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A Learning Community of University Freshman Design, Freshman Graphics, and High School Technology Students: Description, Projects, and Assessment

Article Summary

by

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One common feature of traditional design courses is that they are taught using design teams comprised of students attending the same class and having similar educational backgrounds. The problem with this model is that such courses do not teach students how to collaborate with others from diverse backgrounds and locations. Such collaboration is an important part of the learning process and common in “real-world” engineering design practice. This paper describes a learning community which specifically targets this problem. In this learning community university freshman students are paired with high school students to research, design, build and test a product collaboratively. In order to measure the benefits of the learning community, several direct and indirect assessment tools were developed which target teamwork and communication. These tools were used to assess both students in the learning community, and students in a control group who took a similar design course, but did not participate in a learning community.

Three courses are involved in this learning community: Seattle University’s freshman design class, Seattle University’s freshman graphics course and Central Kitsap High School technology course. Design teams were formed by combining three to four students from each of these courses. The student roles are predetermined and do not overlap between classes, mimicking the real world product development setting. The high school and university students communicated only using e-mails, Internet videoconferencing and teleconferencing, and have met in person only on the last day of the project.

Each team participated in one of three design projects. The projects are design of: 1) a wind turbine that produces the highest power, 2) a door handle with the highest torque-to-weight ratio, 3) and a flywheel with highest power density. The projects provide substantial engineering content without being too complex and were developed specifically for this learning community. A discussion of the hardware and learning objectives for each project are provided in the paper.

In this learning community, individual student grades are determined by combining the scores from individual and team assignments and the results of a peer evaluation survey. These grading components include: 1) a research memorandum (individual); 2) a project report and a project presentation (team); 3) communication e-mails and internet conferencing communication notes (group); 4) technical drawings (individual), 5) team milestones (group), and 6) a team peer evaluation questionnaire (individual), in which each team member is asked to rate themselves and the other team members in fourteen categories, relating to the member's performance on the team.

The results showed that learning community provided some unique benefits what could not be realized though traditional in-class design projects: 1) University and high school students successfully designed products by communicating only through e-mail and videoconferencing; 2) The university students who participated in the learning community gained confidence in using e-mail and Internet videoconferencing for understanding of drawings and specifications, for technical discussions about the designs, manufacturing, and testing, and for decision making; 3) The university students who participated in the learning community gained a better understanding and confidence in the technical contents of the design project over students who did not; 4) High school students were exposed to the engineering design process and developed interest in the hard science behind the designs. Some of these students decided to pursue a career in engineering; 5) High school students obtained college credit for participating in the learning community.

This material is based upon work supported by the National Science Foundation under Grant No. 0126776. Any opinions, findings and conclusions expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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