Exploring Clinical Use of Apparel Design Activities: Enhancing Spatial Ability Through Virtual Apparel Pattern-making

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Patternmaking activities have great potential to act as an effective means to enhance spatial abilities of individuals (Park, Kim, & Sohn, 2011; Workman & Caldwell, 2007). This is because the ability to visualize a garment (e.g., how it will fit and move on a 3D body) is a vital step of the apparel construction (Park, Kim, & Sohn, 2011). In addition, the use of virtual technology has recently gained traction as an attractive tool in enhancing cognitive skills of patients – such as Alzheimer Disease's patients (Coyle, Traynor, & Solowij, 2015). Therefore, virtual patternmaking activities can stimulate the minds of individuals with spatial ability impairment in the direction to enhance that ability. However, no prior study has utilized the apparel design concepts as a clinical method for individuals with spatial ability impairment. Therefore, this study will expand the dimension of apparel design discipline to the clinical area and provide innovative insights to the apparel, clinical, and psychological fields.

Spatial ability is defined as a capability to manipulate a 3D object mentally, including the ability to envision rotating the object, folding and unfolding an item, and picturing the changes in position as the object moves from flat to three-dimensional, as indicated by McGee (1979). Understanding how an object appears and changes in three-dimensions as well as the visualization necessary to imagine and recreate an object from different viewpoints is spatial visualization (Strong & Smith, 2001). It is further referred to as the ability to perceive an object horizontally, to rotate an object mentally, or to perceive one object embedded within a more complex figure as spatial visualization abilities (Linn & Petersen, 1985). As components of spatial ability, Tartre (1990) proposed a classification scheme for spatial abilities: 1) spatial visualization and 2) spatial orientation. The spatial visualization involves capabilities of mentally moving an object whereas the spatial orientation component involves being able to mentally move your viewpoint while the object remains fixed in space (Tartre, 1990). The spatial visualization component is further subdivided into two categories: 1) mental rotation and 2) mental transformation. Mental rotation takes place when the entire object is transformed by turning in space, whereas with Mental Transformation, only a part of the object is transformed in some way (Tartre, 1990).

Apparel design activities have great potential to act as an effective tool to enhance spatial abilities. Patternmakers utilize manipulative, analytic, and visualization skills to understand how the two-dimensional pattern pieces will connect to create the three-dimensional shape of the finished garment and how adjustments, such as dart position or manipulation, will impact the

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resulting silhouette (Workman & Zhang, 1999). Thus, the ability to envision the flat pattern piece in three-dimensions is a necessary skill for patternmaking activities (Workman & Zhang, 1999). Creative thinking is another skill enhanced by spatial visualization activities and it may be employed by reading a garment sketch, creating a 3D garment from the sketch, and possibly working in reverse to create flat pattern pieces based off of a 3D garment (Workman & Zhang, 1999).Virtual technology can also provide a platform that enhance spatial abilities. Use of 3D computer programs was found to significantly improve spatial visualization skills with participants (Braukmann & Pedras, 1993; García-Betances et al., 2014). Coyle et al. (2015) assessed the efficacy of virtual reality cognitive training programs for individuals with mild cognitive impairment and concluded that the virtual reality cognitive training improves participants' cognitive domain including spatial abilities. Thus, carefully designed training using 3D computer programs can have significant benefits on elevating spatial visualization skills (Park, Kim, & Sohn, 2011). Literature indicated that a potential to improve individuals' spatial abilities through virtual patternmaking activities. Spatial orientation can be addressed through moving darts in 2D patterns mentally to achieve a desired shape of a garment. Virtual prototyping programs, such as Lectra 3D, Optitex 3D, and Browzwear VStitcher, provide a platform to stitch a garment and check its fit virtually. Using these programs for patternmaking activities will further enhance individuals' spatial abilities. An application of the virtual patternmaking concept to improve spatial skills is illustrated in Figure 1. As indicated in Figure 1, for example, spatial visualization can be addressed through transferring a 2D sketch into 3D garment design mentally in the design process.

Individuals with spatial ability impairment can benefit from a training utilizing the concept of Virtual patternmaking. For example, decline in spatial ability is a major symptom of Alzheimer disease's patients that severely affects their quality of life quality. Several articles evidenced that cognitive skill training including spatial ability related activities for Alzheimer disease's patients provides improvement in learning, memory, executive functioning, daily living activities, general cognitive problems, depression, and self-rated general functioning (Coyle et al. 2015; Ayutyanont et al., 2014). Therefore, virtual patternmaking activities have a great potential as intervention that starts in the absence of mild spatial ability impairment of individuals to patients of Alzheimer's disease. The current study provides a ground for future study to develop an intervention of spatial ability impairment for individuals. For future study, the researchers will investigate the effects of the patternmaking activities on spatial ability improvement as well as measure individuals' brain activities through the neurophysiological method before and after the virtual patternmaking activities.

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Reference

Ayutyanont, N., Langbaum, J. B., Hendrix, S. B., Chen, K., Fleisher, A. S., Friesenhahn, M., Ward, M., Aguirre, C., Acosta-Baena, N., Madrigal, L., Munoz, C., Tirado, V., Moreno, S., Tariot, P., Lopera, F., & Reiman, E. (2014). The Alzheimer's prevention initiative composite cognitive test score. *The Journal of Clinical Psychiatry, 75*(6), 652-660.

Braukmann, J., & Pedras, M. J. (1993). A comparison of two methods of teaching visualization skills to college students. *Journal of Industrial Teacher Education, 30*(2), 65-80.

Coyle, H., Traynor, V., & Solowij, N. (2015). Computerized and virtual reality cognitive training for individuals at high risk of cognitive decline: systematic review of the literature. *The American Journal of Geriatric Psychiatry, 23*(4), 335-359.

García-Betances R., Jiménez-Mixco V., Arredondo M. T., Cabrera-Umpiérrez M. F. (2014). Using virtual reality for cognitive training of the elderly. *American Journal of Alzheimer's Disease and Other Dementias, 30* (1), 49-54.

Linn, M. C., & Petersen, A. C. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development*, 1479-1498.

McGee, M. G. (1979). Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. *Psychological Bulletin, 86*(5), 889.

Park, J., Kim, D. E., & Sohn, M. (2011). 3D simulation technology as an effective instructional tool for enhancing spatial visualization skills in apparel design. *International Journal of Technology and Design Education, 21*(4), 505-517.

Strong, S., & Smith, R. (2001). Spatial visualization: Fundamentals and trends in engineering graphics. *Journal of Industrial Technology, 18*(1), 1-6.

Workman, J. E., & Caldwell, L. F. (2007). Effects of training in apparel design and product development on spatial visualization skills. *Clothing and Textiles Research Journal, 25*(1), 42-57.

Workman, J. E., & Zhang, L. (1999). Relationship of general and apparel spatial visualization ability. *Clothing and Textiles Research Journal, 17*(4), 169-175.

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