Long-Term Community Service Projects in the Purdue Engineering Curriculum [1]

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Abstract

Purdue University's School of Electrical and Computer Engineering has initiated a new program called EPICS: Engineering Projects in Community Service[2]. Under the EPICS program, students earn academic credit for long-term, team projects that solve technology-based problems for local community service agencies.

Each EPICS project team consists of seven to ten engineering students. The teams are vertically integrated - each is a mix of sophomores, juniors and seniors - and a student can participate in a project for up to three years. The continuity provided by this structure allows projects to last for many years. Projects of significant size and impact are thus possible.

The goals of the EPICS program include: providing students with multi-year, team-based, design and development experience; teaching students, by direct experience, how to interact with each other and with customers to specify, design, develop and deploy systems that solve real problems; and showing engineering students how their expertise can benefit even the most disadvantaged members of their community.

1. Introduction

Undergraduate students in engineering are currently facing a future in which they will need more than just a solid technical background. In setting the goals for any system they are asked to design, they will be expected to interact effectively with people of widely varying social and educational backgrounds. They will then be expected to work with people of many different technical backgrounds to achieve these goals. They thus need educational experiences that can help them develop these skills.

Community service agencies are facing a future in which they must rely to a great extent upon technology for the delivery, coordination, accounting, and improvement of the services they provide. They often do not possess the expertise to use, or the budget to design and acquire a technological solution that is suited to their mission. They thus need the help of people with strong technical backgrounds.

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[2] Further information about the EPICS program resides at: http://purcell.ecn.purdue.edu/~epics

The Engineering Projects in Community Service (EPICS) Program provides a structure which enables these two groups to work together and thereby satisfy each others' needs.

2. Phases of an EPICS Project

The EPICS program supports multiple projects. Each involves a team of seven to ten undergraduates and one or more community service agencies. Five current EPICS projects are listed in Table 1.

TABLE 1: Summary of Fall 1995 EPICS Projects

Project Title:	Automated Assistance Center (AAC)
Project Partner:	Lafayette Crisis Center
Tasks:	Design stand-alone kiosks that will provide information about community services to people in need of assistance. Incorporate means of contacting appropriate agencies.
Project Title:	Homelessness Prevention Network (HPN)
Project Partners:	Eight Agencies of the Tippecanoe County Homelessness Prevention Network.
Tasks:	Design and implement a centralized database that allows the agencies to coordinate their services, track their clients, and assemble accurate reports without violating clients' confidentiality.
Project Title:	Speech-Language and Audiology Clinics (SLAC)
Project Partner:	The M. D. Steer Audiology and Speech-Language Center
Tasks:	Design a communication system to allow a supervising clinician to advise a clinician-in-training without disrupting the session. Automate calculation of syllables-per-breath from clinical sessions. Design speech synthesis systems and interfaces.
Project Title:	Visiting Nurse Home Health Service (VNHHS)
Project Partner:	The Visiting Nurse Home Health Service
Tasks:	Develop software interfaces between databases containing patient care information and other management software. Develop software to manage nurse scheduling and point of care service.
Project Title:	Wabash Children's Center (WCC)
Project Partner:	The Wabash Children's Center
Tasks:	Develop computer-controlled toys for children with physical disabilities. Develop an artificial sensory environment to provide multi-sensory stimulation and a sense of control to children with physical disabilities.

Phase 1 - Finding Project Partners: Each EPICS project addresses the technology-based problems of one or more service organizations in the local community. Agencies with appropriate problems must therefore be found.

When the EPICS program started in the Spring of 1994, we were able to contact many different service agencies at the same time by making a presentation about the program and its goals at the monthly meeting of the directors of all local United Way agencies. This single presentation led to many discussions with individual agencies and a long list of potential projects.

From this list of potential projects, those best suited for the EPICS program were selected. Whether a project is selected depends upon its:

- *Significance* - not all projects can be undertaken, so those that should provide the greatest benefit to the community are selected;

- *Level of Technology* - projects must be challenging to, but within the capabilities of, undergraduates in engineering;

- *Expected Duration* - only projects that would require two or more years of effort from a team of approximately eight undergraduates are chosen.

Once a project has been selected for the EPICS program, the service agency that will be directly involved is designated the *Project Partner*.

Phase 2 - Assembling a Project Team: Once a project and *Project Partner* have been identified, a student team is organized. This is done by advertising the project in various undergraduate classes and on the web. Students expressing interest are asked to submit their names, class level, and background information for evaluation. From these responses, seven to ten students are chosen for the *Project Team*.

The team must be *vertically* integrated: it must be a mix of sophomores, juniors and seniors. Each student is requested to participate in the project for as many semesters as possible. The combination of a vertically integrated team and long-term student participation ensures continuity in projects from semester to semester and year to year. Projects can thus last many years if new students, especially sophomores, are recruited for the project as team members graduate.

The students selected must register for the EPICS Program. Sophomores register for one credit per semester, with the registration as Pass/Fail. Juniors register for one or two credits per semester, and may take the course either for a letter grade or Pass/Fail. Seniors register for one or two credits per semester, and must take the course for a letter grade.

The seniors are generally expected to be the team leaders and to have primary technical and managerial responsibility. Their responsibilities include system design, solving technical problems, and training, monitoring, and directing the sophomores and juniors in the tasks of system construction, testing, and deployment. The responsibilities of juniors include assisting the seniors in the planning and organization of the project, the solution of technical problems, meeting with the Project Partner, and the supervision of sophomores. They also have principal responsibility for finding sources of information or technical expertise needed for the project. The sophomores become familiar with the project by maintaining the project homepage, assisting in the preparation of reports and presentations, and performing tasks assigned to them by the juniors and seniors.

Each student in the EPICS Program attends the weekly two-hour meeting of his/her team in the EPICS laboratory and the common one-hour lecture given each week for all EPICS students. Table 2 lists the Fall 1995 EPICS lectures. The amount of time a student should spend on a project outside of the required class and lab is determined by the number of credits being earned.

Phase 3 - The Project Proposal: During the first semester of a project, the Project Team meets several times with its Project Partner and the EPICS faculty to discuss the project and determine its goals. This process culminates in a written proposal and a twenty-minute presentation that are due by the fourth week of the semester.

The proposal must be approved by the EPICS faculty and then be submitted to the Project Partner. It is critiqued during a lab session, with detailed feedback provided in the areas of organization, content, technical approach, and writing.

In general, a rather extensive rewrite of the proposal is required before it is approved by the EPICS faculty. The students generally do very well in the areas of organization, content, and technical approach, but not very well in the area of writing.

TABLE 2: Fall 1995 EPICS Lectures

wk.	*Speaker*	*Background*	*Topic*
1	J. William Asher	Prof., Educational Studies	Interviews with Students
2	Hank Dietz	Prof., Electrical & Computer Eng.	Project Management
3	Edward Coyle	Prof., Electrical & Computer Eng.	Writing Proposals
4	EPICS Teams		Proposal Presentations
5	Edward Delp	Prof., Electrical & Computer Eng.	Data Security
6	Douglas Curry	Purdue's Technology Transfer Office	Software Licensing
7	Hank Dietz	Prof., Electrical & Computer Eng.	Hardware-Software Interfacing
8	Richard Koubek	Prof., Industrial Engineering	Human Factors, Ergonomics
9	John Boggess	Prof., Computer Technology	Database Management Systems
10	EPICS Teams		Progress Report Presentations
11	Mike Birck	Founder & CEO, Tellabs, Inc.	Entrepreneurship
12	John Pomery	Prof., Management	Ethics (Part I)
13	Chuck Harrington	Technician, ECE Machine Shop	ECE Machine Shop
14	John Pomery	Prof., Management	Ethics (Part II)
15	Ralph Webb	Prof., Communications	Technical Presentations
16	EPICS Teams		Final Report Presentations

Phase 4 - System Design and Development: Starting from week five of the first semester of a project, the Project Team's goal is to produce a prototype of the hardware/software systems discussed in the proposal. Interaction with the Project Partner continues in order to ensure that the systems being designed and developed are as desired. The formal portion of this interaction takes the form of a written progress report and an oral presentation delivered by the Project Team to the EPICS faculty and the Project Partner at the middle and end of each semester. The progress reports must meet the same standards as the proposals.

This phase of a project lasts as many semesters as necessary for the team to complete the project to the satisfaction of the Project Partner. To ensure the students build confidence and the Project Partners see progress, the teams pursue a mix of long-term and short-term projects. Short-term projects generally require only one or two semesters to complete; long-term projects take two or more years.

Phase 5 - System Deployment and Support: The ultimate goal of each Project Team is to deliver a prototype system to the Project Partner for evaluation. The team must train representatives of the partner in the use of the system and make any reasonable changes requested by the partner.

3 Goals of the EPICS Program

The goals of the EPICS program include: providing students with multi-year, team-based, design and development experience; teaching students, by direct experience, how to interact with each other and with customers to specify, design, develop and deploy systems that solve real problems; and, showing engineering students how their expertise can benefit even the most disadvantaged members of their community.

Another goal of the EPICS program is to develop students' skills in the following areas: **Communication -** EPICS projects require written reports, oral proposal and progress presentations, oral communications with sponsors and consultants, and intra-team communications. **Analytical thinking -** Because the scope and size of an EPICS project is much larger than is possible in traditional courses, students have to apply what they have learned to less well defined problems across a variety of disciplines. **Teamwork**

- EPICS projects are large, so teamwork is essential. Students learn to divide up a large problem, assign and schedule sub-tasks, and integrate the pieces into a working solution. **Resourcefulness -** Vertically integrated projects encourage students to pursue non-traditional educational resources, such as each other, their Project Partner, and academic consultants who have experience related to the projects. **Resource management -** Each team will develop a proposal for the equipment and space requirements for the project, and will have to take into account the resources of the sponsor. **Professional ethics -** Professional conduct, both in relation to the sponsor and within the team itself, is essential, so students must maintain an awareness of ethical principles while meeting the demands of the project.

4 Conclusion

The EPICS program represents a new approach to incorporating design and project management experience into the engineering curriculum. It provides projects which the students can easily see will have a real impact beyond campus. It also provides very valuable technical resources to community service agencies.

Our goal in the next few years is to expand the EPICS program to other engineering schools within Purdue and to other universities. We already have students from the Mechanical, Industrial and Biomedical Engineering Schools involved in the program, and wish to establish EPICS courses within their home departments. We will be traveling to three other universities this year to discuss the program.

5 Bibliography

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6 Biographical Information

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LEAH H. JAMIESON received her Ph.D. in EECS from Princeton University in 1977. She is currently Professor and Director of Graduate Admissions in the School of Electrical and Computer Engineering at Purdue University. Her research interests include spoken language processing and the design of parallel algorithms and software for signal processing applications. Jamieson is President-Elect of the IEEE Signal Processing Society, is a Fellow of the IEEE, and is a co-founder of the EPICS Program.