

DEPARTMENT OF ENGINEERING AND COMPUTING EDUCATION
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

FOR APPLICATION YEAR: 2025

PROJECT TITLE: Spatial Training in STEMM Education: Spatial Tasks, Apps, and Assessments (STAA)

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Project Description

Spatial ability is recognized as a pivotal dimension of multifaceted intelligence, crucial for an individual's successful performance in science, technology, engineering, mathematics, and Medicine (STEMM) education and professional domain. Therefore, numerous studies have used spatial training to improve students' spatial ability, which might improve their STEMM performance. Despite its significance, there has been a lack of effort to review and evaluate the training effects from the literature. Therefore, this project aims to (a) systematically review diverse spatial training methods in STEMM education, (b) assess the effects of the training on student performance, and (c) develop an efficient spatial task (e.g., Apps) as a means to accurately assess students' spatial ability.

The undergraduate research assistant (URA) will start the project by conducting a thorough search for experimental research articles focusing on spatial training methods, with a specific emphasis on Virtual, Augmented, and Extended (VAE) reality technology. The tasks will involve the documentation of various aspects of spatial training methods in the identified research articles, such as (a) target population, (b) STEMM content areas, (c) types of spatial tasks (e.g., gaming, animation in surgical training, apps for engineering design graphics within the VAE reality technology), (d) spatial assessment tools, and (e) changes in student performance resulting from spatial training. By reviewing spatial training methods, the URA will be able to contribute to the development of a new spatial task or training tool for improving one's spatial ability. Additionally, there will be opportunities for collaboration in the preparation of a conference paper as a co-author. The position will offer valuable exposure to interdisciplinary research and collaboration with graduate students working on diverse projects within Dr. Yoon's research group.

Dr. Yoon is looking for an undergraduate research assistant who

- has an interest in spatial learning and/or training
- is curious, eager to learn, detail-oriented
- is perseverant and thinks outside the box
- would like to develop an ability to work/collaborate with others
- can work independently
- has working experience in Python programming to develop an app
- has working experience in CAD modeling and/or 3D printing (preferred but not required)
- has an interest in learning about engineering education discipline
- might consider a career in higher education

Dr. Yoon's Mentoring Philosophy

The main goals of mentoring an undergraduate student (i.e., mentee) in a research setting are to guide and support the mentee to develop the necessary research skills, successfully conduct the planned research activities, and professionally grow as an autonomous researcher. To cultivate such a research learning environment, I would like to first identify my mentee's goals, develop a trusting relationship grounded in mutual respect, share my research experiences, and provide career guidance and research resources as well as constructive feedback on the mentee's research activities. Therefore, I expect my mentee to align expectations, maintain open communication, and build rapport with me for effective mentoring relationships.