

USING INNOVATIVE STUDENT CENTERED LEARNING TO STRENGTHEN AN ET COURSE

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ABSTRACT

Students in Manufacturing Engineering Technology at Arizona State University (ASU) are required to take the MET 460 Manufacturing Capstone Project. This course provides the opportunity for students to design, evaluate, analyze, and manufacture components, assemblies and systems, MET 460 is well suited for innovative student centered learning due to the necessary classroom interaction that must occur so students can complete their assigned task. As an added incentive, ASU students compete in the International WESTEC CAD/CAM Robotics Challenge Contest,

This paper discusses how the instructor uses innovative student centered learning techniques to strengthen the Manufacturing Capstone Course, Student centered learning techniques covered in this paper are: developing a student-centered learning atmosphere in the classroom, motivating students in a student-centered learning atmosphere, selecting a suitable project for a student-centered learning course

As one measure of success of the MET 460 Capstone Project Course at ASU, students won the CAD/CAM Robotics Challenge Contest Grand prize for three consecutive years, 1993 through 1995

The Manufacturing Engineering Technology Program at Arizona State University (ASU) requires students to take a capstone course to help prepare them to enter the work force. The capstone course Instructor uses innovative techniques to create a learning environment to prepare self directed students

to participate in the International WESTEC CAD/CAM Robotics Challenge Contest held in Los Angeles California. This paper discusses innovative student centered learning techniques to strengthen the Manufacturing Capstone Course. Student-centered learning techniques covered in this paper are:

- Developing a student-centered learning atmosphere in the classroom
- . Motivating students in a student-centered learning atmosphere
- . Selecting a suitable product for a student-centered learning course

Application of these techniques are essential to the success of the course.

Developing a student-centered learning atmosphere in the classroom

The MET 460 Manufacturing Capstone Project Course provides a learning experience for the students in the Manufacturing Engineering Technology program at ASU. The course is well suited for innovative student-centered learning due to the necessary classroom interaction that must occur so students can complete their assigned task. The instructor of the course holds individual students responsible for the results the team effort.¹ Additionally, the course provides the opportunity for students to participate in a competition that requires them to design, evaluate, analyze, and manufacture components, assemblies and systems using CAD/CAM and Robotics.



Like a good athletic coach, the instructor instills in each student they are winners and champions and are very capable of winning the Grand Prize at the CAD/CAM Robotics Challenge Contest. At the offset of the course, the instructors empowers students to be successful by demonstrating his/her full confidence in each student and his support in their self-directed efforts. This is accomplished by empowering students to choose their own team leaders, to coordinate efforts, and set time tables for task completion. More importantly, the instructors empower the team with the knowledge that the instructor will continue to support them equally in competition, success or failure.

Motivating students in a student-centered learning atmosphere

In higher education we instructors have a tendency to assign problems to students having only one answer. However, in the work place Manufacturing Engineers are faced with problems that having many solutions. The practicing engineer must choose from alternatives based upon a number of factors. Students should also have an academic experience to solve problems having many solutions, thus choosing from alternatives.

One way to introduce students to the many-solutions concept is to provide a significant team problem. The team problem must be very complex so that no individual team member can solve the problem alone. This situation will immediately present the students with a dilemma. The dilemma will arise when the instructor empowers students to select a project so immense that they cannot possibly succeed without everyone contributing to the effort. Due to the complexity of the problem the students quickly learn to depend upon each other. The CAD/CAM Robotics Challenge Contest is a very good vehicle to challenge the students since the contest judges use evaluation criteria that beg for complexity and creativity.

- . Creativity of entry
- Complexity of entry
- Overall impact of entry
- . Abstract quality
- Documentation quality
- Oral presentation

. Work quality

- Evidence of team work.

The team learns their dilemma can be solved by striving for evaluation criteria excellence while improving their chances of winning the competition.

Another strategy is to appeal to student pride as opposed to concentrating on grades as a motivating factor. ASU students have won the Grand Prize in the CAD/CAM Robotics Challenge Contest for the past three years. Therefore, it is easy to point to these previous winners as an example of dedication, excellent team work, and cooperation. Perhaps the most important strategy is to empower students to develop a positive student instructor relationship, where the instructor gives technical advice and student grades are not dependent on whether the students follow the advice. However, student grades depend on performance and effort.

Selecting a suitable product for a student-centered learning course

A very important aspect of conducting a student-centered learning course is selecting a suitable team product. If the instructor selects the product, the students may not assume ownership. On the other hand, when students make their own product selection there is no doubt about ownership. In this course the students are empowered to make all decisions regarding the product to be entered in the contest. They must design, test, and manufacture the selected product while considering the evaluation criteria.² For example, the selected product must be creative and complex enough to satisfy each of the evaluation criteria listed in the previous section.

At the beginning the students are asked to write a course mission statement. The mission statements consist of no more than one paragraph. The current course mission statement is: "Our mission is to defend the title



of Grand Champion at the 1996 WESTEC CAD/CAM Robotics Challenge Contest through the development and manufacture of a hydraulic jack, utilizing concurrent engineering and the latest manufacturing techniques.”

The students are empowered to formulate strategies to fulfill the stated mission. They are also empowered to:

- Allocate financial resources within budget guidelines
- . Develop effective self directed activities
- . Succeed or fail.

Thus, MET 460 Manufacturing Capstone Project gives the student the freedom to design, evaluate, analyze, and manufacture components, assemblies and systems.³

The capstone course Instructor uses this innovative technique to create a learning environment to prepare students for entry level positions in industry.

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