



2024 TIP Winner

Digital Sandbox for Experiential

Model-Based Engineering Education

Vineet Kamat
Civil & Environmental Engineering

Carol Menassa
Civil & Environmental Engineering

Motivation for the Project

- A Construction Engineering and Management (CEM) professional's success depends on two key things:
 - Their sound understanding of multiple engineering principles
 - Their ability to visualize, understand, analyze, and communicate intricate interdependencies between disciplines involved in the design construction of civil infrastructure.
- Such complexity is hard to replicate in classrooms making CEM a field where true learning allegedly only takes place "on the job" through years of field experience.
- This project was motivated by the desire to challenge this status quo and explore methods to mimic construction field experience in classroom teaching.



Images Credit: NBC (<https://www.nbcnews.com>)

What is the project?

- Digital Sandbox for Experiential Model-Based Engineering Education
 - Technologies rooted in Building Information Modeling (BIM)
 - Digital Twins enable simulation of real-world scenarios
- Classroom instructors can create teaching content and assessments of varying complexity suitable for students of all levels and backgrounds.
- The Digital Sandbox represents a “*theater*” within which instructors can stage any “*play*”.
- The experiential learning pedagogy has been introduced in multiple construction classes, extended to engineering and nursing labs at Michigan, and courses at other universities (Texas A&M, Stony Brook).

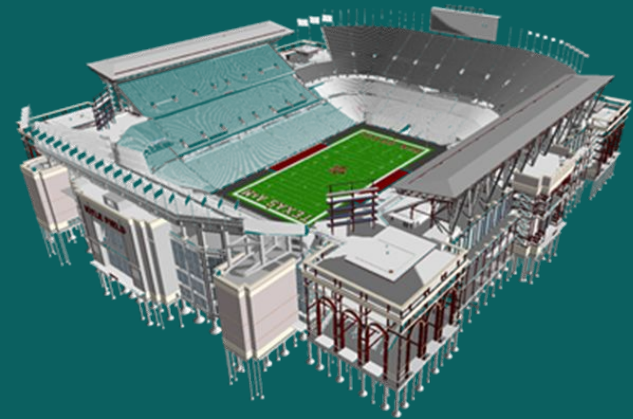
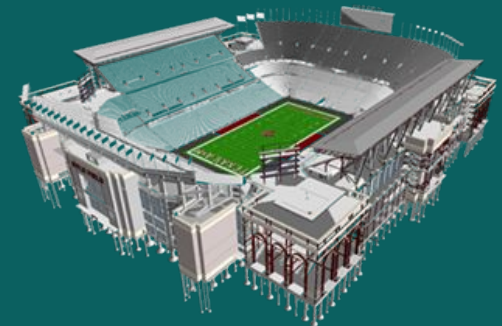


Image Credit: Walter P Moore (www.walterpmoore.com)

Outcomes

- **Gamified Learning** that fosters student engagement
- **Active Collaboration** that promotes interdisciplinary understanding
- **Augmented Reality (AR) and Virtual Reality (VR) Integration** that provides unique learning experiences
- **Open Educational Resources** that cultivate knowledge sharing
- **Project-Based Experiential Learning** with real-world projects



IN ESSENCE, STUDENTS ARE TRANSPOSED TO ACTIVE, ALBEIT DIGITAL, CONSTRUCTION SITES AND THEY REMAIN IMMERSED THERE FOR THE DURATION OF THE SEMESTER