EPICS: Meeting EC 2000 Through Service-Learning

William C. Oakes, Leah H. Jamieson and Edward J. Coyle

The EPICS Center
Schools of Engineering
Purdue University

Abstract

Engineering Projects in Community Service — EPICS — is a service-learning program that was initiated at Purdue University in the Fall of 1995. Under this program, undergraduate students in engineering earn academic credit for long-term team projects that solve technology-based problems for local community service organizations. Approximately 300 students are currently enrolled in EPICS at Purdue and they are organized into 20 project teams. . With its emphasis on start-to-finish design of significant projects that will be deployed by the community customers, EPICS addresses many of the program outcomes mandated for ABET accreditation. This paper describes the procedures and documentation that have been developed to enhance and evaluate the students' abilities to: function on multidisciplinary teams; communicate effectively; and understand the impact of engineering solutions in a global and societal context.

Introduction

Undergraduate students in engineering face a future in which they will need more than just a solid technical background [1,2,3]. 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 face 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 possess neither the expertise to use nor 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.

Service learning has been shown to be an effective means of addressing the needs of engineering curricula and the community [4]. Engineering, however, has lagged behind many other disciplines in the integration of service learning into the curriculum [5]. Recent examples of engineering service learning include projects integrated into freshman-level introductory courses [5, 6], capstone senior design courses [7] and multidisciplinary approaches [8]. Other initiatives have sought to integrate the co-curricular activities of student organizations with engineering service learning [9].

The Engineering Projects in Community Service (EPICS) program provides a service-learning structure that supports long-term projects in which teams of undergraduates in engineering are matched with community service agencies that request technical assistance. Under the guidance of faculty in engineering, these EPICS project teams work closely over many years with their partner community service agencies to define, design, build, deploy, and support the systems the agencies need. The results are systems that have a significant, lasting impact on the community service agencies and the people they serve.

Through this service, the EPICS students learn many valuable lessons in engineering, including the role of the partner, or "customer," in defining an engineering project; the necessity of teamwork; the difficulty of managing and leading large projects; the need for skills and knowledge from many different disciplines; and the art of solving technical problems. They also learn many valuable lessons in citizenship, including the role of community service in our society; the significant impact that their engineering skills can have on their community; and that assisting others leads to their own substantial growth as individuals, engineers, and citizens.

The Structure and Phases of EPICS Projects

Each EPICS project involves a team of eight to fifteen undergraduates, one or more community service agencies, and a faculty or industry advisor. Each team is vertically-integrated, consisting of a mix of freshmen, sophomores, juniors and seniors. Each team is constituted for several years -- from initial project definition through final deployment -- with students participating for several semesters.

Students register for the course for either 1 or 2 credits depending on their load in their other courses. In the freshman and sophomore years, students are limited to 1 credit per semester while juniors and seniors may register for either 1 or 2 credits per semester. The upper division students are encouraged to register for 2 credits because they are expected to serve as the technical leaders on the teams and thereby take on more responsibility.

Each student in the EPICS Program attends a weekly two-hour meeting of his/her team in the EPICS laboratory. During this laboratory time, the team will take care of administrative matters or work on their project(s). All students also attend a common one-hour lecture given each week for all EPICS students. A majority of the lectures are by guest experts, and have covered a wide range of topics related to engineering design and community service. The long term nature of the program has required some innovation to the lecture series as students may be involved in the program for up to seven semesters and do not want to hear the same lectures repeated. This has been addressed by rotating the lecture topics on a cycle of two to three years and also by creating supplements to the lectures called skill sessions, which students can take as a substitute for lectures they have already seen. Examples of skill sessions include such topics as learning to operate a mill or lathe, developing effective surveys and sessions on multimedia software. These have been very popular and we have found that students use them as a way to gain knowledge needed for their projects and as a broadening experience (e.g. computer engineering students learn about a mill)

The structure of EPICS enables long-term projects. Over time, each project has five phases: Finding Project Partners, Assembling a Project Team, Project Proposal, System Design and Development, and System Deployment and Support.

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. Three criteria are used in matching projects to EPICS teams.

- *Significance to the Community*
- *Level of Technology*
- *Expected Duration*

From five initial projects in Fall 1995, the program has grown to twenty projects in Spring of 2000. 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 undergraduate classes, through academic advisers, call-out meetings and on the World Wide Web. Eight to fifteen students are chosen for each *Project Team*. Depending on the needs of the Project Partner, teams may reflect a single engineering discipline or may be multidisciplinary, including students from Electrical, Computer, Mechanical, Civil, Aerospace, Industrial and/or Materials Engineering as well as from Computer Science, Chemistry, Sociology, Nursing, Visual Design, English and Education or other disciplines as needed.

The team must be *vertically-integrated*: it must be a mix of freshmen, 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 freshmen and sophomores, are recruited for the project as team members graduate.

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 advisers to define the project and determine its goals. During this phase the Project Team learns about the mission, needs, and priorities of the Project Partner. A key aspect of this phase is identifying projects that satisfy three criteria: the Project Partner needs them, they require engineering design, and they match the team's capabilities. Also, to ensure that the students build confidence and the Project Partners see progress, the teams are encouraged to 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. This process of project definition culminates in a written proposal and presentation in the fourth week of the semester. The proposal is critiqued during a lab session, with detailed feedback provided in the areas of organization, content, technical approach, and writing. The proposal must be approved by the EPICS advisers and then be accepted by the Project Partner.

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 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 advisers 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.

Phase 5 - System Deployment and Support: The ultimate goal of each Project Team is to deliver a system to the Project Partner. After fielding a prototype, the team must train representatives of the partner in the use of the system, collect feedback, and make any reasonable changes requested by the partner. One of the hallmarks of the EPICS Program is that the systems designed and built by the students are deployed in the field, where they provide real, needed service to the community.

Status of the Program

The EPICS program at Purdue in the fall of 1995 with five teams of students from electrical and computer engineering. In the spring semester of 2001, 300 students were enrolled in the course, distributed onto 20 teams that are under the direction of 23 advisors from seven Purdue departments and three local companies [10]. The students come from 20 different academic departments including electrical and computer, mechanical, civil, and industrial engineering, computer science, sociology, psychology, education, audiology, nursing and management. A description of the teams can be found in the appendix.

EPICS and EC 2000

EPICS offers many opportunities to address the Program Outcomes required for ABET accredited programs under EC 2000, Criterion 3 [11], which states that engineering programs must demonstrate that their graduates have:

(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 multidisciplinary 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.

The very nature of EPICS projects provides many opportunities for students to demonstrate that they have achieved these outcomes. Central to all EPICS projects are outcomes (c) and (d). In their role as engineering consultants, the teams must design a system, component, and/or a process to meet the needs of their project partners (c). The EPICS teams are always multi-disciplinary in composition (d), either involving students from different disciplines (not only within engineering, but also outside engineering) or students within the same discipline who have different areas of specialization within the discipline. The composition of most EPICS teams utilizes both of these definitions, though to different degrees, depending on the specific nature of the team's projects. Each Semester, the composition of the teams may change to reflect the evolving needs of the specific projects.

In addition, since these projects are solutions to real world problems that are ultimately implemented for use by the project partners, they must be economically viable solutions that are safe, reliable, and aesthetically acceptable - issues that relate to professional and ethical responsibility (f). Projects and their impact must be understood and be acceptable in a societal context (h), which can only be accomplished after developing a thorough understanding of the pertinent contemporary issues (j). While teams employ skills and knowledge already acquired, projects typically require researching additional subjects in depth and learning and applying new skills (i). Further, effective communication (g) is essential to the success of the projects - between team members, with the project partner and team advisors, and to the general public.

EPICS provides a structured environment in which engineering students have both the opportunity and, significantly, the time to acquire and even master the skills specified by the EC 2000 criteria. Of particular interest for this paper are the so-called "soft" skills. Instruments have been put into place to enable assessment and improvement of the program's effectiveness in fostering development of these skills. The following sections will focus on how EPICS enhances students' abilities to: function on multidisciplinary teams; communicate effectively; and understand the impact of engineering solutions in a global and societal context.

Teamwork and Leadership

Teamwork is a cornerstone of the EPICS experience. All students are placed onto teams that range in size from eight to twenty students. Team building exercises that are one to two hours in duration are administered by teaching assistants during a lab session early in the semester. Because the EPICS teams continue from one semester to the next, each semester begins with some students returning to that team as well as with new members that must be quickly integrated into the teams. The team building exercises significantly speeds-up this integration process.

Each team develops an organization structure similar to what is shown in Figure 1. Each team is expected to identify a team leader or two co-leaders. Most teams work on multiple projects for their project partner and each of these projects has a designated leader for accountability. Typically, three project teams are operating in parallel on a given team. The responsibilities for organizing the team, running meetings and adhering to the semester schedule rest with the student leaders. The advisors and teaching assistants serve in an advisory capacity and provide direction only when necessary. The result is a very rich, large team experience that allows the

students to learn leadership and management skills and see their results over the course of one or more semesters. They learn by experience how to set up an organizational and communication structure and work within that structure.

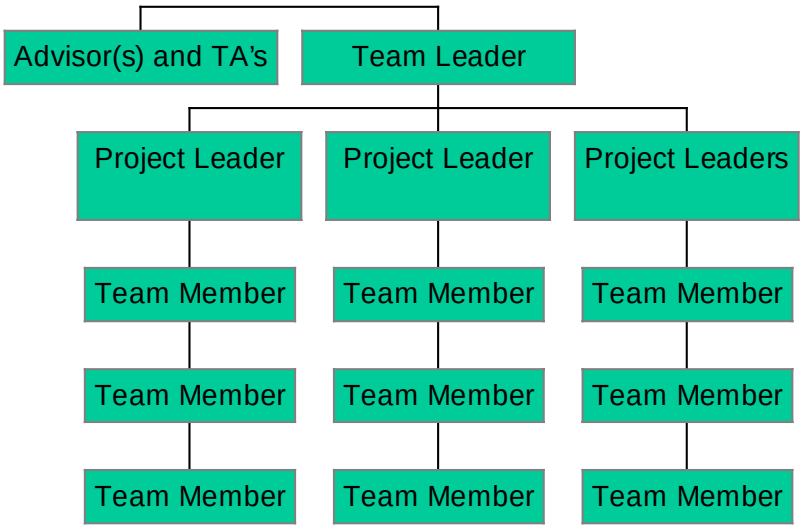

Figure 1. Typical EPICS team organizational chart

In addition to the team and project leaders, each team is asked to identify students for the roles of team webmaster, primary liaison with the team's project partner, and representative to the EPICS student advisory council (ESAC). These responsibilities are in addition to their normal project work.

The webmaster: (a) serves as the primary contact with the EPICS technical staff on matters affecting the computing and networking infrastructure of the EPICS Lab facilities; (b) coordinates the maintenance of the team webpage that contains reports and other information for the current semester and serves as an archive of reports, accomplishments, and technical information from previous semesters.

The liaison serves as the primary contact with the team's project partner. To simplify communication for the community organizations that serve as project partners, all EPICS teams identify one person as the principle communication link with the team. This student is also asked to take the lead in understanding the issues facing the project partner, identifying future projects, and assessing the progress of the team in meeting the organization's needs.

As the EPICS program has grown, it has become necessary to establish a student advisory council (ESAC) consisting of one representative from each team. The council provides feedback to the administrators of the EPICS program on aspects of the program. ESAC has also assumed primary responsibility for the recruitment and placement of new EPICS students. New students who register for EPICS are asked to rate their preferred teams. ESAC takes that information and matches it to the teams' needs. This provides the teams with input into the personnel decisions that affect the following semester.

An advantage of the multi-semester nature of the EPICS program is that students can join a team and participate as part of a project team for their first semester. During subsequent semesters, they have the opportunity to fill one or more of the leadership positions on the team. This provides students the opportunity to experience several different roles on a team during their time in EPICS.

Communication

EPICS students are exposed to several mechanisms to encourage the development of their communication skills. On an individual basis, all EPICS students are required to maintain weekly reports, which are one-paragraph summaries of their accomplishments along with a one paragraph summary of their plans for the coming week. Design notebooks are maintained by all students and are used to document their individual accomplishments and information related to their project and their experiences. These notebooks are reviewed three times each semester and feedback is given to the students.

As a team, two reports are written each semester. For teams that are new to EPICS, this first report takes the form of a proposal to their project partner. This proposal is shared with the community partner and becomes an agreement concerning the work to be performed by the team. For teams that are continuing from a previous semester, a midsemester status report on their current activities and plans is required. All teams are required to submit final reports every semester.

These reports contain a narrative describing the projects as well as a detailed technical appendix that serves as an archive for future semesters as projects carry over between semesters. The students learn to appreciate the effectiveness of their communication when they pick up a project after other students have left. The reports are reviewed by the team's advisor and returned to the team for edits. Once completed, they are shared with the project partner and posted on the team's website.

Students are also given several opportunities to hone their oral communication skills. Formal, team presentations are scheduled at the middle and end of each semester. Advisors and all other EPICS students evaluate the presentations. The students' evaluations are collected on forms that are summarized and returned to the presenters for comparison with both their own self-evaluation and feedback from their advisor. All team presentations are videotaped and each team reviews its tape during subsequent lab periods.

Continuing project teams begin the semester with an in-lab demonstration of the status of their projects. This serves as another presentation opportunity and as a mechanism that ensures everyone on the new team is fully up to speed on the previous semester's efforts by the fourth week.

In the second half of the semester, each team is expected to conduct a technical design review of their work. These reviews are given to invited visitors that have a technical background suited to the projects. The team is responsible for identifying the reviewers who typically come from

Purdue's faculty or local industry. These presentations are longer, more detailed, and allow more opportunities for discussion than the mid and end of semester presentations.

In the spring semesters, a poster session is held in lieu of a mid-semester presentation. Each team constructs a poster and staffs a two-hour poster session. The posters are reviewed in draft form by faculty from the department of Visual Design. The students incorporate the feedback from this review into their final design. The poster sessions have been an excellent mechanism to showcase the breadth of the EPICS program to the students, the university and the local community.

Community Awareness

The service-learning nature of the EPICS program provides opportunities for students to gain an understanding of the societal impact of engineering solutions through the very nature of their community-based projects. Because the teams produce real projects that are intended to be used by the partner, the teams learn quickly that they must be done professionally and must address pertinent issues facing the organization or they won't be used. The beauty of the engineering service-learning experience is that this immerses the engineering students in community issues throughout the design process.
For example, some teams have used supplemental readings and presentations by their project partners or other community resources to enhance their understanding of the needs of their project partner. Many of the teams include discussions of their projects partner's issues as part of their weekly lab meetings

To further promote community awareness and a deeper understanding of the community issues, opportunities for reflection are programmed into each semester. Each student is required to summarize their accomplishments at the mid and end of semester grading periods. These summaries include statements of the student's understanding of community issues as well as technical issues.

Skill sessions and lectures are offered in the area of reflection and community needs. Representatives of the community provide the lectures and the teaching assistants facilitate the skill sessions. The program also allows students to attain skill session credit for work with their community partner if it builds understanding the partner. An example is an electrical engineer that developed, and later shared with teammates, a deeper understanding of the issues involved in disseminating information about community services by attending a day-long meeting of state crisis center administrators. .

Evaluation Results

Evaluations along the dimensions of the EPICS program goals have been collected [ref]. To date we have responses from over 950 students, collected at the end of each semester since the Spring 1996. Each aspect was to be graded on a letter-grade scale, with *"A=excellent, B=good/above average; C=average; D=marginal/below average; F=poor"* with the option for *"N/A" for "not applicable"*.

Table 1 shows the percentage of students responding with an A or B for the categories relating to the "soft" skills identified in EC 2000 for each semester over the last three years. As can be seen from the data, a large percentage of the students feel that these "soft" skills of engineering design have been enhanced by their participation in the EPICS program. The ability to work on a team is the highest rated with an overall score of 88% while all of the criteria are at a 74% or higher.

TABLE 1: PERCENT OF STUDENTS RESPONDING WITH A GRADE OF A OR B TO THE QUESTION: *EVALUATE THE IMPACT THAT EPICS HAS HAD FOR YOU ON YOUR_____..*

	Fall 97	Spr. 98	Fall 98	Spr. 99	Fall 99	Spr. 00	Total
Communication Skills, %	81	85	86	82	83	83	84
Ability to Work on a Team, %	84	85	91	89	89	87	88
Organizational Skills, %	78	76	83	76	81	70	78
Awareness of the Community, %	76	76	82	70	75	68	74
Awareness of the Customer in an Engineering Project,%	83	82	89	80	80	76	82
Overall Evaluation, %	83	85	84	77	82	84	84
Number Of Responses	112	122	148	202	161	202	947

This is validated by the qualitative data collected through a series of open-ended questions at the end of the semester. The results of the responses to the question "*What are the three most valuable things you have learned from being a part of the EPICS program*" for the spring 2000 semester are shown in Table 2. Of the 202 students who responded to the evaluation, 166 students say they learned about teamwork as the most common response. The top five responses are all what could be considered the "soft" skills that EC 2000 seeks to promote.

These qualitative responses showed that the students are much more aware of their development of "soft" skills than of technical skills in the experiential learning environment. Data from focus groups has shown that the students don't perceive that they are acquiring much technical knowledge because they are not aware of what they learned in the experiential environment. They do not feel that they have been "taught" anything and therefore have not learned anything new in their technical area. These data also show that the students do acknowledge that they have learned technical content, which needed to be applied to the project when the issue is addressed directly, but their initial reaction is that they were not taught anything new.

Table 2: Responses to the question:
"*What are the three most valuable things you have learned from being a part of EPICS? "*

Topic	**Number of responses**
Teamwork	166
Communication	62
Time Management/Organization	50
Leadership	33
Community Awareness	26

Other aspects of the survey data that the focus groups have validated include the development of communication skills among students. Some students in the focus groups expressed concerns about the plethora of communication requirements and felt it inhibited the work on the actual projects. These comments were confronted by students who had participated in the co-op program who indicated that EPICS simulated their co-op work environment, where they also felt there was always a report or presentation hanging over their heads.
The responses to the free response questions confirmed the survey data regarding their awareness of the community. Representative comments include:

It [EPICS] has helped me gain a better understanding of the community and how products [are] made/required by it.

… is a non-profit organization that works with very underprivileged people. I have great compassion for what they do which has made me care more about my role in EPICS. It's not always about industry and making money, it's about getting technology to those who need it most.

It has taught me how good it feels to do or make something that directly benefits another person.

It has encouraged me to use my engineering skills to help the community.

… made me a little more focused on the moral implications of my professional actions.

…it provides students with life preparation, not just memorizing and calculating.

EPICS has shown me how my knowledge is an invaluable tool and I've been happy to put the time in for seeing what it does for the community.

I appreciate the value of community service and am more likely to give money to and participate in charitable organizations.

Conclusion

The Engineering Projects in Community Service Program has added a new dimension to the educational experience for engineering undergraduates at Purdue University. It represents the first program at Purdue that formally integrates service-learning into the engineering curriculum. Key features of the program include vertically integrated, multidisciplinary teams and multi-year participation. From the academic side, this structure provides students with the opportunity to be involved in all phases of the design process, from project definition through deployment, on projects that are large in scale.

Moreover, the structure encourages an extended service-learning experience, with emphasis on providing a model of how engineers can use their technical skills to benefit the community while learning engineering design. On the community side, the EPICS structure fosters a long-term relationship between project teams and the community service agency partners, enabling

ambitious projects that can have a significant impact. The student experience in the EPICS program conforms very well to the ABET EC 2000 requirements, including those addressing "soft" skills.

Further information about the Engineering Projects in Community Service Program is available at: http://epics.ecn.purdue.edu/

Acknowledgments

The EPICS Program has been supported by grants from the U.S. Department of Education's Fund for the Improvement of Postsecondary Education (grant P116F50129), the National Science Foundation's Instrumentation and Laboratory Improvement Program (grants DUE96-50771 and DUE 98-51200), the Corporation for National Service Learn and Serve America Higher Education Program (grants 97LHEIN025 and 00LHEIN025 00), the National Science Foundation Action Agenda for Engineering Curriculum Innovation Program (grant EEC-0002638) and by grants and donations from numerous companies, including Microsoft Research, Hewlett-Packard, AMD, Eli Lilly, General Motors, ADC, United Technologies, Rea Magnet Wire Co., MDBS, Great Lakes Chemical, and Alcoa.

References

1. Dahir, M. (1993). Educating engineers for the real world, in *Technology Review*, Aug./Sept. 1993, pp. 14-16.

2. Engineering Deans Council and ASEE (1994). *Engineering education for a changing world*, report of the Engineering Deans Council and Corporate Roundtable of the American Society for Engineering Education. Available from the American Association of Engineering Education.

3. Honnett, E. P. & Poulsen, S. J. (1989). *Principles of good practice for combining service and learning: A Wingspread special report*. Racine, WI: The Johnson Foundation, Inc.

4. Duffy, J., Tsang, E. and Lord, S. (2000). Service-Learning in Engineering: What, Why, and How? *Proceedings of the ASEE 2000 Annual Conference*, St. Louis, Missouri, June 2000.

5. Tsang, E., editor (2000). *Projects That Matter: Concepts and Models for Service-Learning in Engineering*. Washington, D.C.: AAHE.

6. Hobson, R. S. (2000). Service-Learning as an Educational Tool in an Introduction to Engineering Course, *Proceedings of the ASEE 2000 Annual Conference*, St. Louis, Missouri, June 2000

7. Catalano, G. D., Wray, P., and Cornelio, S. (2000). Compassion Practicum: A Capstone Design Experience at the United States Military Academy, *Journal of Engineering Education*, Vol. 90, No. 4, Oct. 2000, pp. 471-477.

8. Nagchaudhuri, A., Eydgahi, A., and Shakur, A. (2000). SLOPE: An Effort Towards Infusing Service-Learning into Physics and Engineering Education, *Proceedings of the ASEE 2000 Annual Conference*, St. Louis, Missouri, June 2000.

9. Stott, N. W., Schultz, W. W., Brei, D., Winton Hoffman, D. M., and Markus, G. (2000). ProCEED: A Program for Civic Engagement in Engineering Design, Proceedings of the ASEE 2000 Annual Conference, St. Louis, Missouri, June 2000.

10. Oakes, William C., Coyle, Edward J., and Jamieson, Leah H., "EPICS: A Model of Service-Learning in an Engineering Curriculum,", *Proceedings, ASEE Annual Conference*, Session 3630, St. Louis, MO, June 2000.

11. 1999-2000 Criteria for Accrediting Engineering Programs - Engineering Criteria 2000.

Appendix Summary **of 2000-2001 EPICS Projects**

1. ***Project Title:*** Automated Assistance Center ***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. ***Impact:*** Improved access to community services. ***Facts:*** Begun fall 1995, Disciplines: EE, Comp E, ME, Sociology, CS.
2. ***Project Title:*** Habitat For Humanity ***Project Partner:*** Tippecanoe County Habitat for Humanity ***Tasks:*** Design energy management systems to minimize home operating costs. Develop new construction techniques and investigate new construction materials. ***Impact:*** More energy-efficient housing for Habitat families.
3. ***Project Partner:*** Tippecanoe County Historical Association ***Tasks*** Develop multi-media and electro-mechanical systems for on-line storage and interactive presentation of historical information. ***Impact:*** Improved access to historical information. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, CS, ME, Photography.
4. ***Project Title:*** Homelessness Prevention Network ***Project Partners:*** Ten 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. ***Impact:*** Improved continuity in serving the homeless; more accurate understanding and reporting of the scope of the homelessness problem in Tippecanoe County. ***Facts:*** Begun fall 1995, Disciplines: EE, Comp E, CS, Sociology.
5. ***Project Title:*** Speech-Language and Audiology Clinics ***Project Partner:*** The M. D. Steer Audiology and Speech-Language Center ***Tasks:*** Integrate a speech recognition system with computer graphics and games to encourage language development. Design and build a working model of the vocal system, for clinicians to use in educating laryngectomy patients. Automate calculation of speaking rate from clinical sessions. ***Impact:*** New services for the clinic's client; improved feedback to speech clients. ***Facts:*** Begun fall 1995, Disciplines: EE, Comp E, CS, ME, IE, Audiology.
6. ***Project Title:*** Wabash Center Children's Services (2 projects) ***Partner:*** The Wabash Center Children's Services ***Tasks:*** Develop electro-mechanical toys and play environments for children with physical disabilities. ***Impact:*** Expanded capabilities and control of their environment for children with physical disabilities. ***Facts:*** Begun fall 1996, Disciplines: EE, Comp E, CS, ME, IE.
7. ***Project Title:*** Imagination Station ***Partner:*** Imagination Station – Local Children's Museum ***Tasks:*** Develop systems to aid in science, mathematics and technology education. ***Impact:*** Improved, interactive displays to interest youth in science, math and engineering. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, ME, MSE, IE, CS, Visual Design, Sociology
8. ***Project Title:*** Happy Hollow Elementary School ***Partner:*** Happy Hollow Elementary School ***Tasks:*** Develop systems to aid in science, mathematics and technology education. ***Impact:***

Improved educational resources for the community. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, ME, MSE, IE, CS, Visual Design, Sociology, Education.

9. ***Project Title:*** Indiana Division of Families and Children ***Partner:*** Indiana Division of Families and Children ***Tasks:*** Develop a centralized database to help the four service agencies coordinate their activities and share information. Develop custom palm-top software to aid service personnel visiting families. ***Impact:*** Improved and less-expensive social services for at-risk children and their families.. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, Sociology
10. ***Project Title:*** Klondike Elementary School ***Partner:*** Klondike Elementary School ***Tasks:*** Design of custom educational software, sound systems, and multimedia tools for education. ***Impact:*** Improved educational resources for the community.. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, ME, CS, Education.
11. ***Project Title:*** Office of the Dean of Students ***Partner:*** Purdue University's Office of the Dean of Students ***Tasks:*** Design classroom furniture for physically handicapped college students; develop closed-captioning systems for deaf and hard-of-hearing college students...***Impact:*** Improved access to education for physically disabled and hard-of-hearing students. ***Facts:*** Begun fall 1997, Disciplines: EE, Comp E, ME.
12. ***Project Title:*** Constructed Wetland ***Partner:*** Purdue Department of Forestry and Natural Resources ***Tasks:*** Develop and construct a test wetlands area to clean up runoff from cattle, dairy and swine farms to treat creek water ***Impact:*** Improved water quality. New techniques for mitigating agricultural runoff. ***Facts:*** Begun fall 1998, Disciplines: CE, EE, IDE, Chemistry, Biology
13. ***Project Title:*** Discovering Engineering Careers ***Partner:*** Purdue Office of the Dean of Engineering and local K-12 schools ***Tasks:*** Develop portable, hands-on demonstrations of engineering principles and practice that will spark interest in engineering careers among elementary, middle, and high school students ***Impact:*** Helping youths make decisions about high school course selection, attending college and career choices. Increased awareness of engineering and interest in engineering among K-12 students and their teachers. ***Facts:*** Begun fall 1998, Disciplines: CE, EE, Comp E, IDE, ChE, ME, IE, Sociology, Education
14. ***Project Title:*** Wabash Center, Greenbush Industries ***Partner:*** Wabash Center, Greenbush Industries ***Tasks:*** Develop mechanical and electromechanical fixtures to aid individuals with disabilities in doing basic manufacturing and packaging tasks. ***Impact:*** Improved working conditions for disabled adults Facts***:*** Begun fall 1998, Disciplines: ME, IE, EE.
15. ***Project Title:*** Lafayette Adult Reading Academy ***Partner:*** Lafayette Adult Reading Academy ***Tasks:*** Design software and hardware systems to help children and adults learn to read and to assist people in learning English as a second language. ***Impact:*** Improved educational opportunities for the community ***Facts:*** Begun fall 1998, Disciplines: Comp E, EE, CS, ME
16. ***Project Title:*** Columbian Park Zoo ***Partner:*** Columbian Park Zoo ***Tasks:*** Develop and construct multimedia educational center for the local zoo ***Impact:*** Improved educational resources for the community. ***Facts:*** Begun fall 1999, Disciplines: ME, EE, Comp E, CS, Biology, Animal Science.

17. ***Project Title:*** Institute for Women and Technology ***Partner:*** Institute for Women and Technology ***Tasks:*** Develop and construct prototypes of technology that better serves the needs of women and families ***Impact:*** Improved use of technology for women. ***Facts:*** Begun fall 1999, Disciplines: Comp E, EE, ME, CS, Communications, and English.
18. ***Project Title:*** Classroom Learning Technologies ***Partner:*** Office of the Dean of Education and local K-12 schools ***Tasks:*** Develop and implement improved ways for educational classrooms to utilize technology in an affordable manner ***Impact:*** Improved use of technology in K-12 and college classrooms ***Facts:*** Begun spring 2000, Disciplines: Comp E, EE, ME, Education, CS.
19. *Project* ***Title:*** Information Management Systems ***Partner:*** EPICS Teams ***Tasks:*** Develop and implement improved database systems to improve the operation of EPICS teams and allow the program to continue to grow to meet the community needs ***Impact:*** Improved production from EPICS teams in meeting community needs ***Facts:*** Begun spring 2000, Disciplines: CE, EE, Comp E, ME, Mgmt, CS.

Authors

WILLIAM C. OAKES is an Assistant Professor in the Department of Freshman Engineering at Purdue University and a Co-Director of the EPICS Program. He serves on the board of the Freshman Programs Division. He was a recipient of the 1997 ERM Apprentice Faculty Grant. He is the recipient of the 1999 and 2001 Best Teacher Awards for the Dept of Freshman Engineering and is an Indiana Campus Compact Faculty Fellow.

LEAH H. JAMIESON is Professor of Electrical and Computer Engineering at Purdue University, where she is co-founder and Co-Director of the EPICS Program. She is a co-recipient of the American Society for Engineering Education 1997 Chester F. Carlson Award for Innovation in Engineering Education for her work on the EPICS Program. Her research interests are in the areas of speech recognition and parallel algorithms. She is a Fellow of the IEEE.

EDWARD J. COYLE is Professor of Electrical and Computer Engineering at Purdue University, where he is co-founder and Co-Director of the EPICS Program. He is a co-recipient of the American Society for Engineering Education 1997 Chester F. Carlson Award for Innovation in Engineering Education for his work on the EPICS Program. His research interests are in the areas of computer networks and digital signal processing. . He is a Fellow of the IEEE