Training in Technologically Enabled Environments:
Do Training Method and Gender Matter?

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EXECUTIVE SUMMARY

The paper reports the findings from an experimental research study based on the pretest–posttest control group design, which examined the differential outcomes of spatial ability training attributed to training condition and gender. The study sample was comprised of 98 eighth graders (36 girls, 62 boys). The first experimental group (EG1) trained in interaction condition, the second experimental group (EG2) trained in animation condition, and the control group (CG) used printed materials. The groups underwent eight 2-hour weekly training sessions, and the Spatial Visualization test and a survey questionnaire were used to collect the research data. Data were analyzed using the SPSS version 16.0. The findings reveal that spatial ability can be trained and interaction is the most effective condition. An interaction effect is observed with boys, who attained performance gains differentially, whereas girls are condition-neutral. Implications of the findings are also discussed.

Keywords: Animation, Experimental Research, Gender, Interaction, Spatial Ability

INTRODUCTION

Training is one of the important human endeavors that aim at improving humans' life encompassing a wide range of fields. In the military, training is routinely performed to ensure military personnel are always battle-ready. Industrial organizations spend millions to train their workforces to improve productivity. In sports, athletes undergo systematic regimes to build strong and resilient physiques for tough competitions. These few examples illustrate the quest by humans to continually improve their knowledge and skills. In tandem, technologies have become a tool that is utilized for training purposes and they come in different shapes and sizes – from simple, mundane equipment to sophisticated, complex hardware. Virtually, all the technologies involved are computer-based and through rapid advancement in computing technology, greater adoption of these technologies in small organizations such as schools is possible. However, using

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technology-based training faces a myriad of challenges- technical, financial, and socio-cultural issues. Factors influencing computer-based training and skill gaining need to be examined in order to predict learning or training outcomes for such an approach (Yi & Davis, 2003). The use and diffusion of technology has taken place very rapidly in line with the current thinking of learning emphasizing the role of pupils as active participants in the teaching and learning process. Training to improve one's performance involves a complex web of issues entailing carefully analysis of factors that can result in either success or failure. The tools and resources for training are aplenty and more are becoming integrated and embedded in IT technology particularly Web technology. Choosing the right and effective tools will be quite a challenge as to create training environment that is not only conducive but also efficient.

One of the human intelligence that has fascinated researchers and scientists is spatial ability or spatial intelligence. Notwithstanding the differences of opinions all agreed that this cognitive ability is importance in order for humans to function effectively in everyday chores and it becomes more pronounced in performing tasks in specialized domains such as engineering and science. Spatial ability is multi-faceted rather than unitary being conceptualized as a cognitive construct built upon several independent sub-abilities or skills. Linn and Petersen (1985) categorized this ability into three components namely spatial visualization, mental rotation and spatial perception. Earlier on, this ability was regarded as innate not amendable to training. However, evidence from experimental studies suggests that improving spatial ability is possible through proper and specific training (Khairulanuar & Azniah, 2004; Olkun, 2003; Rafi, Khairulanuar & Said, 2008; Turos & Ervin, 2000). One of the important discoveries emerging from studies involving psychometric testing of spatial ability was the revelation of gender differences favoring boys. Generally, boys were consistently found to perform better than girls on these tests suggesting that the former possess greater spatial skills than the latter. Male advantages in spatial ability have been established in reviews by Maccoby and Jacklin (1974), Linn and Petersen (1985) and Voyer, Voyer and Bryden (1995). Age was also found to mediate gender differences where spatial ability was relatively higher among girls at young age, but began to favor boys as individuals approached adolescence (Maccoby & Jacklin, 1974). Given the diverging orientations or preferences in engaging spatial activities such as games, sports and types of educational enrolment, it can be inferred that environmental or experiential factors may influence the development of this ability. The more spatial experience one has the higher his/her spatial ability, which reinforces the notion that this ability can be trained. Various training methods have been employed in spatial training to improve spatial ability namely spatial visualization and mental rotation focusing on the use of current technology and gender (Moyer, Bolyard & Spikell, 2001; Rafi, Khairulanuar & Said, 2008; Rafi & Khairulanuar, 2009; Turos & Ervin, 2000). These studies indicate that spatial ability is a malleable to training, but the level of performance gain is mediated by training specificity, gender, practice duration and condition.

Spatial ability has been established to be a strong predictor of success in engineering and science disciplines or majors (Olkun, 2003; Rafi & Khairulanuar, 2007; Sorby & Baartmans, 2000; Strong & Smith, 2001). One such course for these engineering majors is the engineering drawing or engineering graphics where strong positive correlation was found between engineering drawing performance and spatial ability particularly spatial visualization. In general, students need to utilize two perceptual processing when learning the subject matter, which falls into two categories utilizing these two processes. In the first category, students are required to represent a three-dimensional object on a two-dimensional plane surface through multiple-view drawings and the other category involves creating three-dimensional perspectives by working from the two-dimensional representation of the object (Davies, 1973; Rafi, Khairulanuar & Azniah, 2006, Olkun, 2003). The former part requires students to perceive the respective principal orthographic

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