitive activities that have a relationship with creative ideas. In fact, the design studio can be regarded as a cognitive learning process or as a cognitive function of the mind, and, inevitably, the role of the cognitive content of design and design thinking can be described as the basis of architectural design education.

All these components constitute the basic structure and transformation of knowledge and are formed by the cognitive activities of students. This conceptual framework functions as a guide for the model and experimental study. Based on this framework, the study proposes a model for

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