Spatial Performance and Women's Persistence and Success in Science

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Brief Description

The proposed presentation is based in a multi-year interdisciplinary collaborative study of undergraduate women's persistence and success in science. It would focus on the documented relationship between spatial performance and science success. The goals of this workshop session would be to 1) enhance participants' understanding of the extent to which spatial performance can be affected by training and practice, 2) allow participants to discover the variety of effective approaches to solving spatial problems and 3) share an approach that can be effective in enhancing the spatial skills correlated with science success.

Summary

As part of a multi-year study of undergraduate women's persistence and success in science we have assessed incoming university students on a variety of measures and tracked their grades and patterns of course enrollment. A subset of students have participated in a variety of mentoring experiences that focused on science as a profession, academic survival and spatial problem solving strategy development. The proposed workshop would focus on the contribution to science success made by spatial factors and will engage participants in spatial problem solving puzzles, games and exercises.

This work is based in a literature that posits that spatial ability (i.e. the ability to imaginally twist, turn, rotate or invert images or to determine relationships among spatially arrayed stimuli) is fundamental to performance in science, mathematics, and engineering and that these abilities differ between men and women (McGee 1979). However meta-analyses (Hyde 1981; Linn & Petersen 1985) have revealed that biological factors account for no more than 5% of the variability in spatial performance. Conversely, both general spatial experience (regularly engaging in tasks that require spatial problem solving -football, gymnastics, clothing design, etc.), and specific spatial task practice and training are strongly associated with better spatial performance (Saccuzzo, Craig, Johnson & Larson, 1996; Schultz, Chamberlain & Moshenko 1993; Signorella, Krupa, Jameison & Lyons 1986; Stericker & LeVesconte 1982). Further, direct examinations link spatial ability and science success (see Tracey 1987 for review; Bender & Milakofsky, 1982; Carter, Kieg & Rubba, 1993; LaRussa & Bodner, 1987). However, very little academic training in science focuses on spatial thinking and most instructors assume the existence of necessary spatial skills.

As one facet of a multi-year interdisciplinary collaborative study of undergraduate women's persistence and success in science we conducted small group mentoring sessions on spatial problem solving. These sessions focused on experience and practice in spatial thinking and problem solving, emphasizing pluralities of problem-solving techniques. In these sessions women worked small groups solving two- and three-dimensional spatial puzzles and games (e.g., three-dimensional jigsaw puzzles, tangrams, pentomines, Soma Cubes, etc.). Research assistants facilitated discussions of problem solving approaches and of the use of alternate and varied strategic problem solving approaches. As the sessions progressed, the groups moved from working on concrete puzzles and games to working with spatial computer games and programs (e.g., Tetris, Block Out, Vertis Walk-Through) that more closely approximated the imaginal manipulations needed to solve many science, mathematic and engineering

spatial tasks.

For the undergraduate women in this study spatial practice was found to be associated with up to 40% increases in their spatial task scores (control group performance increased approximately15%) making their performance equivalent to that of their male counterparts. Further their science GPA is strongly predicted by, among other variables, spatial task performance, past involvement in spatial activities and participation in the mentoring groups.

Content

The proposed 90 minute workshop would be structured like our small group sessions and would provide a framework in which participants could explore and share strategic spatial problem solving approaches and discover how effective spatial practice and training could be employed with groups of students. The team of presenters would outline the research supporting the relationship between science and spatial abilities, the spatial performance differences found between women and men, and the variety of solution strategies individuals employ when solving spatial tasks. Participants would then be given the opportunity to work in small groups with a wide variety of spatial tasks, puzzles and games. The presenters would facilitate exploration and practice of a variety of strategic approaches to these spatial activities. Subsequently the groups as a whole would discuss what they had discovered about spatial performance (their own and that of others) and work at synthesizing this information and discussing its application to other learning venues and groups of learners.

Format:

This would be a 90 minute workshop for 20 to 30 participants lead by the presenters and structured as follows:

20 minutes for presentation of background information and theory
40 minutes of hands-on spatial problem solving
20 minutes for whole group discussion and synthesis
10 minutes for summary and final questions

Implications:

This workshop would provide faculty, teachers and students with insight into their assumptions concerning spatial task performance and their spatial ability. This workshop would share mechanisms for reducing sex-related differences in spatial performance, enhancing spatial ability and increasing the probability of women's persistence and success in science.