ENHANCING STUDENT ENGAGEMENT IN INDUSTRIAL ENGINEERING PROGRAM

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ABSTRACT

The paper provides an introduction to the industrial engineering (IE) program at UWP and the Pioneer Academic Center for Community Engagement (PACCE). The paper summarizes how student engagement has become larger in scope and now comprises of enhancing learning through service learning activities. The initial motivation for increasing student engagement in the industrial engineering program was to satisfy the criteria for accrediting engineering programs by the Accreditation Board for Engineering and Technology. The more recent development is the establishment of PACCE at UW-Platteville. The paper presents a summary of PACCE service learning projects and student reflections.

INTRODUCTION TO IE PROGRAM AT UW-PLATTEVILLE

The College of Engineering, Mathematics, and Science consists of seven departments: Chemistry and Engineering Physics, Mathematics, Civil and Environmental Engineering, Electrical Engineering, Computer Science and Software Engineering, General Engineering, and Mechanical and Industrial Engineering. The College has over 1700 student majors enrolled in ten degree programs. Bachelor of Science degrees are offered in chemistry, mathematics, civil engineering, electrical engineering, environmental engineering, industrial engineering, mechanical engineering, software engineering, engineering physics, and computer science.

The College's objective is to ensure that its students gain the knowledge and develop the mental skills, attitudes, and personal characteristics necessary to become successful citizens and professionals who can meet the present needs of business, industry, government, society, and the more demanding requirements of the future. Therefore, curricular requirements provide a strong foundation in the student's major field of study, supplemented by a broad background in the social sciences and humanities. Many courses that can fulfill the requirements in humanities and social sciences are available through UW-Platteville's study abroad programs. In addition, technical courses counting towards a degree at Platteville can be taken at our international partner institutions in Australia, Ireland, Norway, Germany, Sweden, and Turkey.

The College offers informal cooperative education programs for qualified students. The co-op programs are designed to integrate classroom studies with practical professional experience in a planned arrangement of alternate work assignments and campus studies. Through this coordination of formal study and practical work, participating students enhance their ability to relate theory to practice.

A new distance education facility in the College allows UW-Platteville to exchange course instruction with cooperating universities through an interactive compressed video system. This facility allows professors at other universities to teach students at UW-Platteville, and professors at UW-Platteville to teach students at other universities. In addition, the facility is available for outreach and extension programs and for guest lectures and professional meetings. The compressed video system enables interaction between participants in this facility and participants in compatible facilities elsewhere.

Articulation agreements provide opportunities for students to complete their first two years of study at one university before transferring to a cooperating university to complete course work for their engineering degrees. UW-Platteville has completed engineering articulation agreements with several other institutions in the UW System, including UWC-Baraboo/Sauk County, UW-Fox Valley, UW-Richland, UW-Parkside, UW-Stout, and UW-Whitewater (1).

The industrial engineering program at the University of Wisconsin – Platteville has been in existence since 1970, it was accredited by EAC/ABET in 1988. The Bachelor of Science in Industrial Engineering (BSIE) degree requires at least one of the four defined emphasis areas to be completed: Production Systems, Management Systems, Human Systems, and Information Systems. A total of 129 to 130 semester credits must be completed for the BSIE degree. The program has four full time tenure-track faculty members. Description of courses and other details of the program are at http://www.uwplatt.edu/ie/.

STUDENT ENGAGEMENT

Educational research on student engagement became popular in 1990s (2, 3). Initially it dealt with factors that enhance students' psychological investment in learning and factors that lead to their disengagement from learning activities. The Secretary's Commission on Achieving Necessary Skills (SCANS) report for America 2000 found that effective job performance required five competencies (effective use of resources, interpersonal skills, ability to acquire and apply information, understand complex interrelationships in systems and ability to use current tools of technology) and a three-part foundation of skills (basic skills, thinking skills, personal qualities) (4). The SCANS report provided a manual for teaching these competencies and skills.

The National Survey of Student Engagement (NSSE) in the Center for Postsecondary Research (CPR) at the Indiana University School of Education considers student engagement as two critical features of collegiate quality (5): the amount of time and effort students put into their studies and other educationally purposeful activities, and how the institution deploys its resources and organizes the curriculum and other learning opportunities to get students to participate in activities that decades of research studies show are linked to students' emotional commitment to learning (6).

Student engagement gained momentum when studies by Stanford Research Institute and the Carnegie Mellon Foundation among Fortune 500 CEOs found that 75% of long term job success depended on people, emotional or soft skills and only 25% on technical, discipline-specific or hard skills (7, 8). The Harvard University studies reported that achievements on

career are determined 80% by soft skills and only 20% determined by hard skills. Technical skills are defined as "those skills acquired through training and education or learned on the job and are specific to each work setting," while soft skills are defined as "the cluster of personality traits, social graces, language skills, friendliness, and optimism that mark each one of us to varying degrees" (7,8). Student engagement activities consist of a wide variety of classroom and off campus work (5, 10) to develop both hard and soft skills required to have a successful career.

At UW-Platteville, the Pioneer Academic Center for Community Engagement (PACCE) was established in fall 2008 to nurture a campus environment to support student engagement through service learning, active learning and other community-based projects. It provides financial support to students under faculty direction to pay the costs of travel, supplies, services, and other associated community project expenses. PACCE is also a campfire where those involved with community-based engagement programs can meet to plan and coordinate awareness, advocacy, training, faculty development, assessment, and communications. Finally, it is a portal through which community and campus entities can meet, plan, and coordinate resources for the mutual benefit of each other. PACCE activities shown in Figure 1 allow students to engage with their course materials, take an active role in learning, reflect on their individual and collective experiences and develop while completing a team project for a community partner (9).

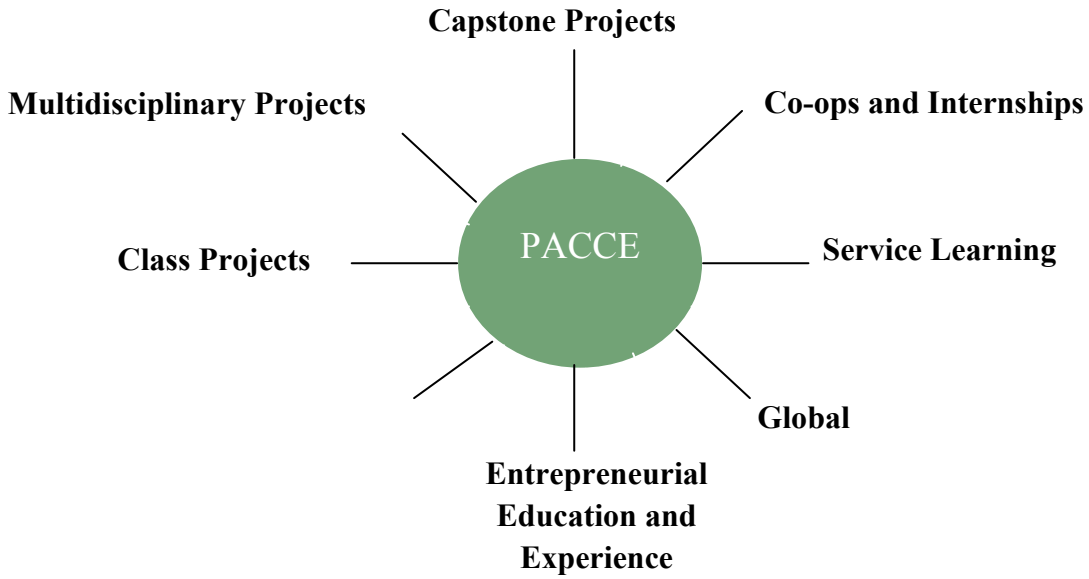

Figure 1: Student Engagement Activities

The PACCE Pioneer Engagement Scholars program provides up to $400 per student to offset the cost incurred by students in conducting a community-based scholarship of engagement project. Funds can either be disbursed to the faculty member for management on behalf of students in her or his class, or can be distributed to students directly for individual projects. Pioneer Engagement Scholars projects must be for credit, must include three committed partners (student, faculty/staff, community), and must include significant interaction between the students

and community partner. Other critical components include student reflection of their engagement experience, dissemination of project results, resume quality professional recognition, and added-value for the community partner. The PACCE Engagement Internship program provides funding for student salary for those situations where an employer does not have the capability to pay the cost of an intern salary. Students must be pre-approved and be enrolled in a UWP internship program. PACCE's mission is that through Scholarship of Engagement, PACCE nurtures a campus environment that empowers students, faculty, staff, and community partners to Experience → Grow → Make a Difference as shown in Figure 2.

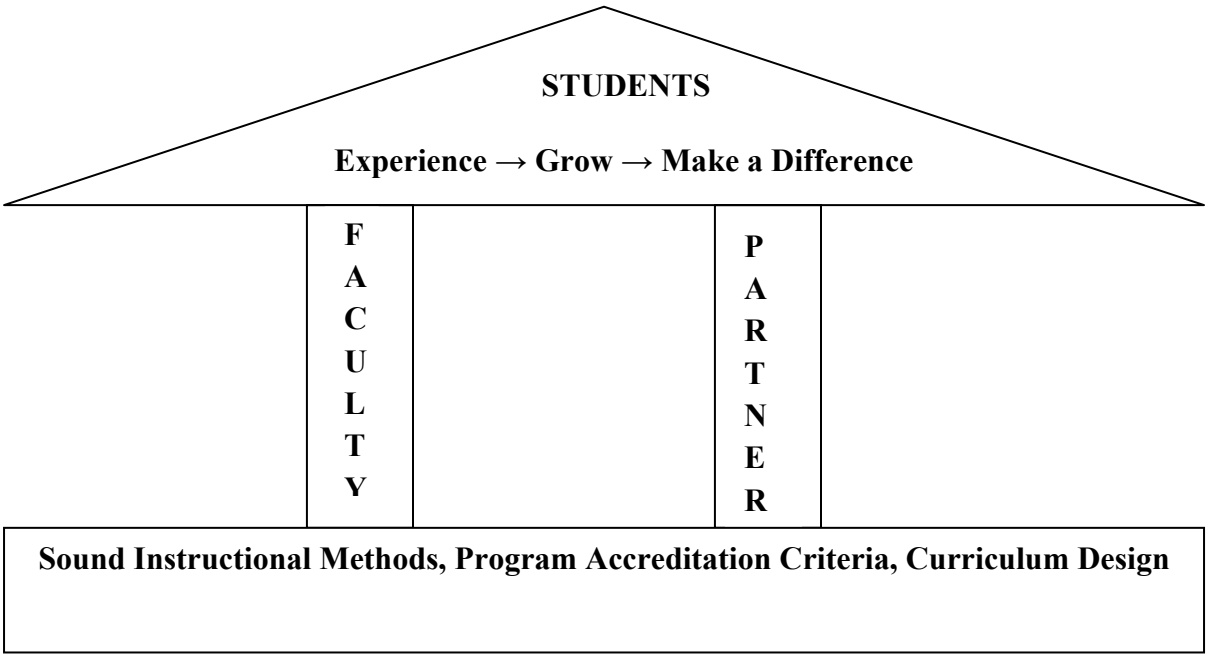

Figure 2: PACCE Mission

STUDENT ENGAGEMENT IN THE IE PROGRAM AT UW-PLATTEVILLE

In the mid 1980s, the primary rationale for using student engagement activities in the IE program was the accreditation of the program by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). The criteria for accrediting engineering programs at that time required specified number of semester credit hours of instruction in engineering design. Engineering design was defined as the use of open-ended problems and case studies that included multiple constraints. The IE program utilized industry sponsored open-ended design projects or case studies from professional organizations in several courses in the curriculum to provide hand-on practical design experience to graduates. The senior-level capstone design course provided integrative experience in an industry sponsored project that allowed students to apply what they had learned in the lower level courses.

From 1970s through the 1990s the industrial design project sponsor reimbursed students' travel expenses. PACCE now provides support for such service learning projects in IE curriculum. This has allowed for more nonprofit organizations to become project sponsors. In fall 2008 with the approval of the Board of Regents, the university implemented the differential tuition plan which generated additional funds by charging $100 per student per year. This plan is scheduled to be reviewed after four years and it now supports a first-year experience program, counseling services, career services staff and PACCE. From fall 2008 through spring 2010 faculty members in industrial engineering received PACCE funds for about twenty projects in upper level courses. These projects were sponsored by community partners which are businesses, industries, social service organizations, libraries, university alumni services, etc. The service learning projects consisted of capstone design projects, multidisciplinary projects and class projects in upper level courses. Lists of past projects and brief description of each may be found at http://www.uwplatt.edu/pacce/past_projects.html.

REFLECTION

Student reflection, by individuals and team, is an essential component of PACCE grants. The PACCE grant proposal requires a description of reflection methods, questions, and techniques. The primary goal of reflection is to prompt students to think critically about the integrative design and team experiences before, during, and after the project. Individual and team reflections assist students in linking the course or curriculum to the project activities and assess the learning process and the outcomes. Through reflection students recognize the soft skills and hard skills they have acquired and refined in the service learning activities of the project. As success in their future career is likely to depend 80% on the soft skills and 20% on the hard skills, the reflection on these skills is important. Service learning projects develop a broad range of competencies classified as soft skills: oral and written communication, self-understanding, self-confidence, leadership, self-directed team skills, ethical and social responsibility, time management, coping with difficult people, etc. A few student reflections are presented below as examples.

Brittany Beinborn, Industrial Engineer: "I have gained more experience with working on real-life projects which will help me in my career. I have also been given the opportunity to apply numerous concepts I have learned throughout my four years of college to a situation I may encounter in my future work experiences. Also working in a team with four individuals has taught me a lot about teamwork skills, prioritization, and organization. My experience with the PACCE project has been very valuable and will help me greatly in the future."

Luis Peralta-Cervantes, Mexico: "Work with Nu-Pak Incorporated through PACCE was an excellent learning-process for me. I am a foreign-exchange student and I came here to learn the way the Industrial Engineers communicate each other, the concepts they use and the actions they use in a company to make improvements. After the project, I learned a lot about IE concepts, teamwork, how a real company works, how to give presentations, and mostly, how the American culture works."

A typical PACCE funded project was the emergency planning developed by three University of Wisconsin-Platteville senior design students, Jenna Walsh, Justin Goodrich and Antonio Encinas, for the Wisconsin Badger Camp. This camp, in Prairie du Chien, serves people

with developmental disabilities by providing quality outdoor recreational experiences. It strives to provide a positive environment where individuals with developmental disabilities can learn their surroundings and realize their full potential. The PACCE funds are being used for the group's travel expenses and to purchase emergency equipment such as fire extinguishers, stretchers and resource material. The group created training modules for staff, updated materials already in place and created an updated checklist of what to do in case of an emergency. As part of the project, the group had to research federal and state safety regulations and understand project management. "Planning is an essential part of project management," said Goodrich. "We definitely used what we learned in class. The project made us more aware of regulation design and the consequences if regulation isn't followed."

SUMMARY AND CONCLUSIONS

This paper provided an introduction to the industrial engineering (IE) program at UWP and the Pioneer Academic Center for Community Engagement (PACCE). The paper summarized how student engagement has become larger in scope and now comprises of enhancing learning through service learning activities. The establishment of PACCE at UW-Platteville may motivate other universities to establish service learning programs. The paper presented a summary of PACCE service learning projects and student reflections in industrial engineering. These may be useful for faculty at other institutions.

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