Cognitive Styles and Performance in Traditional Versus Digital Design Media

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Abstract: This paper investigates the interactions between cognitive styles as measured by Riding’s Cognitive Styles Analysis and performance in traditional versus digital design media. An empirical research revealed that design performance in both media correlated with being at the Imager side of the cognitive styles continuum. The Wholist-Analytic dimension was found to be independent from performance. The Bonferroni tests indicated that the digital drafting scores of the Imagers were significantly higher than that of the Verbalisers, but no other significant relation was observed. The findings suggest that drawing with computers entails specific cognitive actions that may favour visual type of individuals.

Keywords: Cognitive styles; design performance; drafting performance; traditional design media; digital design media.

Introduction

Cognitive styles are regarded as innate and relatively permanent cognitive traits that refer to individuals’ typical or habitual modes of processing information. Many cognitive style definitions had been made in different studies and this rendered the research field scattered and elusive. Riding and Cheema, in their highly cited article, (1991) attempted to unite existing approaches and claimed that different cognitive style definitions can be clustered around two bipolar axes: Analytic-Wholist and Verbaliser-Imager. The Analytic-Wholist (WA) dimension describes individuals’ tendency to process information either as a whole or through dividing into parts. It is assumed that Analytic individuals have a tendency to abstract things from their environment and to process information in a sequential manner, while Wholists are more likely to see “the whole picture” and to use intuition. Verbaliser-Imager (VI) dimension refers to
individuals’ inclination toward coding information either verbally or pictorially. These two dimensions are assumed to be independent from each other. The framework proposed by Riding and Cheema (1991) was presented as a computer-based tool called Cognitive Styles Analysis (CSA) (Riding, 1991). The CSA has been recognized as the most widely used cognitive styles instrument later not only because it synthesized various approaches to cognitive styles construct but also its reliability and validity were established well via empirical research.

Previous studies suggested that the VI cognitive style dimension is related to design and drafting performance with Imagers outperforming Verbalisers. Pektas (in press) studied the interactions between interior architecture students’ cognitive styles and their performance in 2D drafting and design tasks in digital media. She found that Imager students scored higher than Verbalisers did in both drafting and creativity measures. Atkinson (2006) investigated teacher trainees’ performance in design tasks and discussed that Imagers were the most successful cognitive style group both on the VI dimension and among the other cognitive styles as described by CSA. Yukhina (2007) examined the relationships between the VI cognitive styles and design performance among architecture students and concluded that visual individuals tended to have a better quality of their design solutions than was observed among the verbal students.

Some studies investigated the relations between the WA cognitive style dimension and attainment in design. On the contrary with the assumptions of design theorists, existing studies indicated that Analytics performed better than Wholists in design tasks (Roberts 2006; Atkinson 2006). Roberts (2006) studied the relationships between the WA cognitive styles of Cognitive Styles Analysis (CSA) and the design studio performance of architectural design undergraduates at particular stages of architectural education and observed that Analytics achieved better than Wholists in the early years in architectural education, but the difference disappeared at the later years of education. Atkinson (2006) investigated teacher trainees’ performance in design and technology tasks and found that Analytics were the most successful group on the WA dimension, although the differences between the groups were small.

However, to the best of the author’s knowledge, this study is the first to compare traditional and digital media with a cognitive styles perspective. In order to investigate the effects of cognitive styles on students’ performances in traditional and digital design media, a research was conducted among interior architecture undergraduates. This paper reports the findings of the study. The implications of the findings are discussed referring to CAD discourse and to the author’s many years of experience in CAD teaching. The limitations of the study are also addressed and suggestions are made for further research.

Methodology

Subjects
The sample consisted of sophomore students of the Department of Interior Architecture and Environmental Design, in Bilkent University. The sample consisted of 77 students whose ages ranged from 18 to 24. The mean age was 20.36 and the standard deviation was 1.43. There were 61 females (%79) and 16 males (%21).

Performance measures
Cognitive styles of the students were identified by the CSA (Riding, 1991). Every member of the sample completed the CSA in the manner prescribed in the CSA administration documentation (Riding, 1991). The participants were informed about their cognitive styles at the end of the study. Regarding the performance in traditional and digital media, the data were collected from a traditional design studio, a manual drawing course, and an introductory Computer Aided Design (CAD) course. The CAD course included separate drafting and design modules. The performance in drafting and design tasks in both media were measured by the students’ term grades
in the corresponding courses. The letter grades (F-A) were converted to numerical values (0-100) and included in the analysis.

Analysis and results

Cognitive style characteristics of the sample group
The VI ratios ranged from 0.83 to 1.74 with a mean of 1.09 (SD = 0.18) and a median of 1.05. There were 24 (31%) Verbalisers, 21 (27%) Bimodals, and 32 (42%) Imagers. The WA ratios ranged from 0.56 to 3.03 with a mean of 1.56 (SD = 0.62) and a median of 1.45. There were 16 Wholists (21%), 21 Intermediates (27%) and 40 (52%) Analytics.

Cognitive styles and performance
The associations between the drafting/design performance grades and the cognitive style raw scores were analysed first through the Pearson’s Correlation Coefficient. Significant positive correlations were found between the VI ratios and the design performance in traditional (r=0.24, p<0.05) and in digital (r=0.22, p=0.06) media. The largest correlation was found between the digital drafting scores and the Verbaliser-Imager dimension raw scores (r=0.38, p<0.001). The WA cognitive style dimension was observed to be independent from performance. Then, the sample was grouped by the cognitive style categories defined in the CSA administration documentation (Riding, 1991); Imager-Bimodal-Verbaliser in one dimension and Analytic-Intermediate-Wholist on the other (Figures 1 and 2). The analysis of variance (ANOVA) tests were conducted in order to find out if the cognitive styles had any effect on drafting and design performance. The ANOVA indicated that there were statistically significant mean digital drafting score differences only on the VI dimension. The Bonferroni tests revealed that the digital drafting scores of the Imagers were significantly higher than that of the Verbalisers (p<0.01), but no other significant difference was found.

Discussion and conclusions

This study provided valuable insights into the cognitive styles of design students and how cognitive styles may affect performance in traditional and digital design media. Although the importance of visual thinking in design was widely acknowledged in the literature, few studies empirically investigated representational issues in typical complex design problems (Goldschmidt and Smolkov, 2006). This study suggests that one aspect contributing to visual design thinking may be the Verbaliser-Imager cognitive style dimension. Another interesting finding of the study was the significant correlation between attainment in digital drafting and being close to the Imager end of the Verbaliser-Imager range. Such a relation was not significant between the VI cognitive style dimension and drafting in traditional media. This implies that, compared to its manual
counterpart, drawing with computers entails specific cognitive actions that favour visual type of individuals. In what ways does digital drafting differ from manual drafting? The interactions between digital tools and cognitive processes of designers is still a growing area of study. However, we basically know that modelling with digital design tools requires both procedural and declarative modes of thinking i.e. mentally breaking an object into simple objects and executing a series of commands (Hamade et al. 2007). This coincides with the “draw and modify” working principle of the current commercial CAD software i.e. complex forms are derived by modifying simpler forms (Coyne, Park and Wiszniewski, 2002). Moreover, previous research showed that reinterpretation and “seeing” occurred more frequently while working in digital design media than when using traditional materials (Won, 2001). This was accounted for by the high speed of working and the impermanence of digital mark or “see, move, see” that digital working supports very well. Thus, it can be proposed that Imager students performed better in digital drafting than Verbalisers did, because working with digital drawing tools requires intensive processing of images in mind. Further detailed studies are needed to analyse cognitive actions of individuals with different VI cognitive style characteristics. Considering the pervasiveness of digital applications in architectural education, insights into such issues would facilitate for developing teaching strategies and course designs that are well-adopted to individual differences of learners. The author hopes that this study would raise important questions and contribute to the body of knowledge in the field.

References