The relationship between student design cognition types and creative design outcomes

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In this study, the creativity of design students in relation to design cognition types was examined. Measurement items based on the 4 design cognition types identified in previous literature, problem-driven, information-driven, solution-driven, and knowledge-driven design, were developed for this investigation. A confirmatory factor analysis was conducted to evaluate the results of a survey of 215 design students; the analysis results indicate that the design cognition type scale demonstrated strong internal reliability and discriminant validity to measure design cognition types. Among the 4 design cognition types, only solution-driven design can significantly predict creativity outcomes. Students at lower grade levels exhibited a greater tendency toward information-driven design compared with students at the senior grade level. Additional results are discussed in this paper.

Keywords: design cognition, design process, creativity

Creativity is an essential indicator of product quality and capability (Christiaans, 2002; Horn & Salvendy, 2006; Kaufman, Baer, Cole, & Sexton, 2008), as well as a crucial criterion that is considered when evaluating design works (Yen & Sun, 2008). During the design process, the creative quality of design outcomes is influenced by a series of cognitive applications and combinations. This is primarily because the characteristics of design activities typically present indefinite criteria and constraints and are directed to the processing of ill-defined problems (Cross, 2001). During the overall design process, cognitive behaviours such as problem identification, planning, and resolution greatly affect design creativity outcomes.

Studies related to design cognition and creativity have reported that high and low creativity outcomes are affected by design cognition types during the design process. Christiaans and Dorst (1992) adopted protocol analysis to examine college freshman and seniors enrolled in industrial design departments, observing that freshmen focused on acquiring information rather than generating solutions; by contrast, the seniors produced superior creative quality, expressed few demands for information, and could immediately identify relevant problems (i.e., identify constraints or requirements). Atman, Chimka, Bursic, and Nachtman (1999) also adopted protocol analysis and observed that seniors

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from Industrial Design departments spent more time in the latter steps (i.e., the modelling, evaluation, and communication steps; p. 140) of the design process than did freshmen. Seniors who produced superior design outcomes could collect substantial, extensive information related to relevant problems; consider multiple alternative solutions; and transition between the stages of the design process. Kruger and Cross (2006) applied protocol analysis to identify the design strategies of nine industrial designers. The results suggested that design strategies can be categorised into four types: problem-driven, information-driven, solution-driven, and knowledge-driven design. Problem-driven design emphasises defining a problem and finding a solution as soon as possible. Information-driven design emphasises gathering information from external sources as the basis for developing solutions. Solution-driven design emphasises generating solutions without spending time defining a problem. Knowledge-driven design emphasises using prior structured and personal knowledge to develop a solution. These strategies can be regarded as distinctive design cognition types. Kruger and Cross (2006) further reported that designers using solution-driven strategies achieved the highest creativity scores and the largest number of solutions, followed by those using problem-driven and knowledge-driven design strategies. Information-driven design yielded the lowest creativity scores and fewest number of solutions.

Previous studies have indicated that the design cognition types related to creative outcomes typically gravitate toward superior design experience, appropriate information use, substantial idea generation, and longer evaluation times (Atman et al., 1999; Christiaans & Dorst, 1992; Kruger & Cross, 2006). Although design cognition types and creativity are assumed to be strongly linked, little empirical evidence has been found to establish a direct relationship between the two variables. Studies in which the link between design cognition types and creativity is empirically documented are scant. Furthermore, the existing research methods were limited to protocol analysis in a laboratory. Whether a large number of samples can be used for measurement and analysis requires investigation.

In summary, this study investigates the relationship between creativity and the design cognition types (i.e., problem-driven, solution-driven, information-driven, and knowledge-driven design) of students enrolled in design departments. Because previous studies have not introduced appropriate measurement tools for classifying design cognition types during the design process, content analysis of the four design strategies established by Kruger and Cross (2006) was performed to establish a design cognition type scale for verifying the correlation between design cognition types and creativity. The analyses in this study emphasised the differing design cognition types involved in each stage of the design process identified by Kruger and Cross (2006). These stages involve design tasks understanding, information gathering, problem definition, idea generation, and idea evaluation. The following two main