

**Annual Report from the Dwight Look College of Engineering  
Inquiry/Research-Based Education of Undergraduates  
Quality Enhancement Plan  
Academic Year: 2008-2009**

**Project Title:** *Integrating the Design Process into the Existing ENGR 11X Project Structure.*

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**Summary of Activities**

Developed New Projects: Under the NSF/STEPS grant established a final mix of projects.

1. Design to specifications, analyze, fabricate, test and evaluate a simple truss from a SuperMag (stick magnets and steel balls) kits. (existing project)
2. Design to specifications, analyze, fabricate, test and evaluate a wheelchair lift using a Lego Mindstorms kit. (prior project revised)
3. Estimate (on a square-foot basis) the cost of specified Engineering Dormitory using costs from the R. S. Means cost estimating book and then designing a cost recovery plan based on student use fees. (new project)
4. Design to specifications, analyze, fabricate, test and evaluate a hazardous waste transport vehicle to perform a verity of specified tasks. (new project)

Developed Assessment Technique: Under the QEP project developed assessment techniques.

1. Developed a preliminary version of on-line assessment questionnaires to evaluate these projects with respect to learning objectives. The software was developed over the summer and tested using selected classes. The objective (besides finding software issues) was to gauge student reaction to the fall Industry Night and in-class Industry Case-Studies.

**Restatement of Outcomes**

Each of the existing ENGR 11X projects (see below) has an existing set of Learning Objectives; this effort seeks to strengthen student understanding of the general engineering project development and design process. In short students must be able to:

1. Sketch and annotate the general project development process for selected engineering type projects.
2. Students must be able to develop and evaluate a set of feasible alternative design objectives.

## **Restatement of the Assessment Methods for Each Outcome**

An important part of this QEP effort is the assessment of student learning outcomes and the affect of strengthening of the project concept. STEPS students have come to realize the importance of success in Math (and Physics) to engineering design. We are suggesting the following assessment activities:

1. Determine the student's ability to meet the stated learning objectives during the first week of class in ENGR 111.
2. Retest the ability of the student at the end of the ENGR 111 semester.
3. Repeat this process at the beginning of ENGR 112

The introduction of project-centered, inquiry-based learning at the freshman level requires some faculty training in order to be successful. Heretofore, this has been accomplished through a single coordination meeting just before the start of each semester. For one reason or another, many of the instructors in ENGR 111/112 are teaching the class for the first time. Therefore we have concentrated on getting the new instructors "up to speed" rather than working with the population in general.

## **Summary of Results**

Based upon a number of factors we have selected a set of 4 (out of 12) projects to implement on a permanent basis. This should go a long way toward training a set of faculty skills in teaching these classes. Based discussions with individual students need to develop individual assessment questionnaires for each project and begin to implement the software started last summer.

With respect to software testing there is little to report. However, this effort may lead to a new approach in developing on-line pop-quiz questions including graphics; for example, free body diagrams. This is a part of a sponsored NSF project the software developer is working on.

## **Closing the Loop**

As a result of the STEPS project we have been tracking various cohorts of students with respect to retention through graduation in engineering. Although results vary somewhat from cohort to cohort the trend is consistent. For the years 2003-2006, about 60% of the engineering students enrolling in ENGR 111 in the fall are retained through graduation with a degree in engineering. Furthermore, studies show that success in mathematics is one of the most important factors leading to retention in engineering. Whatever progress we have made in ENGR 111/112 has been overwhelmed by this effect.

To that end, as a part of the STEPS Project the Mathematics Department has developed a Math Skills Assessment Test. This Test was implemented for incoming students this fall. As a result of a cooperative effort between Engineering and Mathematics last summers the University developed a proposal to NSF to develop techniques to target individual student's weaknesses. We have proposed to implement this through the undergraduate advisors in engineering and use the ENGR111/112 cohort to track progress. We will continue to make the ENGR111 project more relevant to success in mathematics to the extent possible.

## **Budget**

We spent **\$830.52** for a graduate assistant, for assessment software development during the period 6/1/08-8/31/08. We are not requesting additional funds for this project at this time. With the remainder of the funds, we hope to complete this activity, begin the development of a pop quiz tool this year, and disseminate results of the project as appropriate.