EAGER: Collaborative Research: Cyber-Eye: Empowering Learning through Remote Visualizations using Unmanned Aerial Systems

Our vision is to advance our understanding of Unmanned Aerial System (UAS) technology uses in Construction Engineering and Management (CEM) courses to bring remote job-site environments into the classroom and enhance students' processing of complex spatial and temporal CEM information. Construction projects are becoming increasingly more complex due to the integration of engineering systems required to meet the growing demand for a more sustainable, flexibly built environment. This complexity confounds the design of learning experiences in CEM practices. To overcome this limitation, field trips to the construction site and internships are designed in CEM courses and curricula to heavily expose learners to the complexities of real-world CEM contexts. However, jobsite visits are costly and non-efficient due to time requirements, lack of instructional resources, and safety risks during student visits. The lack of exposure to authentic problem solving found within CEM practices results in students' deficiencies in understanding important CEM physical and social contexts, in particular the dynamic complex spatial constraints (i.e., how construction products are related to one another in a particular contextual space) and the temporal constraints (e.g., order, intersections, and hierarchies to coordinate subcontractors' processes). This project will use UAS technology as a new genre of cyberlearning to capture authentic jobsite environments and design a library of rich CEM cases for classroom use. The purpose is to provide students with real-world physical and social context experience and rich opportunities for discussing cases produced via remote aerial visualizations.

INTELLECTUAL MERIT

This research seeks to revolutionize CEM learning and the students' understanding of the dynamic complexity of the CEM physical and social contexts using UAS. Access to critically important CEM information afforded by aerial visualizations and authentic problem solving cases will transform learning in CEM courses. Aerial visualizations can be augmented to enhance the processing of spatial information and eliminate split-attention effects through the integration of visual information into one view. This provides a unique perspective to the observer to facilitate the simultaneous visualization of physical and social in-situ contexts. UAS has the potential to transform CEM education since it provides access and enhanced viewing of in-situ locations that otherwise would be dangerous and difficult to observe by students as these locations compromise the safety of both project workers and students themselves. This research will advance the understanding of: (a) learners' problem-solving and decision-making skills through direct experience with UAS imagery and problem solving cases; (b) learners' metacognitive skills associated with reflection and evaluation of actions and processes involved in their CEM design conceptualizations; (c) learners' experimentation within the innovative technology and advanced cyber-infrastructure; (d) evaluation and assessments of the impact of cyberlearning technologies.

BROADER IMPACT

The results of the project will directly impact the learning of CEM processes that rely heavily on spatio-temporal skills, as well as learning in those disciplines that require field trips to acquire knowledge of relevant physical and social contexts. The results would be beneficial to a wide range CEM learners and cyberlearning communities since the challenges and opportunities of this project are shared by most scholars of technology-rich learning environments. The results will also respond to calls on more research to scaffold development of spatial abilities in STEM. Recruitment and training of underrepresented students to support experimentation are integral parts of this project. Ethnic and cultural minorities will provide critically important insights on the efficacy of our UAS intervention. This project, therefore, will impact diverse populations of cyber-learners, serving as a cradle for a diverse, high quality construction workforce in the future.