Employing Students in Industrial Outreach

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Abstract

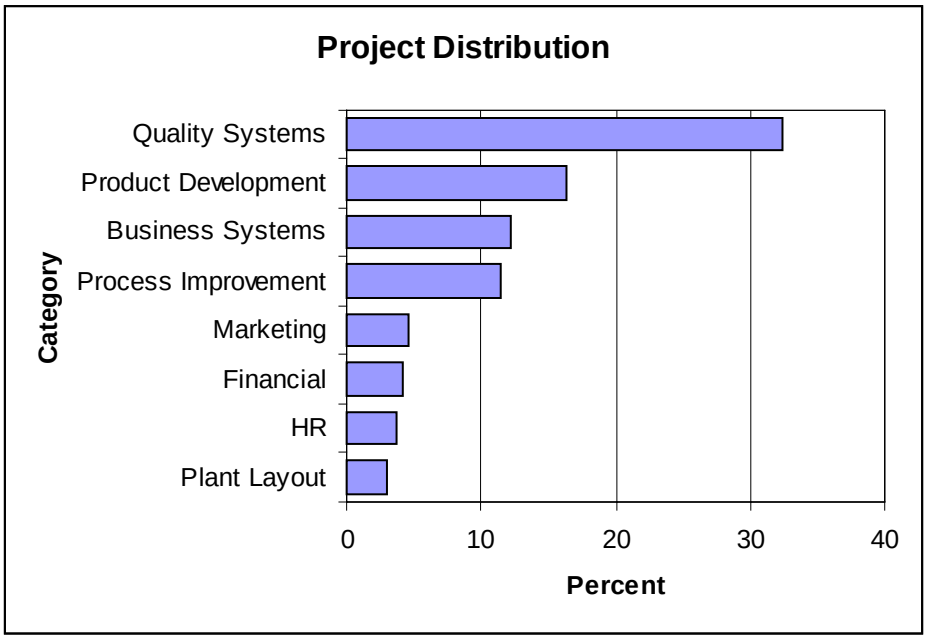
The Center for Industrial Research and Service (CIRAS) at Iowa State University provides engineering and business outreach assistance to Iowa's 6000 manufacturers. CIRAS is able to amplify the services they offer these companies by employing College of Engineering students as co-ops, interns, and as part-time help. These students work with CIRAS project engineers, providing technical assistance to manufacturers that may not have technical expertise in a given area or that may not have the time to complete engineering work on schedule. Students from a variety of disciplines are employed to assist on projects that involve plant layout, product testing, and design and development of products.

Background

The Center for Industrial Research and Service is the vehicle by which Iowa State University carries out its land-grant service obligation to Iowa's manufacturers[1]. The CIRAS mission is to assist Iowa manufacturing firms to improve operational performance. This is accomplished by helping manufacturers identify and analyze manufacturing and managerial problems, by connecting them with the latest technical information, and by assisting them in finding solutions to problems.

CIRAS is an affiliate of the Iowa Manufacturing Extension Partnership[2], which is a member of the National Institute of Standards and Technology's Manufacturing Extension Partnership[3]. The MEP is a nationwide network of over 400 not-for-profit centers with a mission to provide small and medium-sized manufacturers with the help they need to succeed.

CIRAS has a central staff housed on the ISU campus and a group of field agents that are distributed across the state, typically located in regional extension offices. The staff has expertise in many areas, including product design and testing, ISO and QS 9000, constraint management, plant layout, simulation, MRP systems, e-commerce, and productivity improvement. CIRAS provides services to Iowa's manufacturers via direct technical assistance, by acting as a liaison to ISU faculty and laboratories, by offering training workshops at regional community colleges, or by referring clients to outside resources, including federal labs, consultants, etc. Approximately 400 projects with manufacturers are completed each year. A distribution of projects by category is displayed below.



Why use students?

CIRAS has been providing Iowa manufacturer's a connection to the research and technical expertise of Iowa State University since 1963 and has been using undergraduate students to assist in these efforts since 1988. Employing students has allowed CIRAS to offer economical solutions to many of Iowa's small manufacturers. This has also allowed CIRAS to increase the quantity and variety of services offered. Nearly 15% of CIRAS projects are completed with the aid of students and this number is expected to grow.

Employing students in ISU's industrial outreach program also assists the University in satisfying some of their educational goals. The College of Engineering's goals[4] that CIRAS supports include:

Undergraduate and Learning Objectives - All bachelor's graduates will have co-op or engineering intern experience of at least three months duration before graduation. CIRAS currently satisfies this requirement for about four College of Engineering Students each year.

Research and Graduate Education Objectives - Research expenditures will grow to…at least $12 million from industrial sources. About 15% of the College of Engineering's research expenditures come from business and industry sources. CIRAS brings in about 2% of these business and industry dollars through engineering projects with Iowa manufacturers. Undergraduate students are active participants on the majority of these projects.

In addition, CIRAS's work with Iowa's manufacturers is aligned with *ABET's Program Outcomes and Assessment*[5], which states that engineering programs must demonstrate that their graduates satisfy several criteria, including:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Student employees are exposed to every one of these areas while working on CIRAS projects.

The typical student

The majority of the students that work for CIRAS are juniors or seniors. They typically find out about job opportunities from other students that are working at CIRAS; others hear through departmental e-mails or through the Engineering Career Services office. About ten students are employed by CIRAS at a time and eighty percent of these are engineers. Often one or two of these will be CIRAS co-ops. Most are from Mechanical Engineering, Industrial and Manufacturing Systems Engineering, or Industrial Education and Technology.

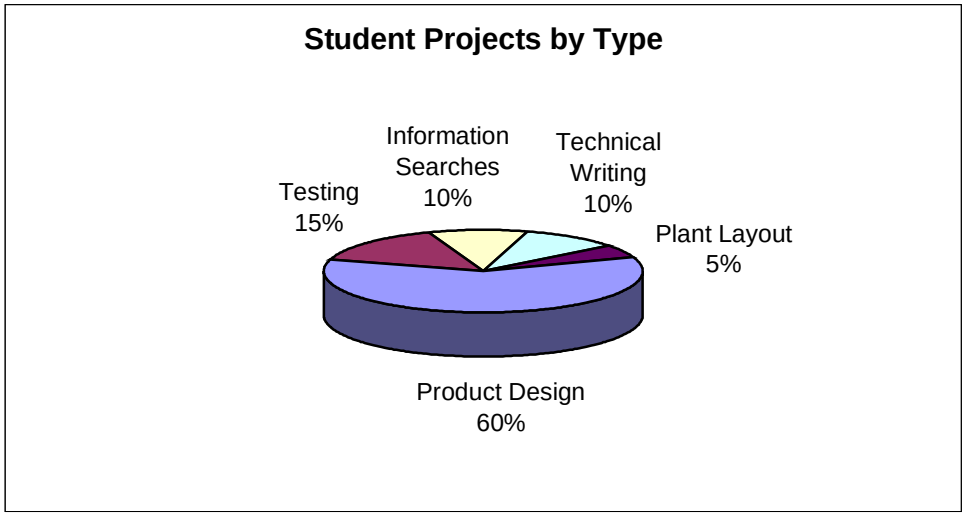
Students work for CIRAS for anywhere from three months to two years, with an average near one year. The students work schedules are fit around their classes, with most working 15-20 hours per week throughout the school year. About one-third of the students go home or to industrial co-op jobs during the summer, a third will continue to work part time, and a third work full time.

Project Format

New students to CIRAS are first tasked with getting up to speed on solid modeling software. This involves running tutorials, asking other students for advice, and designing small parts for projects. After this they are assigned to projects that are managed by a lead CIRAS engineer.

An experienced CIRAS engineer oversees all projects involving students. They provide guidance and training and they make all final design decisions. This oversight is critical to student performance and successful completion of projects. Particular attention must be paid to the flow of information among students since their work schedules seldom overlap.

Most of the student project work will fall into one of three categories, product development, process improvement, or plant layout. The type of work the students are engaged in is displayed below.



Three-fourths of the projects are multi-disciplinary in nature and will involve three or more team members. Three-fourths of the projects require the student to deal directly with the client, which is often a CEO. Clients typically do not have concerns about working directly with a student, with less than 5% preferring to deal directly with the lead CIRAS engineer.

Typically students will be working on two projects at a time, one project will have priority and the second project is used to fill in time when the student is waiting for responses from the client or vendors. Project duration is typically one to three months, but larger projects can last much longer. Projects usually include about 200-400 hours of student time. By the time a student graduates, they may have worked on over ten different engineering projects.

Student views

When students are asked to list the benefits of working for CIRAS, the most common response is the experience that they gain. Students routinely work on real-world multi-disciplinary problems, applying what they have learned in school. They also use equipment and software that they may not normally see in classes, including FARO arms, rapid prototyping machinery, SolidWorks, Mechanical Desktop, and Working Model.

Students also state that they gain an interviewing advantage, find out what is relevant in industry, learn new information, and make contacts with engineers in industry. The students also list job location, pay, access to a campus office, and flexible work hours as important. Benefits that might be a little unexpected include learning about the importance of networking, gaining confidence to work in the real world, becoming more aware of engineering opportunities in Iowa, and helping decide what area they wanted to work in after graduation.

When asked to anonymously list changes they would make to the intern program if they managed CIRAS, over 80% felt that no changes needed to be made.

Case Studies

Advanced Analytical Technologies, Inc. (AATI) had developed the technology and science for a new method of testing for bacteria and other contaminants in streams of liquids. They came to CIRAS for help in converting the laboratory concept to a marketable instrument. The product development and design-for-manufacture project lasted 18 months and involved 10 undergraduate engineering students under the supervision of CIRAS staff engineers. The product included over 200 separate parts and each part and assembly was modeled using solid modeling software. The project also required the students to work directly with AATI personnel, vendors, and fabrication sources. Prototypes were created, tested, and redesigned in several stages as modifications were made to the bacteria-analyzing process.

Frog Legs, Inc. designs, manufactures, and sells front casters for wheelchairs. The casters utilize a shock-absorbing polymer to reduce impact. CIRAS was asked to develop a testing device and process to determine limits of the polymer and caster design in order to assess the current product and establish a benchmark for future changes. Three undergraduate engineering students worked on the project, assisting in the design and manufacture of a test fixture and data acquisition system. This multidisciplinary project required that the students interact with the client, vendors, and a variety of departments on campus. The students gained experience in CAD design, software development, data acquisition, non-destructive testing, and performance characteristics of a variety of polymers.

Conclusions

The use of undergraduate students in ISU's industrial outreach program has lead to a win-win situation for all parties involved. The College of Engineering benefits from an increase in visibility within the state and additional revenue from industrial sources. CIRAS staff get a chance to assist in the education of new engineers and they gain technical knowledge from students, who frequently are some of the most technically proficient people on campus at new engineering software. Manufacturers get top-level technical assistance at economical prices; resources that they may not have received otherwise. The students benefit the most from the program. They are able to do hands-on engineering work on real products for real companies. The cost burden of moving out of town for a co-op or summer internship is reduced. The students gain access to methods and instrumentation that may not be available in their courses. Students can see the entire product design cycle from concept to manufacture, all while operating under real budget and time constraints.

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Richard Grieve, PE, is Interim Director of CIRAS at Iowa State University. He received his B.S. in Mechanical Engineering from Iowa State University and his M.S. in Industrial and Management Engineering at the University of Iowa. His early industrial experience was in product development with John Deere and he has additional experience with material handling, production management, forging operations, and machine design.