THURSDAY SESSIONS

Session T1A: Workshop - Implementing the Design Your Process of Becoming a World Class Engineering Student Project

Chair: Raymond B. Landis, California State University

Time: Thursday August 8, 8:30 a.m. - 10:00 a.m. *Benedum Hall 309*

WORKSHOP A - IMPLEMENTING THE "DESIGN YOUR PROCESS OF BECOMING A WORLD CLASS ENGINEERING STUDENT" PROJECT

Steffen Peuker and Raymond B. Landis

Many students come into an engineering program lacking a strong commitment to stay in an engineering program and to graduate with an engineering degree. For students to accomplish the challenging goal of graduating in engineering requires a strong commitment, and behaviors and attitudes to follow through that commitment. To strengthen the commitment of the freshman engineering students an innovative project has been developed. The project challenges students to develop their process to become a "World-Class Engineering Student". Having freshman engineering students design their individually tailored learning process as part of a semester long project in the setting of a student success focused introduction to engineering course or any freshman engineering course will have a significant impact on their academic success by improving the students' confidence and motivation to succeed in engineering. This workshop will show participants how to implement the "Design your Process to become a World-Class Engineering Student" into their own introduction to engineering courses.

Session T1B: Workshop - Strategies to Enhance Engineering Education at Small Colleges

Chair: Benjamin R. Campbell, Robert Morris University

Time: Thursday August 8, 8:30 a.m. - 10:00 a.m. *Benedum Hall 318*

WORKSHOP B - STRATEGIES TO ENHANCE ENGINEERING EDUCATION AT SMALL COLLEGES

Benjamin Campbell and Sushil Acharya

Engineering programs at small teaching colleges have challenges not faced by large research institutions. The strategies used by a school that has several hundred in a freshman class and dozens of engineering faculty don't necessarily translate well to a smaller program due to economies of scale and scarcity of resources. Likewise, there may be education methods that work better in a small program because of the inherent intimacy of a small class size and more direct contact with faculty. At the 2012 FYEE conference many of the presentations were from schools that had such large programs that even if the topic was of interest to a smaller school, the approach would difficult to implement. This proposed workshop will provide a forum for small engineering program to share the challenges they face and methods for success they have developed. Topics could include: How to involve students in research at a teaching university that lacks research funding and labs; Using small class sizes to build an engineering community; How to efficiently teach heavy course loads without teaching assistants; How to successfully partner with larger schools in mutually beneficial ways; How to develop niche offerings to build your school's reputation for recruitment and job placement; Where to find shared teaching resources and grants for smaller schools; How to encourage adjuncts to take a more active role with students; Developing low-cost lab activities to teach engineering skills; How the First Year Engineering Experience differs on a commuter or branch campus

Session T1C: Workshop - Developing a Classification Scheme for Introduction to Engineering Courses

Chair: Kenneth Reid, Ohio Northern University

Time: Thursday August 8, 8:30 a.m. - 10:00 a.m. *Benedum Hall 319*

WORKSHOP C - DEVELOPING A CLASSIFICATION SCHEME FOR "INTRODUCTION TO ENGINEERING" COURSES

Kenneth Reid, Tamara Knott, Elizabeth Spingola and David Reeping

Many Universities and Community Colleges offer a course entitled "Introduction to Engineering" or similar. These are often designed from scratch and tend to be "personal courses" designed by instructors to cover what they feel is important. Therefore, while they may be prerequisites to second-year courses, first-year engineering

programs are not necessarily integrated into the curriculum. Further, since they are often designed with little consideration for existing models, overall outcomes and content vary widely. This leads to three issues: first, course developers often "reinvent the wheel" by failing to disseminate successful models. The problem is exacerbated by a lack of definition of first year models: a developer may know what they want in a course, but how do they find a course with similar outcomes with nothing more than "first-year engineering" as a description? Second, with little focus on specification of models for these courses, many become a grab bag of unrelated topics. Finally, there are issues preventing community colleges from offering "Introduction to Engineering" • courses, leading to disadvantages for students who could transfer into 4-year programs. Without standard outcomes for a first-year course, students may receive credit for material that is much different than material they covered, and community colleges may not be able to design an introductory engineering course that is applicable to multiple institutions. This session will invite those interested in reviewing and testing a classification scheme for "Introduction to Engineering" courses. The goal of the session will be to announce the proposed classification scheme, to summarize efforts toward the overall goal of developing a classification scheme and to create a community of practice to facilitate this development. Further, the participants will be encouraged and a community formed to identify gaps in the research, especially in needed assessment procedures and instruments.

Session T1D: Workshop - Planting the SEED for Success: Easing Transitions through Living & Learning Communities

Chair: Tamara Fuller, The University of Maryland - College Park

Time: Thursday August 8, 8:30 a.m. - 10:00 a.m. *Benedum Hall 320*

WORKSHOP D - PLANTING THE SEED FOR SUCCESS: EASING TRANSITIONS THROUGH LIVING & LEARNING COMMUNITIES

Tamara Fuller

The object of this presentation is to inform the audience of practices used by the Successful Engineering Education and Development Support (SEEDS) Program at the Clark School of Engineering. Funded through the National Science Foundation, the SEEDS program offers several opportunities to impact success and create community for engineering students. Of these programs Flexus: The Dr. Marilyn Berman Pollans Women in Engineering Living & Learning Community and Virtus: A Living and Learning Community for Success in Engineering have proved particularly helpful in easing the transition for students into their first year of engineering course work. Flexus and Virtus provide 117 first and second year students access to engineering, gender based, living and learning environments. There are many components of Flexus and Virtus including: Summer Orientation; New Resident Orientation; Common Resident Hall; Mid-semester Advising; 1-credit Seminar & Course Clusters

Session T2A: Focus Workshop - First-Year Engineering Programs

Chair: Kerry Meyers, Youngstown State University

Time: Thursday August 8, 10:30 a.m. - Noon *The University Club Ballroom B*

FOCUS WORKSHOP - FIRST-YEAR ENGINEERING PROGRAMS

Kerry Meyers, Matthew Ohland and Kenneth Reid

This workshop will present the elements of multiple successful but different First-Year Engineering programs including: program structures / program types content areas (computer programming, design, discipline specific projects, technical communication) administration and logistics (teaching, grading, etc.) advising Workshop participants will be asked to share the aspects of First-Year Engineering programs that have been particularly successful (or unsuccessful) at their institutions. Finally, participants will have the opportunity to draft and present a First-Year Engineering Program Structure that would be possible at their institution.

Session T2B: Keynote Lunch

Chair: Teri Reed-Rhoads, Texas A&M University

Time: Thursday August 8, Noon - 1:30 p.m. *The University Club Ballroom B*

LUNCHEON KEYNOTE - CHANGING MANY CONVERSATIONS

Teri Reed-Rhoads

The 2008 report from the National Academy of Engineering, "Changing the Conversation: Messages for

Improving Public Understanding of Engineering", encouraged our discipline to take a critical look at how we talk about or message our profession through the conversations we have with others, including prospective students, their parents, and the general public. While the impetus of the original report focused on recruiting, we can take it even further to other important areas within the engineering education pathways, including admissions, retention, and growth. This address will begin with a discussion of this changing conversation and quickly challenge the participant to change many conversations.

Session T3A: Roundtable Discussions

Chair: See Program Book, See Program Book

Time: Thursday August 8, 1:30 p.m. – 3:00 p.m. *See Program Book*

Session T4A: First Year Engineering: Understanding our Students

Chair: Stephen H. Carr, Assoc. Dean for Undergraduate Engineering, Northwestern University

Time: Thursday August 8, 3:15 p.m. - 5:00 p.m. *Benedum Hall 309*

UNIVERSITY OF MASSACHUSETTS LOWELL "LABORATORY IN A BOX" FOR FIRST YEAR ECE STUDENTS

Jay A. Weitzen, Erin Webster and Alan Rux

This paper describes the first year Introduction to ECE program at University of Massachusetts Lowell. The goals of the program for 2nd semester ECE students are to excite the students about ECE through hands on activities, to equalize out the gaps between students who have hands on experience and those who do not, and to stress problem solving, programming and analytical skills required for success in the ECE curriculum. The hands-on gap exists especially between male and female students and between students from affluent versus non affluent high schools. The first year experience is based on our version of the "Lab in a box" which is a complete electronics workbench that can be taken home and used anywhere there is a computer. Students work on their own rather than with lab partners insuring that everyone gets the hands on experience. This paper describes both the "Lab in the Box", as well as a sample first year curriculum based on using the equipment and includes open ended design projects. Use of "Lab in a Box" is currently being extended to 2nd and 3rd year students.

ENGINEERING AND SOCIETY: A COURSE FOR FIRST-YEAR ENGINEERING STUDENTS AND NON-MAJORS

Jan DeWaters, Elisabeth Chapman, Elisabeth Wultsch, Karen Buckle and John Moosbrugger

Engineering and Society is a course designed for first-year engineering students and non-majors. The goals for the design and implementation of this course, as well as course learning outcomes and content are discussed. Preliminary assessment of changes in student perceptions and attitudes after taking the course is reported. Preliminary outcomes assessment for the course is also reported. In general, the course is achieving the goals and outcomes it was intended for.

EXTENDED ABSTRACT: FACTORS AFFECTING STUDENT ABILITY TO INTERNALIZE THE ENGINEERING DESIGN PROCESS

Susan K. Donohue

The primary goal of the research presented in this extended abstract is to identify factors affecting the degree to which first year engineering students internalize and "own" the engineering design process. The ability of two different student populations to do so is studied: traditional first year students in a four-year program and (mostly) non-traditional students in a two-year program. Insight comes also from second – fourth year students reflecting on their first year experiences and continued (non)use of the engineering design process. The data from which preliminary results are developed and conclusions drawn come from qualitative analysis of student responses to exam questions and scenarios.

COMBINING ASSESSMENT WITH THE EXPERIENTIAL ENGINEERING EDUCATION

Robert (Bob) Pieri, Josh Mattes, Ann Valle, Tim Legg and Marie Baker

The PEEC: PTiPS program is an NSF funded collaboration of four North Dakota tribal colleges and North Dakota State University (NDSU) that seeks to provide a pipeline for tribal students into engineering fields. In order to provide a valuable educational opportunity for the students, and also an opportunity for program assessment, instructors in the collaborative created an engineering role-playing scenario for students in the PEEC program. This engineering scenario is in the spirit of similar (non-engineering) assessments that routinely take place at Alverno College. The first engineering scenario, conducted in conjunction with other activities at an

annual 12 day residential student program at NDSU in the summer 2012, had the students playing the roles of junior engineers in a firm that was contracted by the Fort Peck Reservation in Montana to consult on plans for flood management and prevention. After an initial questionnaire/pre-assessment, the students individually conducted background research and submitted initial draft executive summaries. After this submission the students collaborated in teams to discuss ideas and approaches resulting in the submission of a final executive summary report. In spite of the intensity of the general workload of the program, most of the students ranked this scenario as their favorite part of the residential program; many students found it valuable and highly rewarding to see how their engineering, science and mathematical knowledge could be applied to help solve real-world problems. Furthermore, the abundance of written documents and assessments from the students, in conjunction with videotaped recordings of selected group discussions, provided a very rich source of information for assessment of many of the learning outcomes typical of an ABET accredited engineering program. While much work remains to be done, particularly with regards to sharpening the assessment measures, we feel that such student scenarios could be valuable to engineering programs outside of the PEEC: PTiPS is collaborative.

DESIGN OF A 1ST YEAR ENGINEERING TRANSFER PROGRAM: CREATING A SUSTAINABLE LEARNING ENVIRONMENT FOR STUDENT SUCCESS

Shelley Lorimer, Jeffrey A. Davis and Ken R. Fyfe

MacEwan University is a publicly funded institution situated in Edmonton, Alberta and provides a first-year engineering transfer program to over 200 students each year. Due to education funding cutbacks, we are now faced with continually growing class sizes, increased teaching workloads, and rising transfer GPAs. At the same time, the demand for engineers continues to increase in our province. This situation has brought about the need to adapt our engineering program in an attempt to maintain our teaching/learning standards while cutting costs. The focus of our efforts has been on student integration, course inter-connectivity, and sustainable assessment methods. To this end, our institution has integrated a week long engineering preparation workshop, re-evaluated the first year curricula and re-designed a course to promote deeper learning, and are currently developing pedagogical software to provide students with individualized feedback at a crucial stage of the learning process.

Session T4B: University STEM and Pre-College Programs

Chair: John Uhran, University of Notre Dame

Time: Thursday August 8, 3:15 p.m. - 5:00 p.m. *Benedum Hall 318*

AN ENGINEERING EDUCATION INITIATIVE: DEVELOPMENT OF A STEM MATHEMATICS TEXTBOOK

David Reeping and Kenneth Reid

The debate of math pedagogy has been raging in the K-12 environment amidst chatter of revisions to science standards, namely the Next Generation Science Standards. Now instructors are caught in an awkward position to integrate the foreign subject of engineering, the "e" in STEM education, with little to no context. While teachers can enhance their knowledge of new teaching strategies through attending workshops and having university students conduct STEM academies at their school, current textbooks fail to include authentic engineering examples and thus offer little to no support to teachers. With this in mind, a math textbook which integrates engineering at a practical and understandable level would be imperative to satisfy the new standards. In addition, to effectively communicate engineering and mathematics to students, the author of the text would be an undergraduate student majoring in Engineering Education, mentored by a professor with the terminal degree in the field. The student formed a board of teachers willing to participate in the development of this text. Through preliminary research on student learning styles, educator input, and consultation from the student's mentor and university mathematics and statistics department, a textbook or supplement founded in Engineering Education pedagogy would be a welcomed boost in the K-12 movement of integrating engineering.

EXTENDED ABSTRACT - RESEARCH EXPERIENCE FOR TEACHERS (RET) PROGRAM ENHANCES STUDENT LEARNING IN COMMUNITY COLLEGE ENGINEERING COURSES

Marjorie A. Rawhouser, Elizabeth A. Wyler and Isabel K. Lloyd

Research Experience for Teachers is a National Science Foundation-sponsored program that provides opportunities for K-12 teachers and community college faculty members to actively participate in engineering and computer science research, with the goal of helping teachers translate their experiences into classroom activities that encourage and enhance learning for students in science, technology, engineering, and math fields. The authors participated in the 2012 Research Experience for Teachers program "Connecting with Community

Colleges" at University of Maryland's A. James Clark School of Engineering. The program included a six-week materials engineering research project, development of curriculum elements based on the research project, implementation of the curriculum elements in spring 2013, and surveys of students to assess the effect on learning. The research experience, which involved testing of dental composites, was used to build classroom activities for two courses: Introduction to Engineering Design and Mechanics of Materials. In both classes, students were presented with overall information about the project and the authors' experiences. In Introduction to Engineering Design, the dental composites example was then used to illustrate the engineering design process, with students participating in group and individual activities that applied the design process steps to the example. In Mechanics of Materials, the research example was used to supplement an existing lecture and homework assignment relating to material properties. Preliminary results suggest positive impact on learning. When surveyed, students said that use of a current, real-world example was interesting and motivating; it made them want to engage in the learning process; and it gave them an appreciation for specific activities involved in engineering research, beyond what they learned from textbook examples. Future work includes expanding the dental composites example to other course topics, improving the learning assessment tools, and expanding use of the activities to other courses and sections.

EXTENDED ABSTRACT - PRECOLLEGE ENGINEERING PARTICIPATION AMONG FIRST-YEAR ENGINEERING STUDENTS

Noah Salzman and Matthew Ohland

In this extended abstract, we present the preliminary results of a study examining the effects of precollege engineering programs and activities on first-year engineering students. Students in a first-year engineering program at a large public university were asked to fill out a survey detailing their experiences with engineering prior to college. The students indicated the settings where they encountered engineering prior to college, named and described the various activities that they participated in and the approximate amount of time they spent doing each activity. Participants also provided demographic information. Preliminary results show that at least thirteen percent of students enrolling in first-year engineering classes at the university have had significant exposure to engineering prior to college. High school classes are the most common way that students are exposed to engineering content, followed by extra-curricular activities, middle school classes, and summer camps. While the majority of respondents reported participating in one or two different activities, some reported participating in as many as nine different precollege engineering programs or activities. Students interested in each of the major engineering disciplines responded to the survey; however interest in several disciplines were reported at very different rates than their proportional representation at the university. This survey represents the first part of a multi-year, NSF-funded study of the effects of precollege engineering programs on first-year engineering students. The results of the survey were used to select a sample of students to interview about their experiences, and analysis of these interviews will be used to construct an instrument to measure the effects of precollege engineering activities in a larger sample population of first-year engineering students.

EXTENDED ABSTRACT - ENHANCING STUDENT LEARNING AND SUCCESS: FIRST-YEAR ENGINEERING PROGRAM

Liang Wu, Christopher O'Neal, J. Michael McCarthy and Gregory Washington

This study reports on a piloted two-quarter first-year engineering course, Introduction to Engineering, which provides an early introduction to the engineering disciplines and design process. The course teaches basic skills such as CAD and microprocessor programing and the opportunity to design, fabricate and test a device constructed by teams of students. More pragmatically, the course provides students with the information regarding different engineering disciplines so that they can make a more informed decision as to whether engineering is the right major. Furthermore, students learn how to work on teams and lead design teams so as to help the students develop leadership skills and become engineers who will shape the engineering profession and society in general. The impact of the course is assessed through student surveys.

AN INVESTIGATION OF THE CURRENT LANDSCAPE OF K-12 ENGINEERING EDUCATION AND THE POTENTIAL IMPACT OF NGSS ON FIRST YEAR ENGINEERING CURRICULA

Debbie K Jackson and Nigamanth Sridhar

For the first time engineering is included in a national science standards document. The Next Generation Science Standards (NGSS) incorporate engineering design as a stand-alone concept with a set of specific engineering design standards and integrate it throughout the typical science content areas (life science, physical science, and earth and space science). Over the next few years, the influence of these standards will impact students entering engineering programs because they will experience engineering design throughout their K-12 education. In this

paper, we describe a research study in progress that seeks to better understand how students are prepared in high school to succeed in the first year of an engineering curriculum. Our study is focused on answering the following research questions: (1) How are students currently prepared in high school to be ready for an engineering program? (2) How is success in a first year engineering curriculum defined? What are the measures of success currently being utilized? What are the strengths and what are the challenges? (3) What impact will NGSS have on the first-year engineering curriculum? In particular, will there need to be a shift in the kinds of material included in the first year curriculum given the emphasis on engineering design at the high school level?

Session T4C: Advising Issues for the First Year

Chair: Kathleen Ossman, University of Cincinnati

Time: Thursday August 8, 3:15 p.m. - 5:00 p.m. *Benedum Hall 319*

INVOLVING PARENTS IN THE FIRST YEAR EXPERIENCE

Dan Budny, Cheryl A. Paul and Beth B. Newborg

The transition from high school to college can be very difficult for many students. The authors believe that parents can advocate on behalf of their children by educating themselves on particular transitional challenges their children potentially face, as well as by helping these freshmen daughters and sons establish realistic educational and social goals. Parents can assist their children by helping them to anticipate the significant transitions that occur during the freshman year. This paper will acquaint the reader with three key transitional challenges new college students face, and offer an approach to productive interactions between the Swanson Schoolâ€™s orientation facilitators/freshmen faculty and the parents to ease these challenges. The paper will demonstrate the importance of making parents part of the first year orientation and educational process. Steadily improving persistence rates at the University of Pittsburghâ€™s Swanson School of Engineering indicate that educating new students and parents in realistically anticipating first year challenges allows first year to successfully work through key freshman year challenges.

EXTENDED ABSTRACT - INTEGRATING ACADEMIC ADVISING INTO THE ENGINEERING CURRICULUM

Sara Atwood and Kevin Shorner-Johnson

There is substantial room for improvement of academic advising in tightly scripted programs with high attrition rates and low numbers of underrepresented students, such as engineering. Successful advising in engineering is informed by understanding the progression of advising theory, and the dichotomous comparison between prescriptive and developmental advising that is often separated into a role for faculty and a role for student services. From this context, a cohort model for advising at teaching-focused engineering programs is proposed. The 'advising as educating' model integrates advising modules and coursework, prescriptive and developmental approaches, faculty and staff, as well as ABET outcomes and advising assessment. Ultimately, this approach seeks to streamline the advising load on faculty, connect high impact practices with early career and underrepresented students, and enhance classroom content.

TRANSITION TO A NEW FRESHMAN ENGINEERING POLICY

Carolyn Skurla and Ida Jamshidi

Enrollment in freshman engineering courses at our university increased by 110% from the 2001-2002 to the 2010-2011 academic years and by an additional 24% from the 2010-2011 to the 2012-2013 academic years (i.e., 162% increase from 2001-2002 to 2012-2013). Historically, no additional entrance requirements, beyond acceptance to the university, existed for declaring an engineering major and enrolling in freshman- and sophomore-level engineering courses. We needed to move identification of at-risk students from the end of the 4th semester to the end of the 2nd semester. A new engineering admission policy was crafted, based on analysis of ten years of student data. The new policy requires students to declare Pre-engineering as their major in their first two semesters. Requirements for engineering program admission are: 1) math plus verbal SAT ≥ 1110 or composite ACT ≥ 24; 2) B or higher in each freshman engineering course; 3) C or higher in first 2 math courses. The roll-out of the complete policy was accomplished in stages due to time required for administrative approval and inclusion in the undergraduate catalog. The first transitional phase was enforced in the 2011-2012 and 2012-2013 academic years. The prerequisite for the second-semester freshman engineering course was changed to a grade of B or higher in the first-semester freshman engineering course. The prerequisite for first-semester sophomore engineering courses was changed to a grade of B or higher in the second-semester freshman engineering course. Students who earned less than a B in either course could submit a waiver request

to the freshman advisor. Assessment of SAT/ACT scores, math grades, and other personal factors were used to support the decision to approve or deny the waiver. In this report, we present data from these two transitional years, which provide strong support for the validity of our new engineering admission policy.

EXTENDED ABSTRACT: THE GUPTA FIRST-YEAR EXPERIENCE IN THE COLLEGE OF ENGINEERING AT CARNEGIE MELLON UNIVERSITY

Treci Bonime, Nisha Shukla, Kurt Larsen, Janel Sutkus and Annette Jacobson

The Deepak and Sunita Gupta First Year Experience (FYE) at Carnegie Mellon University provides programming for first-year students as they transition from high school into the College of Engineering. The program has been in place for 4 years and offers a combination of academic and professional development and social opportunities for students. Students enter the College without a declared major and must choose their engineering major after the completion of their first year, which provides them with an introduction to engineering fields and concepts as well as the fundamental background in mathematics, science and other skills important to all engineering disciplines. The success of the program has been evaluated through a number of means, including a survey that measured students' reactions to and preferences for various aspects of the program. This survey was administered to the first-year students, on-line, in late February. Access began during the student's Major Declaration Night celebration with a raffle entry awarded to those who completed the survey at the event. The survey remained available for one week after the event. One finding of the survey suggests that 57% of students find social events to be an important part of their first-year experience, 75% find academic events to be important, and 71% find career development events to be important. Although no differences were found by gender, race, or citizenship in the level of importance of social events, women and minority students placed more importance on career development events than men and majority students. Women also placed more importance on academic events than men.

EXTENDED ABSTRACT - SERVICE TO FRESHMEN BY THE OFFICE OF PERSONAL DEVELOPMENT

Joseph Holtgreive and Heather Bacon

The McCormick School of Engineering and Applied Science is the only engineering school in the country with a formally established office of personal development. We are proud of our student-centered focus and the opportunities for personal growth available at McCormick. Our engineering under-graduates matriculate with a bias toward left- brain ways of thinking. They are comfortable solving technical problems with discrete answers leveraging their analytical, quantitative, and critical thinking skills. In addition, due to the virtual nature of much of their social interaction they have become disembodied with very limited awareness of their mind body connection. Our challenge is to support the development of our students into whole-brain engineers capable of bringing an integrating whole-self to the challenges they face. In McCormick one way we are addressing this need is through the McCormick Office of Personal Development. Its mission is to support the exploration of self and co-curricular opportunities, engagement with these opportunities, and reflection on these experiences leading to transformative growth. At McCormick, personal development means an opportunity to: Explore - personal strengths, values, and goals; and explore opportunities to build essential skills. Engage - with academic, professional, and extracurricular experiences in an intentional way. Transform - into an adult with a clearly defined sense of purpose and the skill set to succeed. Our goal is to foster the development of five core competencies through this effort: Awareness, Optimization, Fidelity, Resilience, and Self-Reliance.

Session T4D: Research on First-Year Engineering Courses 1

Chair: Jody Hamabata, Cal Poly Pomona

Time: Thursday August 8, 3:15 p.m. - 5:00 p.m. *Benedum Hall 320*

GRADING POLICIES AND EVALUATIONS IN A FRESHMAN EXPERIENCE CLASS

Simeon Ntafos and Maria Hasenhuttl

The Erik Jonsson School of Engineering and Computer Science at the University of Texas at Dallas introduced a freshman experience class as a degree requirement for all its majors in Fall 2011. The class had enrollments of 667 in Fall 2011, 584 in Fall 2012 with about 600 projected for Fall 2013. Grading policy (both directly and indirectly) has been debated at length and has been a central issue in the makeup and delivery of the class, both of which are continuously evolving. In this paper we discuss several aspects of grading policy and its effect on the delivery of the class, teaching evaluations, and retention. We contrast the grading policy in ECS 1200 with that in UNIV 1010, a university wide freshman experience class that was also introduced as a graduation

requirement in Fall 2011. We also discuss the interplay between grading policy and teaching evaluations and a value-added approach to evaluating teaching effectiveness.

THE ROLE OF THE FIRST YEAR ENGINEERING EXPERIENCE IN CURRICULUM REDESIGN

Peter Blakey

The First Year Engineering Experience seeks to reduce student attrition rates by providing students with orientation, study skills, motivation and other experiences that will enable them to survive in, and ultimately graduate from, engineering programs. The central argument of this paper is that the comprehensive redesign of undergraduate curricula can yield much greater benefits. The paper presents discussions of why comprehensive redesign is needed, how the processes of redesign can be approached, and the potential impact that curriculum redesign may have on the First Year Engineering Experience. Two predictions of the work are that there will be significant diversity among redesigned curricula that emerge at different institutions, and that the First Year Engineering Experience will play a pivotal role in the implementation of redesigned curricula.

DESIGN PROJECT IDEAS FOR A FIRST-YEAR ENGINEERING COURSE

Matthew C. Carroll

The integration of university-based research into undergraduate engineering programs has for several years been a major focus in engineering education throughout the world. For engineering students, training in research and development has until now been primarily concentrated in the final year of studies. Senior design projects, often called "capstone projects," have become almost universal in engineering programs. These nearly always include application of technical material from one or more engineering courses, but often include research, creative design and development, and the written and visual presentation of results to a professional audience as well. Many engineering students have trouble with these design projects. The trouble is not with the application of learned engineering principles to routine design tasks, but rather with the more "creative" and "open-ended" aspects of these challenges, and with the supplemental skills required to make the overall project a success. Examples of these skills would include evaluation of alternative solutions, integration into a project team, procurement of materials, design of experiments, and oral and written presentation of results. In this paper the author presents a number of ideas for design projects that can be included in a first-year engineering course. These ideas were developed from conducting several design projects for first-year engineering students at Texas A & M University at Galveston. The defining feature of these projects is that they incorporate research and development activities. The author believes that it is both possible and necessary to introduce engineering students to research and development issues very early in their engineering studies, and that projects can be attempted for which the level of technical expertise required do not exceed that of the average incoming university student, but that nevertheless can expose this student to all of the essential elements involved in engineering research and development.

A WINDMILL COMPETITION IN A FRESHMAN ENGINEERING DESIGN CLASS

Charles A. Gaston

Many freshmen these days have never had to solve an open-ended problem or design an experiment or build something or work in a team to solve a problem or describe a process in enough detail for someone else to replicate it. Many also have very limited understanding of how to apply physics and algebra. No short series of exercises can close all such gaps, but the sequence presented here at least addresses them all. There are two distinct phases in this exercise: (1) investigation of some of the properties of a windmill, and (2) design and construction of a windmill intended to generate as much power as possible. Both phases are very open-ended; instructions are minimal, so students are expected to think about what they need to do. The basic equipment required is a Windmill Test Apparatus capable of measuring torque and speed, a Test Windmill with adjustable flat blades, and a fan to supply the repeatable wind. The project is introduced with a review of physical measures, units and relationships, and is ended with a competition. Teams vie for best scores in such criteria as highest power, highest power-to-weight ratio, lowest testing time and closeness to predicted power. Scoring of the competition, with its multiple categories, weights and penalties, is complex enough that a spreadsheet is used to process the raw data. The instructor's spreadsheet is used for actual scoring, but as a separate, related learning experience, each student is asked to create a functionally equivalent spreadsheet. This integrated project includes at least a review of physics, experiment design, data collection, analysis, plotting, report writing, following a design process, teamwork, and physical construction. It has been used in a freshman engineering design class for at least fifteen years, with continual improvement.

EXTENDED ABSTRACT RETENTION OF MARGINAL STUDENTS: EFFECTIVE FIRST YEAR INTERVENTIONS

Peter Shull, Paula Ford and Kristen Carrier

Time to graduation and persistence in major have always been an issue for many engineering and engineering technology students. It is not uncommon for students to take an extra semester or more beyond the standard 4 years to complete their degree. Further, many students change their major or leave college altogether because of challenges with specific classes. Students whose academic preparation is marginal make up the largest segment of this group. In this work, we addressed the question "Are there factors that if addressed in the first year could significantly influence student success in engineering particularly among marginally prepared students?" To gain an initial understanding of the most common barriers, we looked for systemic factors within our engineering technology programs that significantly affect students' persistence in the major. From a review of transcripts for a 7 year period for all engineering technology students at our school, the results showed, not surprisingly, mathematics and English to be the biggest academic factors in student retention and persistence in major. Our efforts, funded by NSF, focused on the non-academic areas of personal responsibility, interdependence, mentoring, and the effect of having a strong cohort. The premise here was that academic support in math and English is already widely available, e.g., peers, faculty, and learning resources centers. Further, our interest was to develop methods that did not incur significant additional resources on either faculty or the institution. As one indicator of success, we present the quantitative measure of a comparison of the students' predicted GPA and their actual cumulative GPA. Analysis showed statistically significant improvement in student gains. We briefly present the educational methodologies developed and early results achieved from this effort.

FRIDAY SESSIONS

Session F1A: First-Year Engineering Teaching and Administration Approaches

Chair: Helen Oloroso - Assistant Dean, Northwestern University

Time: Friday August 9, 8:30 a.m. - 10:15 a.m. *Benedum Hall 309*

FLIPPING THE CLASSROOM ON AN ESTABLISHED INTRODUCTION TO ENGINEERING DESIGN COURSE

Kevin M. Calabro

The University of Maryland administers a project-based "Introduction to Engineering Design" course taken by approximately 1000 first-year students each year. Teams of students are tasked to design, build and test an autonomous hovercraft that meets a demanding set of product specifications. The project requires students to learn and apply engineering principles in order to make informed design decisions. The "traditional" instructional model has a single content expert lecture to all students through a series of 50-minute anchor lectures taught on the first six Fridays of the semester. Each anchor lecture is taught multiple times with four sections (or up to 190 students) attending the lecture together. The anchor lectures are fortified with discussions led by an instructor to his/her section of 40-50 students. Anecdotal feedback indicates these lectures are far too fast paced and content packed, assume students have too much prior knowledge, and lack sufficient engagement between the lecturer and the large number of students present. A pilot section "flipped" the classroom by replacing the content taught during the traditional lecture sequence with a series of recorded, web-based lecture segments covering the same information. Students were surveyed in both the "traditional" and the "flipped" course offering to rate the effectiveness of these lectures. Students rated the blended learning approach more effective than the traditional approach in every category assessed, stating what they liked best to be "When something was unclear, you could rewind, and hear the explanation. You could also pause to take notes, as well as refer back to the actual lecture for homework problems." These initial results indicate that pedagogical changes incorporating blended learning approaches can enhance the student experience within an engineering design course.

A COMPLETE REDESIGN OF FUNDAMENTALS OF ENGINEERING COURSE USING BACKWARD DESIGN METHODOLOGY

Ryan A Munden and Shanon M Reckinger

Engaging students in course content through active learning methods is known to be a more effective methodology for achieving course objectives. Fairfield University's introductory "Fundamentals of Engineering" course required for all engineering majors was recreated and revitalized using the backward design framework. First, the course objectives were identified. Next, the desired outcomes were determined and linked to assessment outcomes for accreditation. Assessment linked directly to outcomes was accomplished through frequent student-instructor interaction and project-based evaluation. Finally, the curriculum was delivered using hands-on, interactive methods carefully chosen to most effectively enhance student learning. The active learning experiences used in the course were shown to be effective in achieving the course goals. The primary significance of the course redesign is demonstrated in students achieving the course objectives, such as developing a passion for the engineering discipline. Additionally, the practical significance lies in assessments that directly link to course outcomes, which in turn are directly linked to accreditation outcomes. Each activity in the course is focused on achieving a particular outcome, and so each activity has a clear purpose. Furthermore, the course was team taught by two professors, one from Mechanical Engineering and one from Electrical Engineering. The content of the course is enhanced by linking directly to the content of other courses in other departments that the students are concurrently enrolled in. Results of the Fundamentals of Engineering redesign are measured by: feedback from students (anecdotal and survey comments), quantitative student evaluation results, and data collected from class that links to the course's successes.

EXTENDED ABSTRACT - CONNECTING THE START TO ... FINISH

Greg Spaulding

The vision of this project is to connect the first year experience course, ME 101- Introduction to ME, to the capstone course, ME 574/575 - Industrial Design Project I/II. The idea is that this connection would allow the student to envision themselves completing the program, by making the end tangible and achievable rather than something off in the future. This connection would also allow the students to ask themselves "is this what I want to be doing in four years". The connection between to the courses is made in two ways. The first is to engage the

first year students in a team project that is an "immature" version, of the "mature" version they will complete, in ME 574/575 Senior Design. Just like in the capstone course, the first year students are taught teaming skills, brainstorming, project planning, leadership, decision making, oral presentations and written reports of their design project. These topics, with their application to the design project, allow the first year students to connect ideas and principals with their engineering education to become the successful engineer they sat out to be. The second method of connecting the first year students to the senior course is the use of the senior students as mentors for the teams. Each team is assigned a senior to guide, advise, encourage, and "big brother" the team members. The mentors also act to review and a provide feedback on a series of oral and written design reviews. The outcome of this project, from both the first year students and the senior mentors, has been very positive.

ACTIVE LEARNING AND INCREASED FACULTY INVOLVEMENT TO IMPROVE DESIGN INSTRUCTION AND RETENTION IN A FIRST-YEAR INTRODUCTORY ENGINEERING DESIGN COURSE

Kolby Sorenson and Debra J. Mascaro

We are implementing a strategy to improve students' ability to understand and apply fundamental design methodology techniques introduced in our introductory Mechanical Engineering course, taken during the first fall semester of the ME program. In this course, students learn design methodology, mechanical hardware, physics and modeling concepts in lecture, and then apply those concepts to a team-based design project that culminates with an end-of-semester design competition. Based on our assessment of students both in this course and in the follow-on spring semester course, we are concerned that students struggle with basic design methodology concepts despite our efforts to utilize active learning and project-based learning strategies in both courses. In Fall 2012, we attempted to address this issue by (1) increasing the time spent on project-related active learning activities during lecture and (2) implementing an "Adopt-a-Lab" program in which additional ME faculty join individual lab sections to provide design feedback at critical points during the semester. We expected that this twofold strategy would help to improve both student comprehension of design concepts and the quality of design project assignments (DPAs) submitted by student teams [1]. We also anticipated that the increased faculty involvement would improve retention from the first semester to the second semester of the ME program [1]-[3]. With the help of nine volunteer faculty members, we piloted our strategy during the Fall 2012 semester. This paper presents our motivation, strategy, implementation, assessment, and future plans.

Session F1B: First-Year Engineering Design Courses

Chair: John Uhran, University of Notre Dame

Time: Friday August 9, 8:30 a.m. - 10:15 a.m. *Benedum Hall 318*

FACILITATING TEAMWORK INSTRUCTION IN A FIRST-YEAR ENGINEERING DESIGN PROGRAM: A QUESTION OF BALANCE

David Gatchell, Penny Hirsch, Adam Goodman, John Anderson, Stephen Carr and Bruce Ankenman

For over 15 years our first-year engineering design program has focused on a user-centered approach to design thinking and communication, where students work with real-world clients on ill-defined problems and communicate their ideas in a variety of ways to multiple audiences. To facilitate higher teamwork performance, we historically used two instruments to facilitate teamwork learning: (1) an intra-quarter peer review and self-review, and (2) an end-of-the-quarter reflective memo. In the fall of 2011, our program partnered with the university's Center for Leadership, to integrate opportunities for more teamwork reflection, peer- and self-assessment and teamwork improvement throughout the two quarter experience using an online interface. Peer-assessment and self-reflection pieces at the end of the quarter allow students to determine if they had been successful in achieving their mid-term goals. At the end of the year, however, when we surveyed ~425 students in the program, we were disappointed to learn that, while some of the students found the activities highly beneficial, an overwhelming number saw them simply as "busy work." In addition, a majority of the program's faculty were also frustrated by the new tools. Analysis of the survey responses and the teamwork activities suggested that the problem was one of balance: since teamwork is a goal of the program, but not its primary goal, we believe we built in too many exercises related to teamwork, ironically undermining their usefulness. In addition, by outsourcing the responsibility for administering the activities, faculty were less aware of when assignments were due, the roles of individual assignments, and how to readily assess and apply the students' responses. This study reports the problems we encountered in our attempt to improve teamwork instruction, presents our new hypothesis about how to teach teamwork in a first-year design course, describes the modifications we have made this past year and presents the areas of teamwork pedagogy that we are increasingly

interested in systematically exploring.

THE FIRST YEAR ENGINEERING SEMINAR AT UNLV

Georg Mauer

The College of Engineering at the University of Nevada, Las Vegas (UNLV) introduced its First Year Seminar (FYS) course in 2012 in the course of a campus-wide curriculum reorganization. The engineering FYS is open to all students. Student Learning Objectives – The seminars are designed to encourage the development of capabilities such as Intellectual Breadth, Critical Thinking, communication skills, and ethics. Weekly writing assignments, reports, and presentations are required and used for the assessment of learning outcomes. In addition, the engineering seminar introduces students to the profession, our programs and curricula. Engineering as a Creative Profession – All FYS students participate in a hands-on design lab, where they work in small teams to design, build, and test their own design that must meet a set of performance specifications. Examples of semester projects are: Design and programming of an autonomous mobile robot (Mechanical Engineering), Design of a small mobile robot and motor controller using Arduino components (Electrical Engineering). Students spend on average three hours weekly in lab sections of 25 or fewer students. Assessment and Outcomes – Our first year seminars were well received by students, with freshman enrollment in engineering increasing by approximately 20% in 2012 from the previous year. End of semester course evaluations were generally favorable. Students generally appreciated the opportunity to build functioning designs, and the competition with other design teams. Even though engineering is one of the smaller colleges at UNLV, enrollment in our FYS courses was the highest among all colleges.

EXTENDED ABSTRACT - FYE FOR ENGINEERS LAB COURSE THE MINI ROSE FLOAT PROJECT

Jody Hamabata

This paper discusses how Cal Poly Pomona integrates the Cal State's "learn by doing" philosophy into the curriculum by combining both a lecture and lab to prepare students for careers in engineering through hands on activities. Each Winter Quarter, a lab for the first year experience course EGR 100 is given the task of designing and building a miniature Rose Float. Under given specifications the class brainstorms along the actual Rose Parade theme. During this 4 week project, engineering students learn the respective values of fellowship and leadership. Each section is required to follow specifications for the design of their floats and the animations. Some of the specifications included size, speed, number of animations, and decorations. There is a detailed specification sheet and a rubric used by the judges to score the mini rose floats in the competition. Each class uses 3D modeling tools to develop the design. The "Learn by Doing" project experience takes a project from concept to completion, very similar to what he or she would do in the field as an engineer. At the end of the 4 week project a competition is held and the floats are judged during a parade of the completed Mini Rose floats.

EXTENDED ABSTRACT: IDENTIFYING FACTORS CONNECTED WITH DEVELOPMENT OF AND PERSISTENCE IN ENGINEERING DESIGN PROCESS MISCONCEPTIONS

Susan K. Donohue

The primary goal of the research presented in this extended abstract is to identify factors allowing misconceptions regarding the engineering design process to develop and persist. Knowledge of these factors can inform K-16 engineering pedagogy and K-12 outreach activities. Understanding engineering as a design-based profession in which curiosity, communication, and team management skills can be as important as math and science is important in recruiting and retaining students.

ENGAGING STUDENTS' CREATIVITY AND INTEREST EARLY THROUGH A FRESHMAN CIVIL ENGINEERING DESIGN COURSE

Rupa Purasinghe, John Shamma and Howard Lum

This paper describes how a real world design project was brought to a freshman level course to engage students in a practical civil engineering design project using simplified design approaches. By introducing the intriguing project to freshman, students are driven early in their academic career to pursue an engineering profession. The Freshman Design course is a critical part of the Civil Engineering program at California State University at Los Angeles (CSULA) and provides valuable hands-on learning and research experience to students. In 2012-2013, the students were required to perform a preliminary design of a new water conveyance system and support facilities, including a dam, pump station, and pipeline that supplies water to a local Southern California community. With guidance from the faculty, students were able to engage in gathering project data, develop design alternatives, apply technical and non- technical design constraints, analyze alternatives through pros and cons comparisons, and recommend a preferred solution. A challenging parameter of the design project consisted

of a pipeline that crossed an earthquake fault, which required students to address fault-crossing design of pipelines. They also participated in a seismic research program where the performance of a ductile iron pipe was tested to simulate earthquake displacements and loads that lead to pipeline failure in shear and bending. The project deliverables include layout drawings of the dam, pump station, and pipeline, the application of the design constraints of the project, and analysis of alternative pipeline alignments. With this course, the students learn early-on applications of ABET design constraints pertaining to economic, social, political, environmental, sustainability and ethical elements. The students made PowerPoint presentations of their reports to industry professionals who evaluated their work. The assessment shows that students developed creative thinking skills, practical design skills and interest in civil engineering early on in their studies at CSULA. This course has been the foundation of a strong civil engineering design program that has received two national awards for our senior design projects on connecting professional practice with education.

Session F1C: Teaching the First Engineering Courses

Chair: Dan Budny, University of Pittsburgh

Time: Friday August 9, 8:30 a.m. - 10:15 a.m. *Benedum Hall 319*

DESIGN/BUILD PROJECTS IN AN INTRODUCTORY ENGINEERING COURSE

David E. Cipoletti, K. Joseph Hass and James G. Orbison

A comprehensive design/build project has been incorporated into the introductory engineering course at Bucknell University. Working in teams of four, students address real design objectives, work with real customers, accommodate real constraints, construct a working prototype of a device, and demonstrate it at a public exposition attended by teachers, scout leaders, and 10-year-old children. The project requires students to address essentially all elements of the engineering design process, construct from raw materials a working device, and interact effectively with end users at the exposition.

EXTENDED ABSTRACT - CORRELATING ACT TEST SCORES TO PERFORMANCE IN FIRST YEAR ENGINEERING AND MATH COURSES

Joni Torsella, Jeffrey Kastner, Gregory Bucks, Kathleen Ossman, Rodney Roseman and James Boerio

The College of Engineering and Applied Science at the University of Cincinnati recently enhanced the engineering curriculum by requiring all first-year engineering students to take three new classes. The first class, Engineering Foundations, introduces students to the various fields of engineering through hands-on laboratory exercises. The other two classes, Engineering Models I & II, provides students with an introduction to MATLAB® and using computational methods for solving calculus based engineering problems. This work describes an effort to correlate ACT scores to a student's performance in first-year STEM classes. The advantage of the ACT scores is that these scores reflect a student's competence in English, Math, and Reading. A typical statistical analysis was done between datasets where correlation values and trend lines were studied. The data was split into statistical clusters to further quantify the relationship between the two variables being correlated. The initial analysis began by forming clusters based on student performance in the Engineering Models and Calculus I classes. The clusters were formed specifically using the final grade in the Engineering Models I class and the first exam grade and final grade in Calculus I. After each cluster was formed, the average and standard deviation of the ACT scores were found for each cluster. The general data trend was that students who tended to struggle in both classes had the lowest ACT scores. It was also found that the ACT English score had the greatest variation between clusters while ACT Math had the least variation.

HOVERCRAFT - A PROJECT BASED APPROACH TO INTRODUCTION TO ENGINEERING

Shriram Pillapakkam, John Helferty and Shih-Jiun Chen

A new model has been designed and implemented for the Introduction to Engineering course ENRG-1101 at Temple University. In the past, the course was run as a large lecture style with all students attending a large lecture and various topics that were covered such as time management, career options, on campus tutoring and resource centers to name a few. Based upon student feedback and low retention rates it was obvious a new model was needed. The focus was to be much more hands-on and use a project orientated approach. In addition, multiple instructors were employed from several departments and it was decided that each instructor would teach topics very specific to the instructors' field of expertise. The large lecture mode was removed in favor of splitting the freshman class into groups and rotating them among instructors. The entire course is centered around the design and construction of a remote controlled hovercraft, entirely designed and prototyped by freshmen.

A STUDY OF TEAM UNDERACHIEVERS IN AN INTRODUCTION TO ENGINEERING COURSE

Bonnie Boardman and Lynn Peterson

The University of Texas at Arlington (UTA), a large urban public university, offers an interdisciplinary Introduction to Engineering course, enrolling from 500 – 700 students in this course each fall and spring semester. Students, normally in their first semester of an engineering program, are assigned by the instructors to interdisciplinary teams of six students each. At the end of the semester, each student is required to submit a peer evaluation of each of his or her teammates as well as evaluate their own participation and contribution to the team's activities. The instructors read each of the team members' evaluations and note when a student consistently earns low marks from his or her peers. For the purposes of this extended abstract, those students rated low enough in peer evaluations for the instructors to reduce their project score are defined as "team underachievers." The authors hypothesize that there is a correlation between team performance in this first semester interdisciplinary group work effort and ultimate success in the College of Engineering. For this analysis we identify team underachievers from the Fall 2008 semester and track their academic career at UTA. We compare the number of team underachievers in each of the categories to a randomly-selected group of students from the same peer group who were not deemed team underachievers to look for significant differences in their educational path. Given that the College of Engineering seeks to increase its first-year retention rate, i.e., increase the number of first-year students who continue at UTA into the second year, we examine the utility of this non-grade-based metric gathered in a student's first semester of engineering study to predict a successful educational path. If the metric strongly correlates to lack of retention, earlier and more aggressive intervention by team mentors might be warranted.

EXTENDED ABSTRACT-BLENDING COLLATERAL AND CONCURRENT LEARNING: AN EFFECTIVE METHODOLOGY TO TEACH PROFESSIONAL SKILLS

Peter Shull

Can professional skills which are fundamentally socially-emotionally based be taught effectively in a typical engineering course? For the past several decades, significant efforts have been made to integrate professional or soft skills into the engineering curriculum. The issues from an education standpoint are both how to teach these skills and where to put them in the curriculum. Engineering faculty often argue that they are not trained in most of the elements of professional or soft skills and thus are not qualified to teach them. More commonly, faculty claim that there is no room in the already overcrowded curriculum to add the material. Further, faculty believe that because the material is completely unrelated to the technical material being taught, it should be placed in some other, more appropriate course. In this work, we have developed new methodologies to teach effective soft skills to a class without sacrificing the technical material. We then discuss how these skills can be directly related to learning the technical material. The methodology developed blends the theories of concurrent or dual learning and collateral. Dual learning teaches the traditional topical material in a manner or environment that a secondary concept is taught or reinforced. While this is the topic of recent work out of MIT and other institutes, all of them use a narrowly defined form where the specific goals of the concurrent topics taught are clearly defined to the students in advance of the presentations. While this works well for technical/topical engineering material, it does not work for teaching many soft skills that are social-emotionally based. In fact, in these cases, prior knowledge of the goals (or even awareness of the topic) can often inhibit learning. As such, in this work, the goals and even the specific of the non-technical topic which are taught alongside the topical material are left unstated (students are unaware of their learning) until after the exercises are completed. We refer to this unstated secondary component/goal as intended collateral learning. Making use of intended collateral learning (whose objects are not initially known to the students) and concurrent learning, we superimpose the teaching of professional skills (intended collateral learning) onto a typical engineering topic. This format of blending concurrent and intended collateral learning creates an effective and robust method to teach professional skills and has the added benefit of doing so without the sacrifice of engineering material. We will show the details of this new method and the results for students in a First Year Engineering Design Seminar.

Session F1D: Student Experiences: Living Learning Communities, Student Engagement, Identity, & Leadership

Chair: Ashish D. Borgaonkar, New Jersey Institute of Technology

Time: Friday August 9, 8:30 a.m. - 10:15 a.m. *Benedum Hall 320*

TOWARDS IDEAL ENGINEERS: IDENTIFYING AND DEVELOPING ENGINEERS AS LEADERS

Betsy F. Willis, Mark E. Fontenot and David A. Willis

Industry and government entities have sounded the alarm indicating that the United States needs more engineering and computer science graduates. Graduates need to be prepared not only in their technical discipline, but also in the "softer" skills. The first two years of undergraduate engineering study have continually been a stumbling block for programs and students across the nation, thus causing a relatively significant attrition rate as compared to other academic majors. At Southern Methodist University, we developed the IDEAL (Identifying and Developing Engineers as Leaders) Scholars program aimed at improving retention of financially needy students through the first two years of study. Throughout the past four years, we have incorporated a number of activities and program components to increase engagement of three cohorts of IDEAL Scholars with engineering faculty and with their peers, to prepare students to take leadership roles in projects and student groups, and finally to retain them through the first two of their undergraduate years. Data collected at various points throughout the program indicate positive effects for many of the programmatic aspects. The goal of this paper is to share some of the lessons learned in the development of the IDEAL Scholars program.

EXTENDED ABSTRACT - INFLUENCE OF INTEGRATED ACADEMIC AND CO-CURRICULAR ACTIVITIES ON STUDENT SUCCESS

Timothy Hinds, S. Patrick Walton, Daina Briedis and Mark Urban-Lurain

The Michigan State University College of Engineering CoRe (Cornerstone and Residential) Experience integrates the first-year engineering academic program and an engineering living-learning community to support the academic, personal, and professional growth of early engineering students during this important transition year. Our long-term goal is to provide the foundation for these students to be more successful engineers. To assess the influence of the support structure CoRe has implemented, we surveyed all current engineering students from those just completing their first-year to those graduating. Among other questions, the survey asked about their use of the support functions provided during their first year and their current attitudes towards engineering and our program. Our goal in collecting the survey data was to evaluate our approach to helping students choose and become qualified to pursue a degree in the College of Engineering. Early results suggest some areas of success and provide guidance for future improvements.

THE FUTURE POSSIBLE SELVES OF GRADUATE TEACHING ASSISTANTS IN FIRST-YEAR ENGINEERING PROGRAMS

Rachel Louis Kajfez and Holly Marie Matusovich

In first-year engineering programs (FYEPs) the use of graduate or undergraduate level teaching assistants (TAs) is very common, but based on the literature little is known about the teaching experiences of TAs or their future aspirations with regard to their identity. Since TAs have direct contact with first-year students and may have a great impact on students' education, it is important to understand the TA perspective in terms of why they are teaching and what they would like to do after graduation. This paper explores the future plans of graduate teaching assistants (GTAs) who teach in FYEPs through the analysis of a set of survey questions using Possible Selves Theory (PST). With this information, we can better prepare GTAs for their future careers and can better understand their experiences teaching and their identity which will ultimately lead to systematic enhancements to teaching appointments and therefore improvements in first-year student education.

EXTENDED ABSTRACT - ONLINE COMMUNITY AND CONTEXT TOWARD SCHOLARLY AND PRE-PROFESSIONAL IDENTITY FOR UNDERCLASSMEN

Kurt A. Thoroughman, Kathryn E. Ruzicka and Patricia L. Widder

Our nation needs engineers that will drive innovation and leadership. Colleges and universities have outstanding undergraduate programs to train these rising engineers. Students receive critical elements of this training, however, only late in their undergraduate education. All engineering programs necessarily begin with foundational study, in mathematics, basic sciences, and underlying engineering principles. Explicit integration over this material, engagement with real-world products and research, and presentation of ideas usually happens only in upper-level courses. This structure of curricula is sensible given the goal of proper foundation preceding

higher difficulty challenges. The big ideas and real-world challenges, however, are the elements that attract many students to engineering in the first place. Departments of engineering should meet this interest directly, as early in undergraduate education as possible. As programs meet this goal, students become engaged in larger ideas more quickly and become facile in connecting between materials, thinking broadly. With early engagement in big ideas, our students will be more adept at tackling our nation's problems and leading scientific progress in the 21st century. Engineering Virtual Studio (EVS) directly addresses this need by providing students with content, challenges, and community to build the full spectrum of engineering skills from the very beginning of undergraduate education.

A UNIQUE CO-CURRICULAR PARTNERSHIP: THE DOUGLASS ENGINEERING LIVING-LEARNING COMMUNITY INSPIRES WOMEN TO SUCCEED

Laura Stiltz, Helen Buettner, Emma Kennedy, Elaine Zundl and Candiece White

The Douglass Engineering Living-Learning Community at Rutgers University is a new and unique opportunity for first-year women majoring in engineering. This partnership between Douglass Residential College and the Rutgers School of Engineering, which finishes its inaugural year this May, provides first-year women in engineering the opportunity to live on a floor together in a residence hall dedicated to only students studying engineering. Through this program students live, learn, and connect to an active academic and social network designed to ease the transition to Rutgers and facilitate success in engineering through mentoring and hands-on learning. Components of this program include peer support in-residence through the Douglass PAL (Peer Academic Leader) program, professional development workshops, interaction with and advising from a graduate mentor, and academic support through study groups and tutoring. In addition, all students participating in this community enroll in two required courses: a women's leadership course offered by Douglass Residential College in their fall semester and an exclusive section of the Engineering Exploration course offered by the School of Engineering for the women in this community during the spring semester. Through both of these courses, students interact with engineering faculty and professionals to empower them to become fully integrated into the greater engineering community.

Session F2A: Keynote: The Power of Empowering Students

Chair: Lorelle A Meadows, University of Michigan

Time: Friday August 9, 10:45 a.m. - 11:45 a.m. *The University Club Ballroom B*

KEYNOTE - THE POWER OF EMPOWERING STUDENTS

Lorelle A. Meadows

Empowerment by definition is the act of giving to someone the authority or power to do something. In reality, it is much more than a simple act. It is a process through which individuals who are empowered come to challenge the way things are and the way they can be. In undertaking the course of opening our classrooms and curricula to this process, we engage in these challenges along with our students, and push the boundaries of the learning process. We shift from a model in which power is used to influence outcomes and conceived as a conservative quantity, to a condition where power is created to allow the process of discovery, understanding and ownership. In this talk I will share some of my own experiences with this process over the past few years that I believe have enhanced both my perception of engineering education and my studentsï¿½ experiences in the classroom. And, I empower you to challenge the ways things are and the way they can be.

Session F3A: Diversity Issues in the First Year

Chair: Kris Craven, Tennessee Tech University

Time: Friday August 9, 1:30 p.m. - 3:00 p.m. *Benedum Hall 309*

PEEC PTIPS: STARTING NATIVE AMERICAN STUDENTS TOWARDS BECOMING ENGINEERS WHO ARE NATIVES

Robert (Bob) Pieri, Josh Mattes, Ann Valle, Tim Legg, Marie R Baker and G. (Pad) Padmanabhan

This paper describes the aspects of a program to increase the participation of Native Americans in the engineering profession without forcing these participants to lose their cultural values and identity. The NSF sponsored program is in its third year of five and involves tribal high schools, tribal community colleges and a mainstream 4-yr engineering program to identify, recruit, educate (largest possible meaning) and nurture native students interested in an engineering career. The program uses a 2+2+2+∞ approach to illustrate to the individuals the path from high school to tribal college to mainstream university to profession, helping the

students to develop coping strategies for what could be considered as three first year experiences. The program, connecting four tribal colleges to the state's largest engineering college, takes advantage of an in-place state-wide video network, a history of inter-school cooperation and web-based tools to deliver courses during the academic year to classrooms with very small numbers of students, sometimes just one, in rather remote locations during some of the worst weather conditions that North Dakota has to offer. These are augmented with several face-to-face (F2F) meetings during the semester and a 12 day summer experience that is designed to be intensive at several levels but supportive. During these summer experiences, support is also provided to the engineering instructors to provide professional development opportunities. The value of student –instructor – professor relationships will be discussed in conjunction with individual success stories towards addressing motivational opportunities. The boarder impact of these activities will be illuminated in the context of engaging rural community locations with local stakeholders and resources in partnership with the more mainstream community to leverage efforts towards student success. This program is about to have a relatively large cohort of students transferring to the mainstream institution and steps taken to prepare for that transfer with be presented..

EXPERIENCE WITH A MODIFIED EMERGING SCHOLARS PROGRAM IN HIGH-LOSS MATHEMATICS AND CHEMISTRY COURSES

Lynn Peterson

The University of Texas at Arlington (UTA) was awarded an NSF STEP grant in 2009 for a project called AURAS, the Arlington Undergraduate Research-based Achievement for STEM. The overall goal of the NSF STEP program is to increase the number of graduates in science, technology, engineering and math (STEM) majors. Clearly, success in entry-level courses was a necessary first step in moving on to graduation for students majoring in Chemistry / Biochemistry, Physics, Mathematics and Engineering. A number of freshman-level courses in math and chemistry were targeted for intervention because of their high drop and failure rates that were predictive of student exit from the STEM major: Pre-calculus, Calculus I, Calculus II, General Chemistry I, and Chemistry for Engineers. The Emerging Scholars Program (ESP) model was used to develop courses that were then offered to incoming freshmen beginning in Fall 2010. This extended abstract presents an overview of the AURAS program to date and ongoing efforts to make the program sustainable by the university at the termination of NSF funding.

EXTENDED ABSTRACT-STOPPING LEAKS, INCREASING DIVERSITY IN STEM: THE CASE OF A STEM ENRICHMENT PROGRAM

Tonisha B. Lane

Due to changing national demographics, demands of technological innovation, and a globally competitive market, the United States is in need of diversifying its Science, Technology, Engineering, and Mathematics educational and vocational pipeline. STEM comprehensive programs have shown great promise in sustaining science interest and preparing academically at-risk students for postsecondary education. Research also indicates that STEM program participants are more academically and socially integrated than non-participants. The purpose of this study is to investigate how a STEM enrichment program aids in the retention of academically underprepared, underrepresented minorities at a predominantly White, large public research university. Using an explanatory, single case study approach, this study will examine the strategies and practices employed to retain its student population. The theoretical framework that will situate this study is Raymond Padilla's Expertise Model of Student Success. This framework contends that identification of barriers, knowledge, and actions are central to understanding the student experience and student retention. This study will examine how the STEM enrichment program applies the aforementioned concepts, using the following methods: focus groups and semi-structured interviews with program staff , current students and alumni; observation of program activities (e.g., classroom interactions, seminars); and analysis of program documents. Furthermore, this extended abstract sheds light on how a recent iteration of the Comprehensive STEM Program (pseudonym) summer bridge program component was improved to help students overcome barriers with math placement. It concludes with the significance of the study and next steps of the research.

ENGINEERS OF THE FUTURE (EOF): PREPARING DIVERSE STUDENTS FOR A DIVERSE WORKFORCE

Evelyn H. Laffey and Michael Brown

The purpose of the Educational Opportunity Fund (EOF) program at Rutgers School of Engineering is to support academically talented and economically disadvantaged students, including women and underrepresented groups. Since the early 1970's, engineering industry has strongly advocated for a large diverse workforce. In response, the educational research community examined the factors impacting recruitment, retention, and graduation rates

for engineering students. Utilizing a theoretical framework grounded in the research findings, the EOF program has been designed to provide financial and academic support, as well as professional development and informal learning opportunities. The purpose of this paper is to describe the various components of the successful Rutgers engineering EOF program. The average retention and graduation rates for EOF students match those of non-EOF students. The success of the EOF program is contributed to the customized programming for students that assist them in adjusting to academic and social rigors of the university life.

Session F3B: Workshop - Enhancing First Year Engineering Education through Student-Own Design Kits

Chair: John Schneider, Digilent, Inc.

Time: Friday August 9, 1:30 p.m. - 3:00 p.m. *Benedum Hall 318*

WORKSHOP - ENHANCING FIRST YEAR ENGINEERING EDUCATION THROUGH STUDENT-OWN DESIGN KITS

Alex Wong and John Schneider

Engaging engineering students with hands-on design is a proven way to motivate them and enhance their learning. To help ensure success in their studies, every student should complete significant hands-on design as part of every assignment. Current technology has freed students from having to conduct hands-on work in traditional engineering labs. Instead, for no more than the cost of a typical textbook, students can now own their own design hardware with which they can model, build, and verify both analog and digital circuits. Additionally, using low-cost microcontrollers, students can learn programming skills by writing programs that control interactions with the physical world rather than just changing pixels on a screen. We will discuss the opportunities and challenges presented by this hands-on approach to engineering education and showcase how Digilent is enhancing student learning in the classrooms, laboratories, and dorm rooms around the world.

Session F3C: Retention Programs

Chair: Susan K. Donohue, University of Virginia

Time: Friday August 9, 1:30 p.m. - 3:00 p.m. *Benedum Hall 319*

ENHANCING INCOMING MALE STUDENT RETENTION: AN ANALYSIS OF THE EXPERIENCES OF PERSISTENCE IN ENGINEERING

Adam P Ecklund

More and more engineering programs have become concerned with retention and persistence in their degrees, because about half of their students either change majors or do not graduate at all. Through qualitative analysis, the purpose of this study was to discover how male undergraduate engineering students persisted in their program. The five research questions explored were: (1) What factors of the academic experience are helpful to male student persistence in engineering? (2) How does academic performance impact the student experience and their ability to persist in engineering? (3) What factors related to participation in social activities is helpful to male student persistence in engineering? (4) What features of faculty interactions are supportive to male student persistence in engineering? And, (5) what features of peer interactions are supportive to male student persistence in engineering? The interpretative phenomenological analysis consisted of 12 total interviews, seven senior and five junior students within the mechanical and electrical and computer engineering departments at a mid-sized private institution located in the southwest. This study suggested practices to benefit the persistence of incoming and first-year male engineering students. The findings were preparation prior to college, developing a strong support network, and being grounded in academic skills and characteristics. Aspects of intrinsic and extrinsic motivation also assisted these students to persist. While the 12 students were upperclassmen, their views offered valuable insights to why peers left engineering and described certain persistence factors in engineering programs that are relevant to enhancing the incoming and first-year student experience.

RETENTION IN A FIRST YEAR PROGRAM: UNDERSTANDING WHY UNDERGRADUATE STUDENTS LOSE INTEREST IN ENGINEERING

Lizzie Y. Santiago

Despite all institutional resources allocated to improve student retention, attrition continues to be a significant problem in engineering education. Retention in engineering programs varies in the range of 40-60%. Institutions are recognizing the fact that students capable of completing an engineering degree are switching from engineering to pursue non-engineering disciplines. The purpose of this study was to understand how the first

semester experience influences students' decision to continue a degree in engineering. The goal was to identify the challenges faced by first time engineering students and to identify events and experiences that trigger a change of interest in pursuing engineering. The authors studied first semester engineering students enrolled at a large land grant university in the mid-Atlantic region. Several surveys administered at strategic time points during the semester were used to track level of interest in pursuing engineering and to identify key events that can be consider as precursors to leaving engineering. An analysis of entrance surveys indicated a high level of interest in pursuing an engineering degree in most students surveyed. Key events, such as the first calculus test, triggered indecision in some of the students. Key events identified as precursor to leaving engineering are discussed, as well as the implications for potential intervention programs to address student interest as well as academic success in engineering.

WHO GRADUATES FROM STEM, WHO DOES NOT, AND WHY DOES IT MATTER?

Gelan Badr and Kerry L. Meyers

Tracking retention rate is an important factor given the complexity of establishing the factors leading to an increase or decrease in graduation rates, especially in engineering programs that on a national level cannot meet the demand. It enables the institution to assess the periodic progression of students in its programs. As such, it can be used as an indication of: suitability of teaching methodologies, student expiates, curricular support structures, or the environment in a program or academic unit. Although by itself retention cannot answer definitively answer causality questions, educators can begin to determine where issues may be present to gather further data that can help understand the experiences of students should use it. Prior engineering educational research indicates that engineering programs experience immense challenge in ensuring effective retention rates in the first and second years of study. On a practical level there are too few engineers to meet growing demand so programs continue to evaluate them themselves to improve retention rates. This study considers the graduation and retention rates from the engineering programs at Youngstown State University (Chemical, Civil, Electrical, Industrial, and Mechanical) for the past 6 years (2006-2012). From the perspective of who goes into engineering and who is retained. The approach is to track students starting in the First- Year Engineering Program and determine where each of the students are today (enrolled or graduated from YSU outside of engineering, enrolled or graduated from YSU within engineering, transfer students into engineering, transfer students out of engineering). The direct assessment will come in the form of tracking retention (frequency counts, proportions, and simple statistical tests – gender, race / ethnicity, high school preparation). Once we determine student pathways (graduation, succession, and exit rates) we can establish a continuous procedure to track retention on an on-going basis and propose recommendations for improvements in the engineering program (based on the type(s) of students who do not persist in engineering)

IT'S MORE THAN ACADEMIC: THE FIRST-YEAR ENGINEERING LABORATORY AT THE FAMU-FSU COLLEGE OF ENGINEERING

Reginald Perry and Melodee Moore

This paper describes the content and findings from the first-year engineering course, EGN-1004L First-Year Engineering Laboratory, taught at the joint Florida A&M University – Florida State University College of Engineering. This course is one of five which comprise the college's pre-engineering program. Students must successfully complete specific pre-engineering program requirements in order to continue in the engineering program. The first-year engineering laboratory is designed to introduce students to the study and practice of engineering and the unique aspects and challenges of studying at the joint college. The course must meet the needs of students possessing a variety of academic and maturity levels, in order to prepare them for the rigors of the engineering major. It is designed to smooth the transition between high school and university study. Students are introduced to representatives from academic and several student support areas. Other course topics include time management, test taking, study skills, ethics, problem solving, learning styles, and team work. The course culminates with a design project in which student teams consisting of four to nine students complete a three-week class project. This paper will give a brief overview of the pre-engineering program, provide detailed course content of EGN-1004L First-Year Engineering Laboratory, and present fundamental findings from almost 2000 first-time-in-college students who matriculated through the pre-engineering program between 2004 and 2008.

Session F3D: Student Professional Development

Chair: Sara Atwood, Elizabethtown College

Time: Friday August 9, 1:30 p.m. - 3:00 p.m. *Benedum Hall 320*

DO FIRST-YEAR ORIENTATION COURSES ALTER STUDENTS PLANS FOR ENGINEERING STUDY?

Kerry Meyers

Many general First-Year Engineering Programs across the country offer students an engineering orientation type of course that is intended to help students determine which discipline of engineering is right for them. At an urban, public university in the Midwest, a study was conducted to assess the relative usefulness of this type of a course. At the start of the semester, students were asked to indicate which field of engineering they were considering, and then on a weekly basis students listened to a presentation on the engineering disciplines and were required to complete an on-line survey prior to the next week's lecture (in which they indicated their most current interest level). Student's interests in the different engineering disciplines were tracked over the course of the semester to assess relative changes in intended field of study, and it was found that 20% of students changed from their originally intended major, while 71% said that it affirmed their originally indicated / intended engineering discipline.

FROM UNDECIDED TO COMMITTED ENGINEERING STUDENT THROUGH A T-SHAPED INTRODUCTORY COURSE MODEL

James G. Orbison

The introductory engineering course at Bucknell University is required for all entering first-year engineering students, averaging 185 students each year. Of those, approximately half are enrolled in the College of Engineering, but have not yet declared a specific engineering major. The introductory course has been structured to provide all engineering students with a "T-shaped" first experience in engineering: breadth of exposure to the engineering profession, engineering design, and the disciplines (the crossbar of the T), and depth in multiple engineering disciplines (the stem of the T). Nine faculty teach in the course, with representation from all engineering degree programs at Bucknell. End-of-semester evaluations and subsequent retention data indicate success in introducing the engineering profession and disciplines to first-year students, and in providing an appropriate foundation for subsequent coursework.

EXTENDED ABSTRACT - FLIPPING AND INTEGRATING THE FIRST-YEAR ENGINEERING EXPERIENCE

Gregory Bucks, Kathleen Ossman, Jeffrey Kastner, Joni Torsella, Rodney Roseman and F. James Boerio

Due to a drop in the number of students enrolling and persisting in engineering programs, there is currently a lack of qualified engineering graduates, which jeopardizes both the health of the U.S. economy and the security of the nation. This issue has led to the development and implementation of a variety of first-year engineering experiences. At the University of Cincinnati, three courses were introduced during the 2012-2013 school year to provide students with a hands-on experience with engineering and a link between engineering and the required mathematics and science courses. Following the successful introduction of these courses, efforts are currently underway to improve the experience for students in all first-year courses. A major effort is underway to provide additional connections between the newly introduced engineering courses. A data acquisition (DAQ) device is being introduced as a way to link the content of the courses, where students will write MATLAB® scripts in a course where computing is introduced as a problem-solving tool and will use them during hands-on experiences in an introductory engineering class. In addition, a flipped pedagogy is being implemented in the computing courses so that lecture time can be spent solving problems. Discussions are also ongoing between faculty in Engineering, Mathematics, Physics, and Chemistry to develop a common set of practices within all first-year STEM courses. The first step is the development of a common report structure so that students are exposed to a single set of guidelines. Future plans involve the adoption of common technology platforms and matching schedules so that topic delivery is more cohesive.

Session F4A: Research on First-Year Engineering Courses 2

Chair: Ryan Munden, Fairfield University

Time: Friday August 9, 3:30 p.m. - 5:00 p.m. *Benedum Hall 309*

REVERSE ENGINEERING INSPIRES ME FRESHMEN AT NJIT

Balraj S. Mani and Reggie J Caudill

New Jersey Institute of Technology at Newark NJ (NJIT) has introduced a systemic change with the launching of the concept of Learning Communities for the entering freshmen. Initiated in Fall 2011, the program has generated abundant interest and is yielding rewarding results. As part of this initiative, the Department of Mechanical and Industrial Engineering (MIE) at NJIT has introduced Reverse Engineering as part of the curriculum for the entering freshmen with Mechanical Engineering as their major. The MIE educational staff has creatively blended Reverse Engineering with the existing Fundamentals of Engineering Design-101 (FED-101) curriculum yielding successful learning outcomes. Freshmen experience the role of a Product Design Engineer in a corporation from ideation to product release. The inspiration, which the freshmen experienced through the success and sense of accomplishment in their Reverse Engineering projects, is propelling them to innovate and excel.

EXTENDED ABSTRACT - INTEGRATING INNOVATION IN THE FIRST YEAR EXPERIENCE

Ben Koch, Dorothy Cheng and Simone Gbolo

Student engagement is critical to increasing learning and developmental outcomes of students pursuing higher education. The University of Minnesota Twin Cities, College of Science and Engineering First Year Experience course is entering its fourth year of offering to incoming first year students. The course objective is to assist first year students who are studying mathematics, science, and engineering transition to college by engaging them to gain vital skills such as critical thinking, time and project management, communication, diversity, and innovation. The course is designed to increase student engagement with an experiential learning component required of all incoming first year students called the Innovation Project. During the First Year Experience course, students receive information regarding major exploration, student engagement, diversity, ethics, their own Gallups StrengthsQuest results, major exploration, and the Innovation Project. These varied topics cover a wide array of transferable professional development skills vital to an individual's success as a student and as a future professional in science and engineering. A mix of discussion topics and hands-on opportunities are used to engage the student throughout the semester and offer relevance to their future careers. The Innovation Project not only excites their scientific, math, and engineering interests but also provides a space to develop strong teamwork and communication skills. This paper discusses the successes and challenges of the College of Science and Engineering Innovation Project and its integration into the First Year Experience course.

USE OF ONLINE TOOLS IN TEACHING C++ PROGRAMMING TO FRESHMEN IN ALL ENGINEERING MAJORS

Grace Ni, David Bishop and Anthony Donaldson

As computer software becomes increasingly used in analysis and design in all engineering disciplines, more engineering programs have started including computer programming in their common core for all engineering majors. C++ is a popular programming language that's been chosen for teaching engineering students programming. At California Baptist University, EGR 121 Introduction to Computer Programming in C++ is a required course for all engineering students. Most of our engineering students take this course in their first year. This course was taught using traditional means of lecture, text book reading and exercises along with labs and programming projects. Since the fall of 2012 we incorporated two online resources, an online interactive content resource and an online exercise tool to replace the previous textbook problems as homework. We discuss our experience in the classroom along with survey feedback from our students. Although no statistically significant difference in final grades was detected, we did find anecdotal indication that students benefited from these tools particularly the online homework problems.

EXTENDED ABSTRACT - EXPLORATION OF COGNITIVE APPRENTICESHIP PRACTICES IN A FIRST YEAR ENGINEERING COURSE

Mike Ekoniak and Tamara Knott

The cognitive apprenticeship approach is a pedagogical method that extends the methods used in a traditional apprenticeship to cognitive tasks. The study described in this paper is a follow up on a previous project, in which we found evidence that instructors who are not explicitly trained in teaching using a cognitive apprenticeship

approach still might use techniques that fit that model. In this study, we conduct interviews with instructors in order to determine the extent to which the teaching methods they report employing in the classroom fit the cognitive apprenticeship model. We then survey students in the course to determine how well their experience of teaching methods used in the course compares to both the reported methods from the instructor interviews and the cognitive apprenticeship model. Initial results from the study will be shared at the conference.

Session F4B: Introducing Teamwork in the First Year

Chair: Jim Orbison, Bucknell University

Time: Friday August 9, 3:30 p.m. - 5:00 p.m. *Benedum Hall 318*

EXTENDED ABSTRACT - ASSESSING TEAMWORK IN A FIRST-YEAR ENGINEERING STUDIO COURSE

Stephen H. Carr and Adam Goodman

This presentation describes findings from a long-term project to develop teamwork among first-year engineering students at a major research university. Findings to date from 1,834 teamwork assessments(Goodman, 2013) have identified four top factors that contribute to team success and four top factors that contribute to failure, as well as essential development opportunities for individual students and teams. Additional findings examine motivational factors, receptivity to peer feedback, and the importance of introducing students to a basic team vocabulary.

EXTENDED ABSTRACT - IMPLEMENTING TEAM BASED LEARNING IN FRESHMEN ENGINEERING COURSES

Steffen Peuker and Jennifer Mott Peuker

Team Based Learning (TBL) is a specific pedagogical tool that emphasizes collaborative learning. Oftentimes TBL is confused with group activities and other active learning strategies involving student teams. TBL is distinct because it follows a prescribed sequence of individual work and group work, and includes immediate feedback as well as peer evaluation. TBL is widely used in medical, pharmacy and nursing schools and the use of TBL in engineering education is growing. The advantages of using TBL in the class room include: (1) students are held accountable for individual (pre-class) and group (in-class) work. (2) The responsibility for learning shifts from the instructor to the students, promoting lifelong learning skills. (3) The majority of class time is used for team assignments that use the course content applied to large difficult problems. (4) The students are actively engaged during class time. Furthermore, TBL is suitable for courses having as little as 12 students, but is also used in courses having up to 400 students. Therefore, TBL is an ideal tool to be used in freshman engineering courses. Implementation of TBL in an Introduction to Engineering course at the University of Alaska Anchorage in the Fall of 2013 is in preparation. In spite of all the benefits of using TBL, a possible deterrent for faculty to adopt TBL is the time intensive development of TBL modules and the lack of available support to develop and improve classroom materials. It is the intent of the authors to form a national freshmen engineering TBL support group to facilitate the implementation of TBL in freshmen engineering courses.

EXTENDED ABSTRACT - IT'S A BALANCING ACT: THE INFLUENCE OF NON-SELF-SELECTED PROJECT TEAM FORMATION ON TEAM SATISFACTION IN A FIRST-YEAR ENGINEERING DESIGN COURSE

Natalie C.T. Van Tyne, Robert D. Knecht and Kathryne C.T. Van Tyne

The semester-long first year design course at a public engineering-oriented institution provides both an introduction to the engineering profession and an introduction to engineering design through a semester-long team project. Students are assigned to project teams by their instructors, based on an initial assessment that may include fundamental skills, personality traits and a variety of demographic data. We propose that the criteria used to assign students involuntarily to teams are important features that may influence team satisfaction. The purpose of the present study is to examine these features with a sample of first year engineering students, whose teams were assigned during either the first week or the fourth week of the semester and in consideration of a variety of skill and personality factors, with team satisfaction measured by average peer evaluation score. A total of 147 five-student teams comprised the study population. Peer evaluation data were compiled from the spring and fall 2012 semesters, each 16 weeks in length. This study will continue, using peer evaluation data from the spring and fall 2013 semesters, in order to reveal any trends in successful team formation. Preliminary results indicate that the timing of team formation is a significant predictor of team satisfaction. However, an extensive collection of personality and demographic factors do not significantly influence team satisfaction.

FIRST YEAR STUDENT TEAM PROJECTS USING MATLAB

Kathleen Ossman and Gregory Bucks

This paper describes two team projects developed for a two semester sequence of courses entitled Engineering Models I and II designed for all first year students majoring in engineering and engineering technology at the University of Cincinnati. In 2012-2013, the sequence was taken for the first time by all first year students in the College of Engineering and Applied Science. The courses apply fundamental theory from math and science courses to relevant engineering applications chosen from a variety of disciplines. MATLAB® is introduced and progressively developed as a programming tool to enable students to explore engineering concepts, to investigate solutions to problems too complex for hand solutions, to analyze and present data effectively, and to develop an appreciation of the power and limitations of computer tools. The first team project occurred during the last four weeks of Engineering Models I in the fall semester. Teams were required to develop a game or a set of games using MATLAB®. At this point in the sequence, students had basic programming skills but very little exposure to the graphic capabilities of MATLAB®. To make the project more engaging, several graphical tools were created by the instructors to allow the students to make their games visually interactive. The second team project occurred during the last four weeks of Engineering Models II. Each team was required to design a GUI in MATLAB® that could serve as an effective and engaging teaching tool for a topic that they learned about in one of their first-year courses. Students created GUIs on a diverse set of topics including differentiation, integration, Taylor series, organic chemistry, statics, projectile motion, and circuit analysis.

Session F4C: Transition to College & Mentoring

Chair: Shelley Lorimer, MacEwan University

Time: Friday August 9, 3:30 p.m. - 5:00 p.m. *Benedum Hall 319*

ENGAGING PEER MENTORS IN FRESHMEN PROGRAMS

Summer Dann, Sean King, Jordan Favret, George Barney, Jabari Landry and Warren N. Waggenspack, Jr.

The STEM Talent Expansion Program (STEP) at Louisiana State University (LSU) was designed to increase the number of engineering and construction management graduates through retention programs aimed at: 1) developing and maintaining a sense of community among the students and faculty; 2) enhancing academic skills of the students; and 3) providing a framework for interactions between faculty, students and industry personnel. One third of the freshmen class (approximately 400 students) participates in at least one of the freshmen programs developed to ease a student's transition from high school into the university. The three featured programs include: Encounter Engineering, a summer bridge camp hosted the week prior to the start of school, ENGR 1050 Introduction to Engineering, freshman class, and the Engineering Residential College (ERC), a designated residential hall specifically for 1st year College of Engineering majors. The class and camp include design projects, team building exercises and meeting industry professionals. The ERC helps students connect with other freshmen through living together. All of the programs introduce freshmen to engineering faculty and staff, have student organization activities and provide insight into the engineering disciplines and subsequent careers. A significant lesson learned from the camp and intro course is the strong, positive influence of peer mentoring and its effect on retention. Peer mentors are upper-level, college of engineering majors. Freshmen in the camp and the class are grouped in teams and assigned a peer mentor based on their major. Peer mentors offer advice, oversee design projects, discuss internships and student organizations, and guide freshmen students through their first semester. The peer mentors serve as college ambassadors for special events, help recruit for the college, and perform hands on demonstrations in outreach to the K-12 community. Their newly founded Society of Peer Mentors was recently named Most Outstanding New Student Organization on LSU's campus. Success of the STEP program has been measured through a longitudinal study of all freshmen declaring engineering as a major. Retention and persistence numbers of these students in the college of engineering, STEM fields and in the university are recorded on the 14th day of each fall semester. Completing its sixth year of activities in 2012, STEP freshmen participant retention and cumulative six year graduation (CGR6) rates surpass the non-participant population by 15-20% and 10% respectively. Peer Mentor CGR6 rates are 35% higher than non-STEP students.

BUILDING COLLABORATION BETWEEN PEER MENTORING PROGRAMS AND STUDENT ORGANIZATIONS: UT WOMEN IN ENGINEERING PROGRAM'S MODEL OF THE PEER ASSISTANCE LEADERS PROGRAM (PALS) AND THE LEADERSHIP COLLABORATIVE

Ana M. Dison

The Peer Assistance Leaders program (PALs) provide support to first year engineering women transitioning from high school into the Cockrell School of Engineering (CSE), and to precollege students considering engineering as a major and contribute to the overall goal of WEP to recruit, retain and graduate in four years. PALs serve as role models, receive skills development and leadership training, organize and participate in opportunities for first year, transfer and international women to get connected within the Cockrell School of Engineering, visit with prospective students and their families and help coordinate and facilitate pre-college programs. Over 100 volunteer PALs, representing all departments, are selected and trained by WEP each year. Primarily, the PALs are second year female engineering students, further serving as a retention program. The PAL program has grown significantly to nearly 120 volunteers, up from 35 volunteers in 2006. All first year engineering women (approximately 300 students) are automatically matched to a PAL and will connect on the first class day at a large welcome dinner. For PALS, our goals are: to provide the opportunity to serve as positive engineering role models, develop leadership, mentoring, interpersonal and communication skills and to increase the connection to the CSE and sense of belonging within the UT engineering community. For PAL Mentees, the goals are: to use PAL as a resource for academic success, increase connection to their PAL and to WEP, and to increase connection to the UT engineering community. The WEP Leadership Collaborative (WEP-LC) is a collaborative leadership initiative coordinated by WEP, bringing together WEP & 9 student-led organizations that serve UT female engineering students. The purpose of the Leadership Collaborative is to create environments that foster a sense of community for the students. With particular emphasis on the female students, the WEP-LC is designed to showcase this welcoming community during the recruitment process of high school students through leadership opportunities throughout the academic career of our students. During this process, the goal is not only to create this sense of community and support but also to increase the retention of the female engineering students. Through mentoring, leadership development and opportunities for career mentoring, the offerings span the 4+ years of the academic experience. Four groups are classified as Sponsored Organizations, having formal officers, by-laws and additional privileges granted by the University; one group is classified as a Registered Organization, with limited privileges; and four more maintain a less formal structure and are currently classified as groups. The WEP-LC includes leadership training, monthly collaboration meetings, & coordinated community building, career exploration, mentoring & outreach initiatives. The WEP-LC involves over 30 student leaders and 250 active WEP & organization participants impacting over 1,400 women in engineering. This talk/session would showcase these two initiatives, share best practices and discuss future program offerings and directions.

PROJECT CONNECTIONS-ENHANCING THE FIRST-YEAR EXPERIENCE THROUGH FRESHMEN-SENIOR INTERACTIONS

Harovel G. Wheat

While many incoming freshmen are fascinated by the field of engineering, some often have very little idea about what engineers really do. Project Connections was designed to increase the understanding of what engineers do (in particular mechanical engineers), and to highlight and emphasize the problem-solving capabilities that the incoming students can have in just four years. This was done by integrating and connecting the first year experience with the experiences of students in their final year of study. Senior students gave presentations to the freshmen classes on their Senior Design Capstone Projects. In addition, freshmen students wrote short papers highlighting the project problem, the solution, and what the senior students had to know or determine to solve the problem. The anecdotal evidence indicated that Project Connections was very beneficial to the freshmen students and rewarding to the senior students as well. Results are continuing to undergo evaluation and Project Connections is continuing to undergo modifications. The results after implementation for two semesters will be described.

EXTENDED ABSTRACT - TEACHING COMPUTER PROGRAMMING TO A DIVERSE STUDENT BODY THROUGH SERVICE LEARNING

Jeffrey L. Schwartz

The first year of engineering technology can be daunting for any student, let alone the diverse student body at Queensborough Community College, where many of the students are not native English speakers. When these students take Introduction to Computer Programming, most often in their second semester, many of them have never written a single line of code. Not only are standard programming assignments confusing to many of them, but they can also seem irrelevant or uninteresting. This paper describes how students have been able to make the connection between the computer programs they create and their usefulness through the high-impact teaching strategy of service learning. The process starts with six labs teaching them the fundamentals of programming in Visual Basic. This is followed by a step-by-step process of meeting with the client, reflection, planning, and creating and presenting their work to the client. The client's comments are then reflected upon and used to create an improved version of their work for their final projects.

FROM CO-OP TO CAREER DEVELOPMENT: ENGAGING FRESHMAN IN LIFELONG CAREER PLANNING

Helen Oloroso

From Co-op to Career Development: Engaging Freshman in Lifelong Career Planning The McCormick Office of Career Development is a radical expansion of the renowned engineering co-op program at Northwestern University and now serves nearly all engineering undergraduates. Its overarching objective is to enable students to set themselves on a path to a professional pursuit of their own making. The McCormick Career Development programs provide opportunities for students to have industry experience (co-op or internships), service learning projects, or employment in research laboratories. This expansion follows the reasoning laid out in research on the connection between cooperative education and career development, conducted by Fletcher (1989), Bounous (1986), Perry, DeWine, Duffy and Vance (2007) and Parks, Cash and Onwuegbuzie (2001). McCormick freshmen are encouraged to take the co-op and internship prerequisite course, Introduction to Career Development course (CRDV 301). The course is taught by adjunct faculty who are working professionals in engineering organizations and the topics addressed in this course equip our students with the tools necessary to acquire their first position as an intern or in co-op and to manage a lifelong career in the professions. Although not all students elect to take CRDV 301 in their freshman year, the course itself has created a climate of early engagement in career development through work-integrated learning. Anticipated and Actual Outcomes: It was predicted that we would expand many programmatic elements and thereby be serving 30% participation in career development programs. The student response was nearly double what we expected, at 55% of undergraduates in an internship, co-op or service-learning arrangement, or paid position in a research lab. The first increase that we experienced was in the enrollments for CRDV 301, which was initiated as a beta test version in the fall quarter of 2007. One section was offered and 15 students enrolled. By the end of the spring quarter of 2008, an additional 85 students had completed the course. Beginning in the fall of 2008, CRDV 301 was established as a prerequisite for students entering the Co-op Program or the Engineering Internship Program and enrollments have averaged 300 students per year since the fall of 2009 â€“ nearly 75% of the freshman class. The second major development was to add the opportunity for students to work as research assistants in university or government labs, applying the same â€œwork-integrated learningâ€• principles that are present in the co-op and internship experiences. At the same time, in fall 2009, we added a program called Engineering Projects in Service Learning for students whose work would be as volunteers in the non-profit sector, again applying the same principles as the co-op and internship programs. We now serve over 1000 students (67% of all undergraduates) in the combined programs of co-op, internships, service learning, and research experience. Although none of these programs are required of students at McCormick, it is clearly becoming a choice that many students make because they see the value of integrating theoretical and practical knowledge to become whole-brain engineers.

EXTENDED ABSTRACT - BUILDING COMMUNITY TO IMPROVE FRESHMAN RETENTION

Ralph Sprang and Robert S. Weissbach

High freshman attrition in engineering programs is a significant and growing concern. In 2010 and 2011, less than 41% of first year freshmen received a grade of C or better in first semester technical major courses at Penn

State Erie. Retention rates increased by 15% to 25% for the first semester of implementation for the programs described in this paper, fall 2012. Existing events and programs that are targeted at freshman did not significantly improve retention. The two existing programs are the Freshman Interest Group (FIG) and FastStart. The FIG program houses students in dormitories by major and provides a peer mentor but does not engage students living off-campus. The FastStart program holds a few social events per year to bring students and mentors together, but requires the freshman student to take the initiative to join the program and maintain contact with his or her mentors. Programs that support development of community and increase student engagement can improve freshmen retention. These programs build community among students, peers, and faculty by "forcing" students to participate. The students are required to learn each classmate's name and to complete group work with every other student during the course of the semester. A student-led club provides social, academic, and technical events led by upper class mentors.