Industry Partnerships for Quality Programs

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Industry partners play valuable roles in the senior project courses for computing and engineering students. The partners act as mentors, assessors, advisors, and project sponsors. Interaction between the students, faculty and industry partners stands to benefit all of the participants and enhances the senior project course and the students' academic experience.

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Introduction

Including local industry professionals into the undergraduate capstone experience, the senior project course, benefits the individual students, their programs, and industry partners. The association with industry professionals offers students a more worthwhile educational experience. Industry professionals have played several important roles in engineering programs at the University of Houston-Clear Lake (UHCL) [6].

Approaches at other institutions

According to a national survey of engineering capstone courses published in 1995, 64% of the respondents incorporated some type of industry sponsorship. Fifty nine percent solicited the project topics from industry. Of those, 83% obtained at least some of the projects from local industry[8]. Opinions differ on whether industry sponsored projects are desirable[2]. UHCL senior projects use a combination of industry sponsored, faculty suggested, and student selected projects. A national survey conducted in 2001 shows that 68% of respondents used industry sponsors to help with student assessment[5]. Industry sponsor evaluations of the computing and computer engineering are an integral part of the UHCL ABET assessment process.

Brigham Young University used surveys to determine industry preferences for skills to be taught in their capstone course. The results from the survey were incorporated into the capstone class. Feedback from both industry and students was positive[9]. Texas A&M University-Corpus Christi has established an industry advisors council to assist in program assessment in addition to sponsoring projects[1].

Benefits to students

Students who have an opportunity to interact with experienced professionals will, inherently, become better employees. Because of the association with industry professionals, students will have several chances to ask questions, observe professional behavior and learn current practice and process. When those students enter the workforce they will already have a sense of what behaviors are expected. Several universities have recognized the value for a close relationship with industry partners[3, 7].

The association also results in a personal relationship in which the industry partners become familiar with prospective new hires. While this relationship may or may not result in students being hired, students who have more connections with persons in the workforce will have more hiring potential.

As students get to know industry partners as individuals, students will be in positions to receive de facto mentoring from professionals. Since the industry partners are frequent visitors to campus, students can learn social and professional skills that are not typically taught in university courses. For example, students observe speaking and greeting norms, dress norms, time-management, project documentation and project management skills. While some of these skills may be addressed in a course, nothing can replace the example of a true professional.

Benefits to the programs

Important processes for computing and engineering include design methodology and project management. Many textbooks cover such topics, but students require practice. Input from industry professionals lends validity to the importance of methods and processes. Thus, curriculum can be

strengthened by the current methodologies used by practicing professionals.

Assessment is a process that requires the attention of individuals from different positions with different perspectives. Assistance with the assessment of learning outcomes is a key contribution of industry partners. Instant feedback on behaviors, attitudes, and understanding can be provided by industry partners with regard to student capabilities. Students and programs benefit when viewed from outside an institution.

It is important to have the student projects critiqued by professionals who are not on the faculty. Not only does the outside influence demonstrate the program's desire to appropriately prepare students, it also demonstrates that critical examination is appropriate and necessary for computing and engineering projects. Industry partners who are familiar with the types of student projects undertaken may later be motivated to sponsor or serve as mentors for future projects.

Benefits to industry

Industry partners have the occasion to become aware of student capabilities, not just as individuals, but also as graduates of a program. Industry partners are privy to knowledge of the program's curriculum. Since many of them are aware of the accreditation requirements of such accrediting bodies as ABET, they will know the basic content and requirements of many of the undergraduate courses. They are also aware of what the program does and does not prepare the students to do. If invited, they may also be given opportunity to give input on ways to strengthen the curriculum.

Industry partners also have the occasion to establish a relationship with faculty in a setting in which they discuss specific outcomes rather than general goals. While many university-industry partnerships discuss planning, fewer have the chance to see student behaviors demonstrated. Such observations give the faculty and the industry partners a common perspective from which to measure outcomes.

From this shared perspective, industry partners may recognize the feeling of making a "real contribution" to students and programs rather than an often "hands-off" role of a planning or advisory board. Project mentoring and sponsoring has the added benefit of reducing training time for companies.

Using industry partners in Senior Projects courses

Industry partners interact with students in several possible formats: they may act as mentors, assessors, advisors, or project sponsors. Students may be introduced to an industry partner for the first time when the partner participates on an industry panel that is open to all students. In the past, topics have addressed ways that students can distinguish themselves during a job search, preparing job interviews, and student expectations for entering the workforce.

Since many of our graduates find work in the local area, it is important that the community, including local industry personnel, is aware of the capabilities of our students and their academic preparation. Not only can the industry partners know the students as individuals, they can also be familiar with their curriculum by having a thorough knowledge of their courses. Periodically, the industry partners are asked for input on the programs and processes. They are a key component of program assessment since they evaluate the behaviors and attitudes of the students, and the deliverables that they generate.

Partners are invited as guest speakers to the senior project course. In this role they are usually asked to speak on an area of their expertise: design, security, project management, project documentation, etc. Since this is a smaller venue, students in the senior project course are encouraged to ask questions and learn as much as possible from a local professional.

Some industry partners actually sponsor a senior project. Their company or their support group suggests a real-world project suitable for the duration of a semester, and they may lend equipment, expertise, or mentoring for the students.

Senior Project Presentation Day

Perhaps the largest contribution of the industry partners is made at the end of the semester at the Senior Project Presentation Day. The day consists of lunch, assessment of student presentations (interlacing the engineering and the computing projects), project evaluation and an exit interview with each graduating student.

During lunch, faculty members meet with industry partners. For new partners, the rubrics used for assessing student oral presentations are explained, and the exit interview process is explained. This also acts as a social time for the faculty and the industry advisors to stay acquainted and abreast of university and student issues.

Student presentations are given to an audience of students, faculty, and industry partners. Both faculty and industry partners are asked to assess the student presentations. Students will have had several opportunities to make presentations to their classmates before the final presentation. Rubrics used by the industry partners focus on the delivery of the presentations and demonstrations and include such items as: looking at the audience, speaking in a clear and interesting tone, not reading from prepared slides, etc. Such behaviors are assessed as part of the programs' learning outcomes, and are used to meet the university's student learning outcomes as well[4]. Industry partners lend a new set of eyes and ears to the assessment process.

The exit interview is administered in individual rooms, one-on-one with one industry partner per student. The interviewer asks questions about the student's future learning plans and the student's knowledge of ethical situations, and legal, global and social issues of computing and engineering.

The project itself, including project requirements, design, test plans, results and documentation, is evaluated by both the faculty and the industry partners. Project documentation is examined and deemed acceptable or unacceptable. The results of the project documentation examination and assessment are fed back into each of the programs' assessment processes. The partners are further asked for feedback on the quality and appropriateness of each of the projects.

Proposed schedule

A schedule to be maintained by the senior project courses currently contains the following milestones: contacting industry partners for speaking in class during the semester, formal invitation to the senior project presentation day, sending abstracts of student projects a week before the senior project presentation day, preparing and revising rubrics as necessary, collecting assessment materials, and closing the loop by assessing the collected materials.

Response of Industry Advisors

The engineering and computing programs at UHCL define program quality as the ability of an academic program to satisfy the stated or implied needs and expectations of its constituencies. As one of the constituencies, the industry partners offer a perspective on the quality of our programs, and hold us accountable for continually working to improve our programs and processes.

Recently our advisors replied to the question "Do you believe that your participation in the Senior Projects course benefits **the industry** in the area that hires our students?" One of the computing industry partners responded:

"… by being exposed to what UHCL's Computer department is doing, I become familiar with the types of capabilities that new graduates possess. By seeing the types of projects these students develop, I have higher confidence that UHCL students may be well suited for an easy transition into the professional working world. This can translate into more opportunities being offered to UHCL students."

Jeff Cline
Manager, Information Technology
Barrios Technology, Ltd.

One of the engineering industry partners responded:

"Real hardware, team experience, deadlines, budgets and similar project experiences give the Senior Project participants some experience that should be attractive to prospective employers.

As a prospective employer to the students, gaining an understanding of the current engineering environment is a true educational experience for me. It is a real help to see where the current crop of prospective new hires is based, what new tools they are using, what typical experiences they are bringing into the world of employment, and how fast they will be able to hit the ground when employed. Participation in the reviews of the Senior Projects assists me in staying current in the new employee end of technical environment and I learn a few things in the bargain."

Kenneth R. Goodwin, Jr.
Site Manager (retired), Field Site Office
C. S. Draper Laboratory
NASA Johnson Space Center

When asked "Do you believe that your participation in the Senior Project course benefits the computing and engineering students?", Bob Smock replied:

"Absolutely! The vast majority of students that I have encountered over the years of my participation seem genuinely interested in professional feedback on their projects and their performance. More than that, in the one-on-one sessions with each student, they always ask to discuss topics that range from 'was their project applicable to the real world', to 'how did I get my job', to 'what line of study or training should they follow to get a job like mine'. It's always fun."

Bob Smock
Senior Consultant, Security and Identity Management
Burton Group/Gartner

Conclusion

The collaboration between the university and industry is a partnership that benefits not just students, but the computing and engineering programs and local industry as well. Students who interact with industry professionals will be better prepared to enter the workforce, local industry will have a stronger pool of students to hire, and university programs will have well-scrutinized processes and projects.

References

1. Bachnak, R., An approach for successful capstone projects, *35th ASEE/IEEE Frontiers in Education Conference*, October 2005.
2. Dutson, A.J., Todd, R.H., Magleby, S.P., Sorensen, C.D., A review of literature on teaching engineering design through project-oriented capstone courses, *Journal of Engineering Education*, January 1997.
3. Excelsior College: Filling the nuclear industry's employment pipeline, *Nuclear News*, June 2009.
4. Hall, S.P., and Bryant, V., Assessment of professional skills for students in computing and engineering programs, *The Journal of Computing Sciences in Colleges*, April, 2008.
5. McKenzie, L.J., Trevisan, M.S., Davis, D.C., Beyerlein, S.W., Capstone design courses and assessment: A national study, *Proceedings of the 2004 American Society of Engineering Education Annual Conference & Exposition*, 2004.
6. Single, P.B., Muller, C.B., and Inoue, K., Industry professionals as mentors: A model to guide mentor training, *29th ASEE/IEEE Frontiers in Education Conference*, 1999.
7. Smith, R, Mackay, D., Challis, D., Holt, D., Seeking industry perspectives to enhance experiential education in university-industry partnerships: Going beyond mere assumptions, *Asia-Pacific Journal of Cooperative Education*, 2006, 7(2), 1-9.
8. Todd, R.H., Magleby, S.P., Sorenson, C.D., Swan, B.R., and Anthony, D.K., A survey of capstone engineering courses in North America, *Journal of Engineering Education*, April 1995.
9. Todd, R.H., Sorenson, C.D., and Magleby, S.P., Designing a senior capstone course to satisfy industrial customers, *Journal of Engineering Education*, April 1993, 82(2), 92--100.