

Teaching Team-Based Design in a Distributed Education Environment

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Abstract

Increasingly, working engineers conduct design as members of geographically-distributed teams. Engineering students in residential programs of study need to use distributed communication solutions as part of their studies. In an effort to *teach leading edge engineering knowledge and skills* to engineering students, this project is developing:

- A distributed communication infrastructure
- A scoring rubric for engineering design projects and uncovering best-practices in:
- Team-taught instruction (between faculty at different institutions)
- The education of geographically-distributed groups of engineering students.

The desired next step:

Development of an inter-institutional, undergraduate team-based design experience.

Introduction and Objectives

Learning outcomes and objectives

Current ABET accreditation guidelines spell out that colleges and universities must teach students how to communicate effectively and use the techniques, skills, and modern engineering tools necessary for engineering practice.

Discipline and level

Undergraduate engineering design

- Introduction to engineering, or
- Senior year capstone design, possibly in Materials Science and Engineering

Developmental History of Innovation

Distributed education

- Since 2002, I have been the Director of Distributed Engineering Education for UVA.

Team-taught instruction between institutions

- In 2006, I became PI on an inter-institutional NSF grant to explore the sharing of graduate-level nanotechnology courses.

Distributed communication infrastructure

- Since 2006, I have guided the development of an undergraduate distributed education program, *Engineers PRODUCED in Virginia*.

Engineering design scoring rubric

- Since 2007, I have worked with Leigh Abts at the University of Maryland and other colleagues to develop a scoring rubric for engineering design projects in K-12 and higher education.

Learning Activities and Materials

An Engineering Design Process Portfolio Scoring Rubric is under development to provide a clear roadmap for the steps of the engineering design process and the assessment of student engineering design work.

I currently teach an Introduction to Engineering course to a geographically distributed student population. The course includes a team-based engineering design (and build) project.

I am overseeing the development of a robust distributed education environment that includes:

- Blackboard Collaborate as a primary tool for the delivery of *formal class sessions*. UVA now has multiple years of experience using this environment for course delivery.
- Microsoft Lync as a support tool that facilitates *informal learning interactions*. Lync offers “presence” and access to multi-modal communication (i.e., text, audio, high definition video, and desktop sharing).

Execution

To date, I have taught team-based design to a geographically-distributed student population in an Introduction to Engineering course. For the team-based design work, I am now beginning to organize teams so that students must work across distances with team members who are not co-located. Student comfort with distributed team-work varies.

My belief is that exposure to *distributed* team-based design might be most effective in the final year of undergraduate studies, when students are seeking to complete their capstone design experience. I anticipate that the maturity level of these students will have evolved so that most students are able to adapt to the unique challenges of distributed teamwork.

While I do not currently teach a capstone design course in my department, I feel that my work and experience to date has prepared me to consider the development of an inter-institutional capstone design experience.

Major Issues to Resolve

To implement my innovation I need to identify a partner institution with an interest in team-teaching a senior capstone design experience. While my area of technical expertise is materials science, the cooperative course would not necessarily need to be discipline specific. It could instead seek to recruit students for a multi-disciplinary design effort.

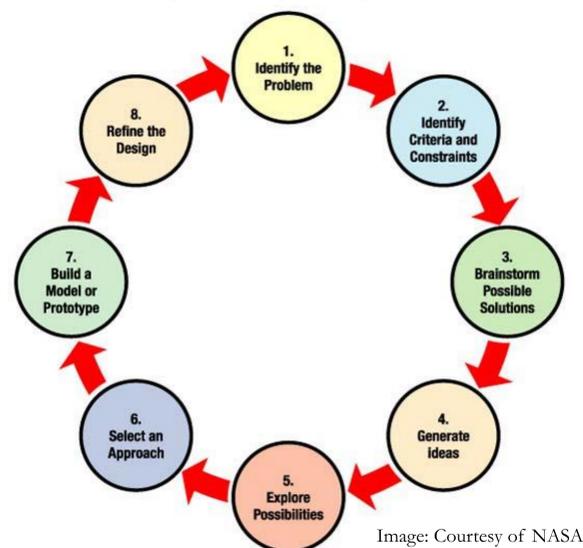
I would certainly want the course to be a strong learning experience for students, with demonstrated learning outcomes that would contribute to satisfaction of the ABET criteria related to communication and modern tool use. I would want support in the assessment realm.

Based on my work to date, I have observed certain challenges associated with student work in the distributed environment. The most critical are:

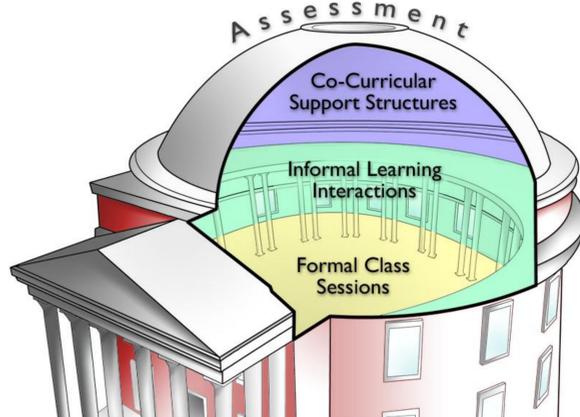
- Students need to be equipped with the full hardware and software toolset for engagement with others at a distance.
- Students need to receive some guidance in best practices for scheduling informal meetings with team members who are not co-located.

In contrast, students appear to be well versed in sharing documents (i.e. project content) in fairly sophisticated ways (e.g., Google Docs).

The Engineering Design Process



A “Complete” Distributed Education Environment



Discussion

I would like to gauge the reaction of other faculty to the introduction of distributed education activities into the undergraduate curriculum, for students studying in residential programs of study.

- Do faculty believe distributed team work is an important engineering skill?
- Are other faculty interested and motivated to undertake this type of undergraduate engineering education development?
- Do faculty believe they would receive the institutional support needed to invest time in this type of instructional endeavor?
- Do faculty believe they would receive appropriate credit for team-teaching this type of course?

This project could form the basis of an NSF TUES proposal, or related submission.

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