Provost's Learning Innovations Grant for Faculty
Request for Full Proposal
2001-2002

Please send your completed grant proposal (4 pages, plus attachments), one original and eleven copies, to
Linda Jones, 4000 Eastman
by 4:30 p.m.
Friday, February 16, 2001.
No hand written proposals will be accepted.
Notification of awards will be made by Friday, March 16, 2001.

Project Title: Product Realization

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Product Realization

Summary

Students will be provided a real connection between their education and their career path. An actual product development/design/manufacturing cycle will connect coursework in over a dozen individual courses, culminating in the capstone Product Realization course where a short production run will manufacture, assemble and package actual product. The MMET/PS department has substantial resources in place to accomplish most of the component manufacturing, assembly and packaging.

Elements of the product realization cycle will be accomplished in required and elective courses spanning the entire 5 year program of students in Mechanical Engineering Technology (MET) and Computer Integrated Manufacturing Engineering Technology (CIMET). The Product realization course will be offered to selected 4th and 5th year students many of who will have contributed to the design and development of the product in other classes. The cycle will take two academic years with a new product cycle starting each year. Over their RIT experience students will participate in 3 to 5 different cycles at different stages. This proposal is to complete the first cycle, which is currently under way, by funding the Product Realization course next year.

It is anticipated that future cycles will be funded from other external sources. Student success and satisfaction will be enhanced by the increasing connectivity between coursework and career. Faculty will benefit from the project opportunities available to enhance existing courses. The project differs from First in Class manufacturing efforts in that the invention and innovation will largely spring from the students and faculty in the participating courses.

Product for First Cycle

The product being designed, developed and ultimately manufactured in this first cycle of the project will be an electronic kitchen scale and clock. The electronics are simple enough not to intimidate mechanical students, the mechanical components will be developed in several mechanics of materials courses, the case materials selection and mold design will be accomplished in three plastics courses, the manufacturing sequence, and work cell design will be performed by students in several manufacturing courses, the product design, DFMA and robust design courses are or will be contributing, and perhaps most important, the design in CAD courses are developing potential designs for the first product.

The students next spring in the first section of the Product Realization course will coordinate the actual injection molding of the cases, the surface mount circuit board manufacturing, and the work cell assembly of the product, all of these manufacturing activities are possible using industry donated equipment in the department. The faculty and students hope to present the first production products at the time of graduation in May 2002. Currently, the product design has gone through customer requirements, CAD design, mockup, and electronic bread boarding. Spring quarter will result in material selection and the beginning of mold design. Next fall sophomores will test and confirm the load cell design while upperclassmen will be doing value analysis on several competing features. Winter quarter next year will see mold design completed and a mold constructed, circuit boards designed and work cell design configuration started. This is a brief and incomplete listing of activities and courses involved, but the excitement among students and faculty working on the start of the project is palpable.

Targeted Learners

The primary targets are students in the MET and CIMET programs. Collateral targets include students from Packaging Science (PS), Electrical/Mechanical Engineering Technology (EMET), students from the programs in Civil Engineering Technology, Electrical Engineering Technology, and Computer Engineering Technology via service courses, and even College of Engineering students enrolled in our plastic design sequence. This effectively covers the Engineering and Technology cluster of programs.
There are two levels of participation in the Product Realization course project. Explicitly there will be the students in the capstone course, Product Realization. More important will be the implicit participation of a much wider population of students in various courses contributing to the design and development portion of each product cycle. As many as 18 courses could be involved in any given product cycle, involving multiple times the enrollment of students in the MET and CIMET programs (translates to roughly 500 students). In addition to full-time day students, the evening students (largely part-time) in the same courses will also participate.

Impact on Teaching

It is always easier to teach students when they can see where the material is leading in a career sense. This project integrates learning and application in a real way. The faculty teaching the many connected courses will be able to use the project as case studies, group projects, laboratory exercises testing materials and designs and illustrative lecture material. Theory becomes reality for students seeing an actual purpose and end goal. The only completely new course in the project is the capstone Product Realization course; however many courses will be stimulated and energized by the connection. The project has been favorably received by our Industrial Advisory Board and assistance has been offered to faculty to assist in the execution of portions of the project at or beyond our lab capabilities.

Measurement of Impact

The success of this project will be measured in several ways. Standard student course evaluations and a specialized evaluation for students in the MET and CIMET programs investigating their understanding of the "connection" between their studies and the career which will lead from those studies. The "connection" survey will be completed annually beginning this spring. Obviously demand for the Product Realization course will be a direct indication of the students' impression of success. The overall success will be best indicated by an enhanced identification by students with their career choice. Success from the perspective of the faculty within the two primary programs will be easier to assess, the faculty meets biweekly with a major focus on continuous improvement issues and the exchange is free and frank, especially if a faculty member feels a course is not "working right."

In addition to the obvious coordination required within the project between numerous courses the product realization project will remain an open item on the biweekly meeting to ensure communication within the department. The proposers will also prepare and present at appropriate internal and external forums the results of the project. ASEE, NYSETA, and NCIIA are engineering education organizations seeking examples of innovative educational strategies. This project's goal of connecting coursework with a design thread culminating in a capstone course will be attractive.

Relevance to Learning Innovation

Related programs in CAST are collected into departments and some departments share common courses (eg, the engineering technology departments), but there is much less connection between other departments. This project's primary target, the students in MET and CIMET degree programs share a common first two years. In the CIMET program currently a pair of courses provide a capstone project experience. The MET program has several multi-course sequences and individual courses having large capstone-like experiences.

While both programs have required course sequences and large experiential projects in individual courses, this project will provide a new and unique thread tying diverse courses and subjects together. Reducing the tendency of students to perceive courses as standing alone as individual knowledge sets.

This project when implemented will present a clear image of the career path to which their education is being directed. It is an observable fact that students are more eager to learn after having cooperative
education experience and this innovative approach to including tradition capstone activities from start to finish within the curriculum will have a similar effect. Presumably the enhanced engagement of students with their curriculum will improve student satisfaction and retention.

This project will provide an immediate enhancement to many existing courses taught by all members of the faculty teaching in the MET and CIMET programs. While this project will be managed by two members of the faculty, the ideas and goals have been discussed and developed by the entire faculty. The success of the project will be built on the successes of each faculty member in the department capitalizing on the potential improvement in the individual courses.

Qualifications

The proposers have diverse background and experience. Carl Lundgren has been a faculty member for 20 years and the advisor and program chair for the lower division of the MET and CIMET programs for 4 years. This proposal has grown from his realization that student uncancess and lack of academic success is frequently the result of misconceptions of where the curriculum and career path is leading. Professor Lundgren has also been searching for means to incorporate more emphasis on student innovation and invention in a traditionally analytically focused curriculum without compromising the necessary rigor and required program breadth.

Professor Bill Leonard is a Visiting Professor and has previously been an adjunct faculty member teaching in the MME/PS department for the past 3 years. Prior to RIT, Mr. Leonard has had a successful career at Eastman Kodak, including product design, development and realization. Currently he has a successful consulting business specializing in providing rapid prototyping and product development services. He has numerous patents and trade secrets to his design credit.

Uniqueness of Proposed Project

This is the first example of a comprehensive unifying theme to tie together a significant portion of the courses in this, or other, mechanical or manufacturing engineering technology curriculum. While many examples of capstone courses are available, this attempt at a "keystone" course tying and locking together large elements of a curriculum while serving two degree programs is unique.

This project will develop within the curriculum the crux of the educational goals of our programs, that our graduates will be leaders in the design, development and manufacturing fields. As a bonus, student satisfaction and retention should be improved and our attractiveness as a program increased.

Other capstone courses seek and receive industry projects for students to complete. Our intention is to have the project to be largely the result of student innovation and invention without the constraints imposed by the requirements of a benefactor.