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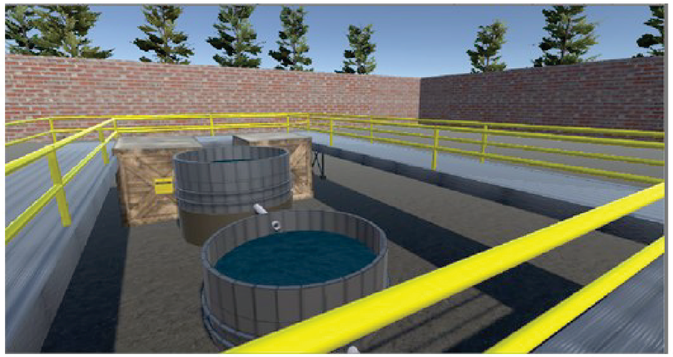
2019 Teaching and Learning Collaboratory (TLC) Seed Proposal Winners

The Virtual Chemical Plant: Innovations in Chemical Engineering Education

Ronald Hedden (Chemical and Biological Engineering)

Our project aims to provide innovations in undergraduate chemical engineering education through the use of Virtual Reality (VR) in the classroom. A "Virtual Chemical Plant" simulation environment will be developed and implemented in undergraduate CHME courses to advance capabilities in teaching chemical process dynamics and control, chemical reactor design, process safety, and plant design.



A fully immersive, virtual environment incorporating visual, auditory, and other sensory elements enables interactive pedagogical approaches that would otherwise be too expensive, too dangerous, or too large to implement in a classroom setting, potentially offering transformative educational benefits to undergraduate engineering students.

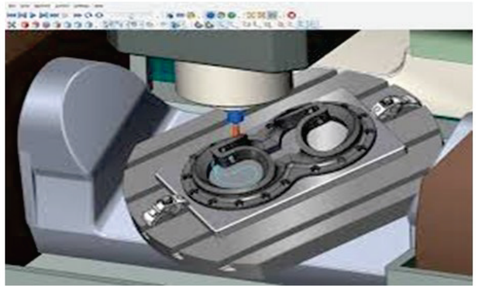
The proposed will be staffed by undergraduate researchers from CBE and related disciplines and will harness the capabilities of both the Beta Classroom and the new RAVE laboratory in JEC 2317 to achieve the intended educational outcomes.

Incorporating Digital Simulation Tools in Teaching Manufacturing Topic in ENGR. 4710 & 4720 Manufacturing Processes (MPS) and Systems I & II Classes in the MILL

Prof. Matt Oehlschlaeger, Jeff Morris, Ph.D., Larry Oligny, and Sam Chiappone

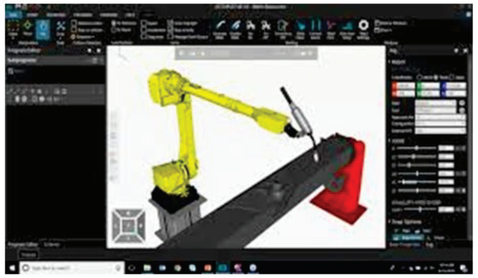
Objective

- Enhance the MPS learning experience, and replicate industry standards, by incorporating self-paced online CAE digital simulation video exercises to augment hands-on lab exercises.
- A pedagogical shift allowing students to gain pre-lab knowledge through out-of-class digital simulation exercises on manufacturing topics related to in-class hands-on experiments.



Outcomes

- Develop students understanding of engineering theory, simulation, and prediction as they relate to manufacturing processes.
- Provide a foundation for the exploration of simulation in manufacturing.
- Replicate current industrial trends in CAE digital simulation systems.
- Deliver a consistent learning experience. Online digital simulation tools provide the same content and delivery method for all students ensuring consistency.



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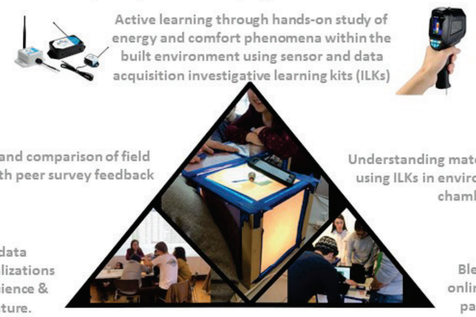
Integrating Interactive Research and Visualization Tools into Building Science Curriculum

Gabrielle Brainard (ARCH), Mae-ling Lokko (ARCH), Nina Sharifi (ARCH), Raquel Velho (HASS)

This project aims to integrate experiential active and blended learning into introductory Building Science and Design courses, enabling students to discover links between data literacy, design and performance in the built environment. The major aspects of this project include:



Interactive Visualization of Communications in Networked Programs to Enhance Student Learning and Aid Debugging

Barbara Cutler, Stacy Patterson, and Buster Holzbauer
Department of Computer Science

Submitty currently supports approximately 2000 users per term across >15 courses in CSCI, MANE, COGS/GSAS, and ECSE. While Submitty began as an automated grading (autograding) system, it has expanded to include course management features including PDF exam grading, course communications via email and course forum, course material hosting, and plagiarism detection.

The most significant impact of Submitty has been in managing and maintaining the high academic standards in our first two introductory programming courses: Computer Science 1 and Data Structures, even as our enrollments have surged (increasing by 300% over 5 years). We are interested in extending these benefits to upper level courses, specifically the networked programming assignments in courses such as Operating Systems, Network Programming, and Distributed Systems and Algorithms.

Networked assignments require two or more instances of student software to communicate over a network. Designing, implementing, and debugging these projects teach students to reason about issues of concurrency, fault tolerance, coordination, and synchronization. Students with a strong understanding of these fundamental concepts will be well positioned for careers in Cloud Computing, the #1 job skill on LinkedIn.

When writing networked programs, students contend with a variety of problems they may never have encountered before. Even basic setup, testing, input, and output for networked applications can be difficult. Once student programs are networked, issues of concurrency including message loss, delay, and interleaving can make it difficult to reason about internal network state. Manually grading networked programs is burdensome and time consuming, as instructors and TAs must overcome these same problems. In Fall 2018, we deployed our new Network Generation Module (NGM) for automated grading of networked student assignments with promising results.

We propose new interactive features to improve and enhance student learning:

- Prepare space-time diagram of program execution to aid student reasoning about network state.
- Generate heatmapped graph visualization of network load to provide realtime feedback to students and instructors.

These visualizations will be developed for and evaluated in the following contexts:

- **Submitty Homework / Project Autograding:** Ongoing work to support a wide variety of complex assignments in upper level courses.
- **Hands-on Lab Exercises:** Minimize network setup time and allow students to focus on algorithm details. Teaching staff to help interpret and teach from resultant visualizations.
- **Interactive Lecture Examples:** Facilitate on-the-fly instructional demonstrations.

The Well-being Toolbox:

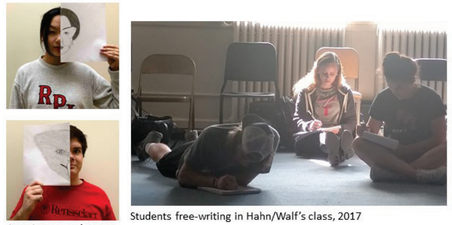
interactive approaches with complementary use of technology

Alicia Walf (Cognitive Science) & Tomie Hahn (Arts)

Addressing stress and promoting well-being are critical concerns on college campuses. Change in RPI campus culture concerning issues of well-being is vital, but it cannot be accomplished from one office or individual. This project aims to start the conversation through an interdisciplinary, First Year IHSS course called *Well-being: Cultivating Curiosity*.

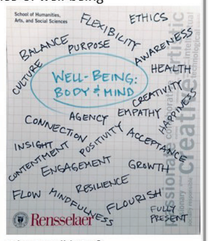
GOALS OF PROJECT

1. To refine pedagogical innovations to support students' development of a personal well-being toolbox
2. To pilot technological and data approaches that could be used in the classroom to foster awareness
3. To reach a larger population of students in our classes to focus on practice and science of well-being



Students free-writing in Hahn/Walf's class, 2017

Monitoring one's well-being and health



What is well-being?

Imagine your alter ego