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Service Learning in Computer Science and Engineering

Moderator: Leah H. Jamieson, Purdue University, lhj@purdue.edu

Panelists: Edward J. Coyle, Purdue University, coyle@purdue.edu; Greg Madey, University of Notre Dame, gmadey@nd.edu

Panagiotis Linos, Butler University, linos@butler.edu; Jon Reid, MicroDataBaseSystems (mdbs), Inc., jon@mdbs.com

Kipp A. Scott, Tippecanoe County Probation Department, kscott@county.tippecanoe.in.us

Stephanie Herman, Butler University, sherman@butler.edu; Kelly Schneider, Purdue University, kschnei5@purdue.edu

Summary

Attention is increasingly focusing on the need to educate students in areas that extend beyond the traditional technical basis for their field: the Kellogg Commission's mandate for a "scholarship of engagement" [3]; the emphasis in the 1994 Engineering Deans Council report on teamwork, communication, and the need for students to "understand the economic, social, environmental and international context of their professional activities" [2]; the inclusion in CSAB Criteria 2000 of requirements in written and oral communication and "coverage of social and ethical implications of computing" [1]; the growth of broad IT programs and schools.

Service learning offers the opportunity to broaden the educational experience by engaging students in "real-world" projects. However, it also poses new questions: Should students earn academic credit for courses in which a significant portion of their time is spent on "soft" skills? Are students gaining valid technical experience on projects that are defined by an outside customer rather than by CS&E faculty? How can curriculum structures support projects that aren't constructed to fit within semester boundaries? How do we assess service-learning projects? The panel includes faculty and students from service-learning programs, the chief technical officer for a software company, and a community "customer."

Edward J. Coyle, ECE, Purdue University

<http://epics.ecn.purdue.edu/>

Undergraduates in engineering and computer science face a future in which they will need more than just a solid technical background. In setting goals for any system they 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 need educational experiences that can help them develop these skills.

Community service agencies face a future in which they must rely heavily 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.

The Engineering Projects in Community Service (EPICS) program, created at Purdue University in 1995, provides a curricular service-learning structure that enables these two groups to work together and thereby satisfy each other's needs. EPICS enables long-term projects in which teams of 12 to 15 undergraduates from engineering, CS, and other disciplines are matched with community agencies that request technical assistance. Under the guidance of faculty and industry advisors, these EPICS project teams work closely over many years with their partner community

organizations to define, design, build, test, deploy, and support the systems the agencies need. The results are: systems that have a significant, lasting impact on the community organizations and the people they serve; students who have a very deep understanding of the design and development process; and citizens who understand how everyone in their community can benefit, in very compelling ways, from technology.

Greg Madey, CS&E, University of Notre Dame

<http://epics.cse.nd.edu/>

In its mission statement we find that, the University of Notre Dame "... seeks to cultivate in its students not only an appreciation for the great achievements of human beings but also a disciplined sensibility to the poverty, injustice and oppression that burden the lives of so many. The aim is to create a sense of human solidarity and concern for the common good that will bear fruit as learning becomes service to justice."

EPICS in CSE at Notre Dame: Status and Challenges - Our CSE curriculum, embedded within a challenging College of Engineering curriculum, is most demanding on the students' time, energies and commitment. Thus, one challenge we face includes meeting the University's goal of helping the students develop a concern and commitment for social justice and community service, while maintaining our commitment to academic excellence. We are experimenting with several small EPICS projects that provide students with computer science based service-learning experiences, including the Homeless Prevention Network project, a River Quality Database project, and a Center for the Homeless project. Other challenges include 1) the long term maintenance of deployed systems, 2) the fact that many community service projects, because of limited resources, have the appearance of being "low tech" and the concerns about the level of the "academic" learning experience, 3) building of a "critical mass" of faculty and student participation, and 4) the assessment of the quality and value of the learning provided by the service learning projects – on both the CS and social concerns dimensions.

Panagiotis K. Linos, CS&SE, Butler University

<http://www.butler.edu/~linos/Epics>

In a small liberal arts University environment such as Butler's, where broad education is emphasized, community service is rewarded and technical expertise is promoted, appears to be an excellent incubator for the EPICS program. In addition, the need for IT renovation and modernization of many non-for-profit organizations in a two-million-population metropolitan area provides many opportunities for mutually beneficial EPICS projects.

To-date Challenges/Issues: Starting an EPICS program at Butler University has been challenging as well as exciting. Some of these challenges include: (a) Establishing solid team structures (i.e. balanced team roles and dynamics etc.) (b) Establishing assessment and evaluation methods for each student's progress. (c) Establishing long-term continuity project plans. (d) Establishing a mechanism to smoothly introduce new students in the middle of an on-going long-term project. (e) Selecting software engineering, long-term projects appropriate for Butler students. (f) It is worthwhile mentioning that attracting students, especially female students, has not been an issue to the EPICS program at Butler University so far.

To-date Rewards: (a) Students are excited about participating in something different than a traditional lecture-based course. (b) Students enjoy meeting with real customers and undertaking a realistic software engineering project. (c) Students enjoy and don't hesitate to take leadership roles in a team.

Jon Reid, CTO, MicroDataBaseSystems (mdbs)

I am the chief technology officer for mdbs, a software company located in the Purdue Research Park near Purdue University. I have been an industry advisor to the EPICS program at Purdue for 2 years, and have worked closely with a team of students developing a database used by the local county government to track probationers. The EPICS teams at Purdue are cross-disciplinary including students from Engineering, Computer Science, and even Liberal Arts. The students gain valuable experience by doing work for a real customer, solving real-world problems. They work as a team just as in industry, and deal with common issues such as team continuity, customer relationships and communication, maintenance, designing for reliability and ease of use. As a software development manager I consider participation in programs such as EPICS an enormous plus on resumes of graduates seeking jobs

in my organization.

Kipp A. Scott, Deputy Chief Probation Officer,
Tippecanoe County Probation Department

The partnership between EPICS at Purdue and the Tippecanoe County Probation Department began in Fall 1999, with a project to develop a database system to track adult criminal offenders in Tippecanoe County. The initial prototype was developed in the Fall 1999 and Spring 2000. Major modifications were made in Fall 2000 and the beta version was deployed in Spring 2001. The final and full version is expected by November 2001. The benefits of this partnership have been two-fold. Purdue students have benefited from the experience of project development, keeping projected deadlines, and the experience of developing a database system for a government agency. The Probation Department will benefit from the deployment of an offender tracking database and technical support that would otherwise be prohibitively expensive. The EPICS Program has also offered us the opportunity to improve current services and try new and innovative ideas in offender tracking.

There have been many challenges to the EPICS team. The overall design of the database was changed, with the creation of new field and an "easy to use" menu system. The challenges to the Probation Department have been negligible. Since project inception, this department has worked with four different teams of students. Several team members returned for consecutive semesters but this project is approaching its second full year of development. The Tippecanoe County Probation Department has been a leader in probation offender tracking since 1991. Other area probation departments have requested updates on our project and will hopefully participate in a continued partnership with the EPICS program.

Stephanie Herman, CS&E, Butler University

EPICS represented "the real world" to me. It was a chance to experience software engineering hands-on and also a chance to help others. I wanted to actually participate in a project from start to finish with physical results. EPICS also was a chance to get out of the academic environment and network with people in the community. Finally, it was an opportunity to collaborate with students and produce a quality product. Basically, EPICS was a new experience in which I could learn valuable lessons that I can carry throughout my career.

Kelly Schneider, EE, Purdue University

I am a senior in EE at Purdue. This will be my second semester in the EPICS Program. I am part of the Institute for Women in Technology (IWT) team. As a member of IWT and EPICS, I have used my education and short experience with industry to participate in a very exciting project. The IWT team is developing a small laptop designed especially for pre-teen girls. One main goal we wish to achieve is to entice and encourage girls/women to become more involved with technology.

EPICS is a wonderful opportunity. The program offers real-world experience that you do not get in the classroom. All day long I sit in classes and learn the theory behind electrical engineering. The question I find myself asking is "How is what I learn in class going to help me in the real world?" EPICS allows you to grasp what a project in industry would be like, a project with design, testing, and marketing. However, this is not the best part about EPICS. For me getting involved with the community and feeling like you can make a difference is the best benefit.

References

- [1] CSAB, *Criteria for Accrediting Programs in Computer Science in the United States*, Jan. 2000. http://www.csab.org/criteria2k_v10.html.
- [2] Engineering Deans Council and ASEE, *Engineering Education for a Changing World*, 1995. <http://www.asee.org/publications/reports/greenworld.cfm>
- [3] Kellogg Commission, *Renewing the Covenant: Learning, Discovery, and Engagement in a New Age and Different World*, 2000. <http://www.nasulgc.org/Kellogg/kellogg.htm>.