THURSDAY SESSIONS

Session T1A: Workshop: Developing Videos and Support Materials for First-Year Engineering Design Courses

Chair: Ann Saterbak, Rice University

Time: Thursday, August 7, 8:30 a.m. - 10:00 a.m. *Room 1011C*

WORKSHOP: DEVELOPING VIDEOS AND SUPPORT MATERIALS FOR FIRST-YEAR ENGINEERING DESIGN COURSES

Ann Saterbak, Amber Muscarello and Matthew Wettergreen

Building on best practices in engineering, faculty at Rice University are creating instructional materials to enable teaching a first-year multidisciplinary engineering design course using a flipped classroom model. With the support of an NSF DUE grant (#1244928), the workshop leaders are developing videos, quizzes, and in-class exercises to be used at Rice University and other engineering schools. During the workshop, participants will participate in evaluating and producing video materials. The collective wisdom of the participants will enrich and strengthen the materials, which will be widely disseminated.

Session T1B: Workshop: Holistic Advising: Does Your University Have a Safety Net?

Chair: Betsy Willis, Southern Methodist University

Time: Thursday, August 7, 8:30 a.m. - 10:00 a.m. *The Presidential Dining Room*

WORKSHOP: HOLISTIC ADVISING: DOES YOUR UNIVERSITY HAVE A SAFETY NET?

Betsy Willis, Eileen Hoy and Deanna Tilley

Retention of first year engineering students to the second year and onto graduation remains a challenge. More students intend a major in engineering than complete a major in engineering. In addition to taking on a rigorous curriculum, students bring outside issues and pressure with them to college. For example, two behaviors that when taken to an extreme can negatively affect academic performance include gaming and partying. In the 2013 Cooperative Institutional Research Program (CIRP) survey, approximately 1/3 of students reported spending 1-10 hours per week playing video games and approximately 40% reported partying 1-10 hours per week. If such pre-college behaviors are taken to extremes in college, students risk falling short of academic expectations. Colleges' and universities'' mental health professionals report an increase in the number and severity of student mental health cases. During the transition to college, students are challenged with balancing new found freedom with responsibilities. Students' mental and social well-being can play a significant role in their academic success and ultimate retention to engineering major declaration and graduation. In this workshop, participants will explore actual case studies and have the opportunity to identify and develop their own campus network. Participants will engage in a discussion of emerging issues and needs of first year engineering students.

Session T1C: Workshop: Active/Collaborative Learning in the College Classroom

Time: Thursday, August 7, 8:30 a.m. - 10:00 a.m. *Room: Hagler Auditorium*

Session T2A: Workshop: Design Your Process of Becoming a World-Class Engineering Student

Chair: Steffen Peuker, Cal Poly, San Luis Obispo

Time: Thursday, August 7, 10:30 a.m. - Noon *Room 1011C*

WORKSHOP: "DESIGN YOUR PROCESS OF BECOMING A WORLD-CLASS ENGINEERING STUDENT" - A POWERFUL PROJECT FOR ENHANCING STUDENT SUCCESS

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. Furthermore, many students lack the attitudes and behaviors to accomplish the challenging goal of graduating in engineering. To strengthen the commitment of first-year engineering students and guide them in developing academic-related skills, academic self-confidence, and personal skills an innovative project has been developed. The project challenges students to develop their process to become a "World-Class Engineering Student". Having first-year 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 first-year engineering course will have a significant impact on their academic success by improving the students' skills, confidence and motivation to succeed in engineering. Implementation of the project at two universities showed a significant impact on first-year students, e.g. the overall GPA of first-year students increased by 0.5 points. 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. Participants will be provided with supplemental material to help in the adaptation of the project.

Session T2B: Workshop: Training Student in Responsibility for Their Own Learning: True Student Centered Learning

Chair: Peter Shull, The Pennsylvania State University

Time: Thursday, August 7, 10:30 a.m. - Noon *The Presidential Dining Room*

WORKSHOP: TRAINING STUDENT IN RESPONSIBILITY FOR THEIR OWN LEARNING: TRUE STUDENT CENTERED LEARNING PROGRAMS

Peter Shull

This highly interactive workshop is about doing something different-providing faculty with proven tools that instill student responsibility for their own learning. The workshop will focus on pragmatic and effective methods that create a clear and common understanding of what is meant by student responsibility for learning. It will clarify both effective and ineffective behaviors of both students and faculty, and how to instill these skills. Specific active and experiential lessons will be presented in a highly animated format. This workshop is for anyone who believes "I know students can do better, I just don't know how to make it happen." Or for those who simply want to dramatically reduce student complaints or excuses in a positive way.

Session T3A: Roundtable Discussions

Chair: P. K. Imbrie, Texas A&M University

Time: Thursday, August 7, 1:30 p.m. - 3:00 p.m. *Room: 1011B & C*

Session T4A: Design in an Introductory Course

Chair: Tamara Knott, Virginia Polytechnic Institute and State University

Time: Thursday, August 7, 3:15 p.m. - 5:00 p.m. *Room: 1011B & C*

INTRODUCTION TO ENGINEERING DESIGN THROUGH A FRESHMAN REVERSE ENGINEERING TEAM PROJECT

Ronald Barr, Thomas Krueger, Billy Wood and Mostafa Pirnia

Our group at the University of Texas at Austin has developed the current version of Engineering Graphics based on the pedagogical triad of: 1. engineering graphics fundamentals, 2. computer graphics modeling fundamentals, and 3. computer graphics applications. The engineering graphics fundamentals part covers the traditional topics of sketching, projection theory, orthographic drawing layout, sectioning, and dimensioning. The computer graphics modeling component teaches 2-D computer sketching, 3-D solid modeling of parts, assembly modeling, and the projection of an engineering drawing directly from the 3-D model data. The graphics application part includes kinematics animation, finite element analysis, and generation of a rapid prototype directly from the 3-D data base. In order to motivate the freshmen students in engineering design, and to tie the three pedagogical components into a unifying theme, we have instituted a team project based on the concept of reverse engineering. Reverse engineering is the dissection of a common mechanical assembly into its individual parts, studying the geometry and design function of each part, and then reconstructing the parts into 3-D solid model data bases. The student teams select a mechanical assembly, dissect it into individual parts, make measurements and sketches, build 3-D solid models, apply the solid models to various analyses, and make rapid prototypes. The whole project is eventually documented in a final report with sketches, 3-D model image printouts, various analysis reports, printed 3-D prototypes, and final drawings.

EXTENDED ABSTRACT - MAKE LEARNING MORE REAL: AN INTRODUCTION TO REFLECTIVE LEARNING IN A FIRST-YEAR ENGINEERING DESIGN COURSE

Natalie Van Tyne and James D Wong

Reflective learning methods have been practiced in many college-level liberal arts courses in the liberal arts and

have begun to appear more often in engineering curricula. Fundamentally, the term "reflective learning" refers to the active monitoring and evaluation of one's own learning in order to discern concepts, patterns and relationships. This leads to recognition of what was taught and how new information can be added to an existing body of knowledge for application to college coursework, life outside the classroom, or even the engineering workplace. We were aware of the use of reflective learning in a multi-disciplinary and multi-age engineering project-based course at other institutions, and wondered if this technique would enhance the learning of fundamental engineering skills for our first year students. To that end, a simplified weekly reflective journal assignment was added to our students' workload in order to observe and measure their capability to identify, qualify and implement new skills and insights. Students recorded one or more skills and reflections for each week of the semester to answer these questions: What did you learn? Why is it important? Where else could you use this skill? Entries were graded periodically and, collectively, these grades comprised 10% of the students' overall course grade. While most students identified specific skills and observations pertaining to the course, occasionally their responses containing skills learned in other courses or in out-of-classroom situations on and off campus. There was no length requirement, and some students were more expressive than others. As expected, certain students completed the assignments more diligently than others, resulting in descriptions containing a greater sense of perception and synthesis of related ideas. Since it was also our intent to guide students into identifying similarities in content and application between our course and other required "core curriculum" courses, as well as application to everyday life, we were encouraged by responses involving ways in which specific technical skills taught in our course could be used to save time and improve accuracy in other courses. The students gave examples such as physics or chemistry lab reports, organizing information for assignments in an evidence-based humanities course, and noting the similarities between estimating the cost for a completed conceptual design and estimating the cost to pursue a hobby. By adopting a basic, easy-to-use format for our reflective journals, we were able to "make learning more real" by enabling our students to identify not only what they learned, but what it meant to them.

A PROJECT-BASED, INDUSTRY-DRIVEN FRESHMAN DESIGN SEQUENCE FOR MECHANICAL ENGINEERS

Timothy J. Garrison, Emine Celik and Scott Kiefer

The engineering programs at York College of Pennsylvania recently undertook a comprehensive review of the two-course freshman engineering design sequence. This detailed study resulted in a complete restructuring of the sequence. This paper describes the original structure of the sequence, the shortcomings identified through assessment of its effectiveness, the structure of the new sequence, and results/observations from teaching under the new structure during the 2013-2014 academic year. York College offers three engineering programs - mechanical, electrical, and computer - all of which require three full semesters of cooperative work experience. While the redesign affects all of the engineering programs, the focus of this paper is specific to the mechanical engineering program. Originally, the three engineering programs shared a common two-course introduction to engineering sequence. The primary goals of the original sequence were to expose students to the engineering design process via hands-on projects, to develop teamwork skills in a multidisciplinary environment, to illustrate the differences in the three engineering disciplines, and to develop basic engineering skills including CAD, manufacturing methods, programming, and electronics. Assessment of the course outcomes along with an extensive, multi-year survey of the employers of the programs' co-op students revealed several shortcomings with the original structure. To address these shortcomings, the introductory engineering sequence was completely revamped. The new sequence consists of a common first course in the fall followed by a major-specific course in the spring. The common first course is split into two half-semester modules, one focused on mechanical engineering and one on electrical/computer engineering. The second course in the sequence is major specific. The mechanical engineering majors now take a course that integrates advanced CAD, CAM, and CNC machining via hands-on design projects.

USING THE ARDUNIO IN FRESHMEN DESIGN

Mark E. Cambron

This paper will present the implementation and usage of the Arduino Uno microcontroller into EE Design I. EE Design I introduces design and electrical engineering to freshmen students. The Arduino Uno is a single-board microcontroller designed around the 8-bit Atmel AVR microcontroller. The board has a simple development environment that runs on both PCs and Macs and allows users to write programs using C and C++. The Arduino Uno is a low cost platform that can be bought for roughly $30. The low-cost easy to use board is an ideal platform to introduce programming and design to freshmen engineering students. Projects in this course support

our vision of project-based engineering. In this paper will discuss the robot project and the experiences developed to prepare students for their project.

IMPROVING STUDENT SUCCESS AND RETENTION RATES IN ENGINEERING: ONE YEAR AFTER IMPLEMENTATION

Nova A.G. Schauss and Steffen Peuker

To strengthen the commitment of first-year engineering students and improve retention rates, an innovative approach has been developed linking student development focused first-year courses and a project called "Design Your Process of Becoming a World-Class Engineering Student." Set within developmental first-year courses, the project challenges students to design their individually tailored learning process to have a significant impact on their academic success by improving the students' skills, confidence and motivation to succeed in engineering. The approach was implemented at Oregon State University (OSU) as well as the University of Alaska Anchorage (UAA). OSU piloted one section during Fall 2013 of ENGR 199 with students (N=23) who had an average cumulative GPA of 3.04 after Fall 2013 term, compared to the average of a comparator control group of 2.48 who did not complete the course. In regard to academic standing, 88.2% of students who completed ENGR 199 were in Good Standing (2.0+ term GPA) with the University after Fall term, compared to 70.6% of the comparator control group who did not complete the course. At UAA, the students (N=151) who took ENGR A151 in either Fall 2012 or Spring 2013 had an average cumulative GPA of 3.00 at the end of Spring 2013, compared to the average cumulative GPA of 2.51 of the students (N=112) who did not take the course. The retention rate of students who took ENGR A151 was 87.4% compared to 79.5% who did not take ENGR A151. Based on the first year implementation results from OSU and UAA, the approach of linking a student development course with the "Design Your Process of Becoming a World-Class Engineering Student" project, is an effective method to improve engineering student success and retention rates, because it can be implemented virtually anywhere with minimal cost and change of curriculum.

Session T4B: Non-Technical Issues for Engineering Students

Chair: Shari Luck, Kettering University

Time: Thursday, August 7, 3:15 p.m. - 5:00 p.m. *The Presidential Dining Room*

IMPROVING THE TRANSITION FOR HIGH SCHOOL AND TRANSFER STUDENTS TO THE FIRST SEMESTER ENGINEERING COURSE EXPERIENCE

Kelvin Kirby

Freshmen and first semester transfer students are often mislead by their personal expectations of the first semester of engineering courses. It is acknowledged that transfer students have the first semester college experience and are informed college students. In general, freshmen and transfer students experience similar challenges with the first semester engineering course load. The Roy G. Perry College of Engineering of Prairie View A&M University utilizes a one credit hour, Intro to Engineering, Computer Science and Technology course to help both freshmen and transfer students to transition to engineering course studies. The textbook for the course is "Studying Engineering: A Road Map to a Rewarding Career," 4th Edition by Raymond B. Landis. After several years of observation and data collection, the textbook by Landis is an excellent text for the goals and objectives of the freshman course. The freshmen and transfer students come to engineering studies with the mindset that what worked in high school and community college will continue to deliver academic success in engineering studies. The textbook presents a very convincing approach with the topics of: (1) Keys to Success in Engineering Study, (2) Fixed versus Growth Mindset, (3) Mistakes Students Make, (4) Improving Your Learning Process, (5) Personal Growth and Development, and many more very important topics. It is often a proven fact that having the knowledge of what to do and wanting to do what should be done are not enough to motivate or inspire one to change one's mindset, attitude and behavior. Freshmen and transfer students often approach engineering studies with attitudes and behaviors which have been practiced for years. The challenge becomes how to transition students from what they have practiced for years to attitudes and behaviors which will secure great academic success in engineering studies. Activities and concepts which have proven success in changing what students practice will be presented along with supporting data.

DIVERSIFY FIRST YEAR ENGINEERING STUDENTS' PROBLEM SOLVING EXPERIENCES - IMPLICATIONS FROM ENGINEERING WORKPLACE RESEARCH

Rui (Celia) Pan

Previous studies show that engineering workplace problems are different from textbook or classroom problems

in many ways. To better prepare students with workplace competencies, it is important for engineering educators to design meaningful learning experience and actively engage students in solving real world engineering problems. Based upon research on problem solving and the author's own teaching experience in the first year engineering program, this study proposed several recommendations regarding how to diversify students' problem solving experiences and better equip students with real world problem solving knowledge and skills.

EXTENDED ABSTRACT- SUPPORTING FIRST YEAR ENGINEERING STUDENTS IN COMMUNITY COLLEGE PROGRAMS

Shelley L. Caraway and Jamie L. Turner

The U.S. faces a shortage of one million STEM professionals in the next decade putting U.S. global competitiveness at risk. Community college (CC) engineering programs are key to increasing both U.S. STEM graduation rates and the diversity of STEM students earning baccalaureate degrees. Five years ago, Texas CC and university faculties aligned curriculum to create statewide Voluntary Engineering Transfer Compacts to articulate 6 pathways for students transferring to most Texas universities. Community college programs soon realized a number of challenges. Few students begin mathematically prepared to study engineering, thus requiring leveling courses. Time to completion is extended since CC students frequently enroll less than full-time due to job and family responsibilities. Retention also becomes a challenge. Upon transferring, CC students face more scrutiny than university natives applying to engineering programs. CC students initially experiencing academic challenges, are not considered by engineering programs. Texas CC's are significantly more diverse than four-year schools. In fact, a majority of Texas students start at CC's, many working and enrolling only part-time. Trained on the job as technicians, drafters, mechanics, or in construction, these students bring valuable experience to classrooms however, few gain the academics needed for university engineering programs. CC's committed to engineering programs, use high touch strategies to ensure student access to academic supports. Orientations inform pre-engineering students of time commitments necessary. Ramping or strategically intensifying course loads in the first two semesters improves success and retention. Advisors/counselors working with faculty improve CC engineering student success using early alerts and identifying services and interventions needed.

OPEN ADMISSIONS AND THE COMMUNITY COLLEGE PATHWAY TO ENGINEERING

Paulina Sidwell and April Andreas

Community colleges serve an important role in preparing students for careers in engineering. According to a study by the National Science Foundation, more than 40 percent of recent Science and Engineering graduates have attended community colleges at some point in their educational paths. These two-year programs allow students to take their core class requirements as well as freshman and sophomore-level engineering courses. These then transfer to four-year institutions where students can complete their engineering degrees. This is an attractive alternative for students who a) are coming back to school to get an engineering degree after years in the workforce; b) do not have financial or geographic access to a nearby university that offers an engineering degree; c) do not meet the admissions requirements to enter the four-year institution of their choice; or d) a combination of these factors. Community colleges, as opposed to most four-year institutions, typically have an open admissions policy. While this allows students to pursue engineering who may not have otherwise been able to, this presents challenges as well as opportunities for the two-year institutions. With proper advising and support, the accessibility that community college programs provide can increase the number of students that consider engineering as a viable career path, even if they have to begin in remediation. To better understand the impact of an open enrollment policy on student success, data from McLennan Community College's engineering students were gathered and analyzed. Several questions are addressed in this preliminary study. How does the open admissions policy impact accessibility for engineering? The engineering program at McLennan Community College has only been active since 2009. As such, this initial study focuses only on the Introduction to Engineering course. Only now are our first students beginning to complete degrees at the university level, but as this study progresses, we hope to discover if success in the Introduction to Engineering course predicts ultimate success in engineering programs.

FIRST YEAR MATHEMATICS COURSE CREDITS AND GRADUATION STATUS IN ENGINEERING

So Yoon Yoon, P.K. Imbrie and Teri Reed

This study explored how first year engineering (FYE) students' types of mathematics course credits and performance relate to their graduation status. The data of 1,975 new first time freshman, in the fall of 2006 in an engineering program at a southwest public university, showed that 19.5 % of students got transfer course credits for Calculus I. Among them, 10.9 % of students achieved credits from AP and CLEP exams. On average,

students who achieved transfer course credits graduated more from engineering than students who took the course at the university. However, when transfer course credits were disaggregated, students who achieved credits from AP and CLEP exams graduated more from engineering than students who took the course at the university, followed by students who achieved transfer course credits from other institutions. In addition, students' graduation rates in engineering significantly varied by their letter grades and types of course credits. Students who earned an A or B at the University graduated more from engineering than students with transfer course credits on Calculus I.

Session T4C: Teaching Strategies for First Year Courses

Chair: Jenahvive K. Morgan, Rowan University

Time: Thursday, August 7, 3:15 p.m. - 5:00 p.m. *Room: Hagler Auditorium*

USING MODIFIED EMERGING SCHOLARS PROGRAM CONCEPTS IN PROFESSIONAL DEVELOPMENT FOR TUTORS

James Epperson and Lynn Peterson

As one of the projects funded by the National Science Foundation Science Talent Expansion Program (NSF STEP) grant program, The University of Texas at Arlington undertook a five-year project designed to increase the number of graduates in STEM fields. The project, called AURAS (the Arlington Undergraduate Research-based Achievement for STEM), approached the task of increasing graduation rates by working to increase success rates in traditionally high-loss courses for science and engineering students, namely Pre-calculus, Calculus I, Calculus II and General Chemistry, and Chemistry for Engineers. The Emerging Scholars Program (ESP) model was used to develop courses that were then offered in these subjects. ESP takes a problem-based approach to learning, emphasis on community building, collaborative learning and small group interaction. Marked improvement in pass rates and decrease in drop rates characterized the outcomes of these AURAS courses. But the additional resources needed to sustain these gains may not be affordable by the institution on a long term basis. Since institutional commitment was still uncertain, we focused our attention on the training of tutors who staff clinics for mathematics, physics and chemistry, and a learning center for engineering. A content-intensive collaborative learning workshop was held last year for professional development of those assisting in the ESP classes, and the methodology of that 2-day training workshop will now be more widely applied to the improvement of tutoring in clinics. The goal of these efforts is the same: to increase success rates in the early STEM classes in an effort to retain and graduate more science and engineering majors. This extended abstract describes the content of the collaborative learning workshops intended as professional development for tutors and its relationship to the original research in the development of the ESP model.

FRESHMAN ENGINEERING DISCOVERY COURSES AT MARQUETTE UNIVERSITY - COLLEGE OF ENGINEERING

Hyunjae Park

The Freshman Engineering Discovery courses at Marquette University - College of Engineering provide freshman engineering students the vision to become an engineering student and an engineer in the future. The students are given a taste of engineering, while receiving guidance on how to think like an engineer and gain insight as to what an engineer does. In order to meet some of the course objectives, the students are asked to find proper and creative answers and solutions to various multi-disciplinary engineering environments and problems. As the semester progresses, the students will be asked to participate in various types of team/group projects (or challenges), which include individual and team responsibilities on assigned topics/tasks/works. Through the Freshman Engineering Discovery courses, the freshman engineering students are able to recognize the types of knowledge and skills necessary to succeed as an engineering student, discover their way towards the engineering disciplinary area of their interest, and layout their vision as a future engineer.

EXTENDED ABSTRACT - INDUSTRY-BASED STRATEGY FOR TEACHING FIRST YEAR ENGINEERING STUDENTS

Shana Shaw

Most first year engineering courses are taught using a lecture-based curriculum. Some engineering courses are taught using a project-based model. Austin Community College has developed an industry-based approach to teaching the Introduction to Engineering course. The class model is based on developing students as functioning engineers before they exit college by emphasizing interpersonal skills, critical thinking, collaborative projects,

and using standard engineering tools of today's industry. It is augmented with industry guest speakers and tours. The study hopes to compare traditional-based curriculum versus the industry-based curriculum as a means to enhance the overall student learning experience and preparation for an engineering career. A further goal is that the college retains engineering students by showing them what it is like to work as an engineer early in their college career rather than waiting until the senior year as in most engineering degree plans. A goal of the new curriculum is to train engineering students to act as practicing engineers so that they are more proficient engineers from the start of their career.

EFFECTIVELY USING ONLINE HOMEWORK

Richard Bennett and William R. Schleter

Recent enhancements to a customized online homework system used in a large, first-year physics for engineers class are presented. Some of the changes that are discussed include the following. Examples were added, initially just being references to textbook examples, and then links to instructor-generated examples, and finally short videos of solutions to the examples. There has always been a direct link to a discussion board, but now discussion board posts from previous semesters have also been made available to students. A units utility has been added whereby students have to enter units, rather than the units be specified. An automated intermediate value check has been added, where students can check some intermediate values with no grade penalty. Common mistakes and unreasonable answers are identified, with a warning given to the student. There are several common mistakes that are automatically checked for each problem, such as being off by a multiple of 10. Each of these interventions has proven to be helpful, but there have also been unintended consequences. These are discussed in the paper.

EXTENDED ABSTRACT - ANALYZING THE FIRST YEAR OF A FRESHMAN ENGINEERING EXPERIENCE PILOT PROGRAM

Jared Hansen, Bradley Bowen, Scott Pryor, Dan Ewert, Robert Pieri, David Wells, Magdy Abdelrahman, Joel Hanson and Lauren Roy

The North Dakota State University College of Engineering has over 500 freshmen enter the engineering program each fall. Of these students, approximately 34% graduate with an engineering degree within six years. A core group of faculty representing each of the different engineering departments has collaborated on the development of two freshman engineering courses to increase engagement and thereby achieve a higher retention rate for these students. The first course began in the fall of 2013 with 33 students, all of which were undeclared as to their intended engineering field, but calculus-ready. Eleven students enrolled in the second semester course. These courses are designed around project-based learning to engage the students in hands-on interactive experiences. The courses increased in rigor over the two semesters and had a unique design that was influenced by the interest of the students. This gave the students flexibility in the preferred deliverables, and met the requirement for several of the departments' graphical communication courses. These courses also include content for students to substitute or waiver some of their freshman general education requirements. Although mainly implemented to improve retention, several other benefits have been encountered during the pilot program; chiefly, influencing graduate student mentors in regards to teaching careers and improvement in student professional skills. Challenges have also been realized such as how to; 1) structure course substitutions, 2) meeting prerequisites from different engineering departments, 3) determining which classification of students to include given limited resources, 4) structuring the courses without full-time course instructors, and 5) implementing a systemic college change in a traditional instructional system. This paper describes the initial design of the first year engineering program in regards to the benefits and challenges mentioned above. It also describes the preliminary data collected from the faculty and students during the first year's implementation process.

FRIDAY SESSIONS

Session F1A: Choosing a Major

Chair: James Warnock, Mississippi State University

Time: Friday August 8, 8:30 a.m. - 10:00 a.m. *Room Frymire Auditorium*

FRESHMEN SEMINAR: GATEWAY TO CHOOSING THE RIGHT STEM MAJOR THROUGH CONNECTIONS

Grazia Lopez, Ashish Borgaonkar, Sarah Vandermark and Kelly Mongelli

I want to be an engineer – is that not good enough? Do I have to pick a major too? Oh Boy! Most engineering students have to go through this phase. Some are able to make a decision quickly and some need more help. Like many colleges, New Jersey Institute of Technology (NJIT) allows students to be admitted into engineering as 'undeclared.' Not declaring for too long is as dangerous as making a hasty decision and being stuck in the wrong major. It is very important that these students get all the help they need to make an informed decision. This paper describes how a general university requirement (GUR) course such as, freshman seminar class, can be used as a launching platform to organize and implement various strategies and initiatives to help students pick the right major during their first year. Using peer mentors to coordinate all these efforts helped maximize the effectiveness of this initiative.

ADVISING THE ENGINEERING COMMUNITY COLLEGE STUDENT

Susan Meardon

A student who wants to start their Engineering education at a Community College has very little idea of what classes to take, what classes transfer to a University and what is needed to succeed. It is imperative that the student has a well-defined pathway and is advised by faculty in the Engineering Department. The Engineering faculty is able to guide the selection of courses for their first two years that transfer to a University, so they may continue their coursework at the University, which enables them to find employment in their Engineering field of study. The advising model outlined in this report not only guides the student and connects them to their education plan. The Engineering Department at Wake Technical Community College has developed a process that ensures the students chooses the appropriate classes and meets the pre-requisites to graduate with an Associates in Engineering degree. An additional benefit of this model is to give the Engineering faculty member and the student establish rapport with one another. All Engineering Faculty worked in industry, therefore giving credibility to the advising for their semester by semester plan. The student understands the rationale behind the courses that they are to take. Research shows that when students forms a close relationship with an advisor, they complete and succeed at a higher rate. This paper describes the innovative process and interactive model for the student to follow thus providing a pathway to success in Engineering.

DEVELOPING AN ENROLLMENT MODEL FOR EVALUATING ALTERNATIVE STANDARDS FOR ADMISSION INTO ENGINEERING

Dennis O'Neal and Carolyn Skurla

Overall undergraduate enrollment in our engineering programs has grown rapidly during the past decade from 312 in 2004 to 764 in 2013. In fall 2012, we put forth a proposal to require a minimum composite SAT of 1110 (composite ACT of 24) for admission into pre-engineering because historical analysis showed that fewer than 15% of the students below this SAT threshold graduated with a degree in engineering. The prior analysis did not focus on the impact of SAT thresholds for managing enrollment. Because of the rapid growth in applications and student enrollment in engineering, a more detailed analysis was required that could evaluate student success and the impact of raising the minimum entrance requirements on the future growth of engineering. We developed a retention model, which used historical data to develop average year-to-year student retention rates within engineering for both freshmen and transfer students. The model also incorporated average data for students changing majors to engineering from within the university. The model performed well in predicting historical engineering enrollments over the 2006 to 2013 time period. The model was then used to evaluate different composite SAT thresholds (1150, 1190, 1220, and 1260) on future engineering enrollments under two application scenarios: 1) no growth and 2) 3% growth in future freshmen engineering applications and admissions. Based on the analysis, we selected a minimum composite SAT threshold for guaranteed admissions into pre-engineering of 1220 (ACT of 27) to begin to manage growth in the undergraduate program.

USING A CAREER CONFERENCE TO PROMOTE ADVISING IN THE FRESHMAN CURRICULUM

Dan Budny, Beth Newborg, Trisha Hyatt and Jim McCarthy

To help improve the retention of engineering students in the freshman year we created a number of writing assignments in the first year Introduction to Engineering course. These writing assignments were designed to engage students to research the field of engineering they were interested in. Despite our efforts many of the students just did not take the assignments seriously and as a result they did not get the full benefit of the assignment. To encourage the students to put more effort into the assignments we created the Freshman Career Conference. The conference is a Saturday event, that was modeled after career conferences at student professional conferences such as SWE, NSBE and SHPE. In the conference we brought in cooperate speakers that gave professional development workshops to the students and talked to the students about the importance of being their career development plans now as freshman. This paper discusses the factors around creating such a conference and the impact it has made.

Session F1B: Non-technical Issues for a First Engineering Course

Chair: Timothy J. Hinds, Michigan State University

Time: Friday August 8, 8:30 a.m. - 10:00 a.m. *The Presidential Dining Room*

EXTENDED ABSTRACT - HOMEWORK MENU SYSTEM FOR AN INTERDISCIPLINARY, INTRODUCTORY COURSE

Bonnie Boardman, Linda Barasch and Nancy Michael

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. All students entering the college are required to take this one credit hour introductory course. Students enter the college with vastly different past experiences. Some students are entering directly out of high school while others enter the college with as many as 100 transfer credit hours. This non-standard population meant standard homework assignments didn't always benefit all students. Study skills type questions that often tremendously benefited true freshmen were sometimes unnecessary for students who had been in higher education for many semesters. Those more seasoned students often also had life experiences which made them appreciate problems that focused on professional skills that the newer students didn't have enough experience to grasp. In the Fall 2013 and Spring 2014 semesters, to try to better accommodate the entire population of students in the course, the authors experimented with a new format for the homework assignments. Students were given a menu of homework problems with differing point values. Students could pick and choose any combination of problems to earn the total value of the assignment. The problems in each menu were assigned based upon text reading from one or more chapters. Therefore, while content was consistent for all problems, the depth and critical thinking skills necessary to successfully answer the question differed. The goal of the homework menu system was to allow students to choose problems that would individually benefit each student as much as possible. This paper will discuss the details of the homework menu system as well as an analysis of results from the first semester of use.

SKILL SETS TO BE INCORPORATED IN THE FIRST YEAR OF ENGINEERING EDUCATION

Sandeep Dilwali

This paper reviews skill sets which are generally included in the curriculum of the first year of engineering at many institutions of higher education. Innovative suggestions are made regarding few skill sets which if included in the first year of engineering education, would enhance significantly the quality of engineering education. These recommendations are based on experience and discussions held with industry, faculty and administrators regarding skills sets required in successful engineers and professionals. This work has significance in review of first year engineering education and suggestions for changes which if incorporated, could be helpful in the overall development of well-rounded engineers.

PROJECT CONNECTIONS: FRESHMEN-SENIOR INTERACTIONS-YEAR 2

Harovel G. Wheat

Project Connections is an initiative in which senior Mechanical Engineering students in the senior design capstone course give presentations to first-year students in the introductory course in Mechanical Engineering. The presentations are related to the projects the senior students are working on. The idea is to encourage interactions between seniors and first-year students, to increase understanding of what mechanical engineers do, and to show first-year students what they will be capable of in just four years. Project Connections was first

implemented in the 2012-2013 school year with special funding from the School of Engineering. That included funding for a special TA for Project Connections activities. Due to the overwhelming success of Project Connections, as measured by student responses to surveys, it was continued during the 2013-2014 school year. However, this time there was no special funding. This paper describes activities in the second year of Project Connections and efforts to make it sustainable, with limited financial support.

FOUNDATION COALITION: IMPACT ON CHEMICAL ENGINEERING EDUCATION AT TEXAS A&M UNIVERSITY 20 YEARS LATER

Mark Holtzapple, Katherine Toback and Carol Kamps Holtzapple

In 1993, the Foundation Coalition (FC) was formed to provide an innovative curriculum for freshman and sophomore engineering students in nine universities, including Texas A&M. FC themes include an integrated curriculum, active/cooperative learning, technology-enabled learning, and continuous improvement. For many years, FC was generously supported by the National Science Foundation (NSF) and produced numerous papers showing significant benefits, such as greater retention, improved academic performance, and more rapid graduation. Once NSF funding ended, Texas A&M institutional commitment to FC waned and the freshman engineering program fragmented into three tracks. Only Track C (chemical and petroleum engineering) continued the educational traditions established by FC. Because of transfers and changes of majors, not all students who enter the sophomore chemical engineering programs had Track C as freshman. This provides a unique opportunity to run "controlled studies" to determine the impact of FC principles on chemical engineering education. The data demonstrate that students who participated in Track C exhibited significantly better performance. For example, grades in the first chemical engineering course (mass and energy balances) increased by 0.45 grade points and the "recycle rate" for this course decreased by a factor of 2.6.

Session F1C: Laboratories for a First Year Course

Chair: Rod Foist, California Baptist University

Time: Friday August 8, 8:30 a.m. - 10:00 a.m. *Room: 1011C*

USE OF ROBOTICS IN FIRST-YEAR ENGINEERING MATH LABORATORY

Rod Foist and Grace Ni

According to National Science Foundation (NSF) research, engineering mathematics courses with a laboratory ("hands-on") component are more effective in helping students grasp concepts, than lecture-only approaches. Beginning in 2008, California Baptist University (CBU) received NSF funding through Wright State University to develop a first-year Engineering Math course (EGR 182) with laboratory projects. Our new College of Engineering currently offers nine degrees and all freshmen must take this course. The lab projects aim to illustrate key mathematic concepts via hands-on experiments representing each discipline. Two new projects were introduced during the 2013-2014 school year. This paper reports on a trigonometry-with-robotics lab. A companion paper describes a calculus-themed project using electronic filters. The trigonometry lab runs for two lab sessions. In the first session, students focus on taking angle-versus-lengths measurements with a sun-dial-like instrument and calipers. The simple Plexiglas "sun-dial" simulates a two-link planar robotic arm. Given an angle, students dial it onto the instrument, then measure the x and y lengths; or vice versa. They also create MATLAB function and script files to cross-check and validate the measurements. In session two, a computer-controlled humanoid robot replaces the "sun-dial". Students type in shoulder and elbow joint angles, watch the robot move its arm, then hear the robot report verbally the final location coordinates of its hand. Conversely, robot hand coordinates can be typed in to determine the resulting joint angles. Also, MATLAB files are edited to create equivalent files tailored to the robot. After running the new lab for two semesters, no statistical data has yet been acquired regarding final grade improvements. However, student feedback indicated a high level of popularity with the lab. They felt that it showed a good real-world application of math concepts and was a "cool way" to introduce robotics.

AN "INTUITIVE CALCULUS" PROJECT, USING ELECTRONIC FILTERS, FOR A FIRST-YEAR ENGINEERING MATH LABORATORY

Rod Foist and Anthony Donaldson

According to National Science Foundation (NSF) research, engineering mathematics courses with a laboratory ("hands-on") component are more effective in helping students grasp concepts, than lecture-only approaches. Beginning in 2008, California Baptist University (CBU) received NSF funding through Wright State University to develop a first-year Engineering Math course (EGR 182) with laboratory projects. Our new College of

Engineering currently offers nine degrees and all freshmen must take this course. The lab projects aim to illustrate key mathematic concepts via hands-on experiments representing each discipline. Two new projects were introduced during the 2013-2014 school year. This paper reports on a calculus-themed project using electronic filters. A companion paper describes a trigonometry-with-robotics lab. Fundamentally, calculus is about two related concepts: the mathematical operations known as integration and differentiation. The "intuitive calculus" lab's primary objective is to help students see a simple and applied way of understanding these two operations. Simply put, integration is a "smoothing" function, and differentiation is a "roughening" function. In engineering language, they're known as a low-pass filter (LPF) and a high-pass filter (HPF), respectively. Following a novel pre-lab assignment, students build and evaluate simple low- and high-pass "RC filters" (using one Resistor, one Capacitor). Next, they repeat the experiments, but using equivalent digital filters—implemented in a provided Field-Programmable-Gate-Array (FPGA) circuit board—which we developed. In all cases, the smoothing and roughening operations are observed, via an oscilloscope, by varying the filter input frequency and noting how the output is attenuated—as a function of frequency—depending on the filter type (LPF/HPF). After running this new lab for two semesters, no statistical data has yet been acquired regarding final grade improvements. However, student responses to the pre-lab and hands-on portions seem to indicate an improved understanding of calculus and fascination with seeing math used in a real-world application.

EXTENDED ABSTRACT - ENGINEERING RETENTION AND STUDENT MATH PREPAREDNESS

Sungwon S. Kim

Retention of freshman engineering students has become an important national issue, as many students seem to start out in engineering programs but not enough seem to finish. Many reported data show freshman enrollment numbers compared to seniors who graduate successfully with engineering degrees to calculate a retention rate. While this number may be easy to calculate, it fails to provide any insight into any characteristic of the students included in the numbers making it difficult to identify the root of the so called retention problem. This paper investigates the level of math preparedness of students in a freshman introduction to engineering course. A wide spectrum of student math preparedness levels was observed from students who were enrolled for algebra courses all the way up to students who had completed differential equations. The large population of students who were not adequately prepared with college freshman level math skills had difficulty in following lecture material and their level of satisfaction was low. Contrastingly, the students who were adequately prepared enjoyed the lecture material and their level of satisfaction was high. Survey results showed that higher level of math preparedness led to higher levels of learning and course satisfaction, indicating that adequate math readiness at the freshman level could be seen as an important indicator that can be used to gauge student success in engineering programs, including issues related with retention. Based on these survey results, a co-requisite designation was placed on to the freshman introduction to engineering course so that only students who were minimally prepared in math were allowed to register. These survey results help to better identify important factors in retention issues and provide direction to potential solutions.

PROVIDING MORE LAB OPTIONS FOR FIRST-YEAR FEMALE ENGINEERING STUDENTS IN MATH AND ENGINEERING COURSES WITH LAB COMPONENTS

Ziliang Zhou, Helen Jung and Rod Foist

This paper discusses an observation which the current authors have made over the years of freshmen engineering teaching and it is related to courses with lab components. We have noticed that most of the first-year female engineering students were more intimidated by the lab activities than their male counterparts. When performing a group lab activity, the female students tend to stay in the background and naturally migrate into the supporting roles, such as taking data and cleaning up afterwards. They let their male classmates take charge of running the actual lab experiment most of the time. In this work-in-progress study, we begin with some preliminary data of the roles played by both male and female students in a typical lab activity. The data were analyzed together with our anecdotal observations based on working with the students in various lab courses. As we continue our effort of recruiting more female engineering students, we believe that having a complete lab experience plays an important role in female engineering student retention. When designing courses with lab components, we need to consider the impact of this experience and make proper adjustment in the content of our lab activities. For future work, we plan to increase the variety of lab activities, some of them tailored more towards female engineering students. Our long term goal is to keep the proper balance on the variety of lab activities for both male and female engineering students and to improve specifically the female engineering student retention rate.

Session F1D: Technology Enhancements in a First Year Course

Chair: Brent Donham, Texas A&M University-Commerce

Time: Friday August 8, 8:30 a.m. - 10:00 a.m. *Room: Hagler Auditorium*

EXTENDED ABSTRACT - ENHANCE STUDENT INNOVATION WITH FIRST YEAR ENGINEERING PROGRAM

Liang Li Wu and Gregory Washington

Implemented for the second year, this study reports on the continuous progress of a two-quarter first-year engineering course, Introduction to Engineering, which provides an early introduction to the engineering disciplines and design process. Students are challenged to finish two design projects in Fall and Winter quarter respectively acquiring skills in CAD and microprocessor programming to design, fabricate and test a device in teams. 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, we develop student leadership and inspire innovation by integrating entrepreneurship into the course during the second quarter. Students experience the process of developing a business plan using engineering ideas with frequent interaction and guidance from industry affiliates. The impact of the course is assessed through student surveys.

EXTENDED ABSTRACT - A PROBLEM-ORIENTED VISUALIZATION APP FOR IMPROVED LEARNING OUTCOMES

Nasser Alaeddine and Bing Guo

This paper presents the development of a problem-based learning environment in the form of a new App, MechaGym, for mobile devices and the web. MechaGym is designed initially to assist in the first-year engineering education course Statics and Particle Dynamics. It enables the user to practice solving problems in an interactive 3D environment for improved learning outcomes. It exploits visualization techniques to present interactive 3D objects, thus making it more intuitive to learn the concepts. A prototype tool preceding MechaGym had been shown to be effective in enhancing students' understanding of 3D force vector analysis. It is expected the app MechaGym, when completed, will produce major improvement in the learning outcomes of Statics and Particle Dynamics.

WEB BASED PROJECT REPORTS

Richard Bennett and William R. Schleter

Most freshman engineering classes have some form of a presentation and /or a report associated with projects. One of the challenges with a large class is providing efficient, but meaningful feedback and grading. It is also important to provide a good framework of instruction to students for their first projects in engineering. We have experimented with a web based form for the project report. The students fill in boxes for such things as title, description, process, conclusions, feedback, other information, and references. Students also upload a device picture, a team picture, a video of the project in operation, and a short video in which the team describes their project. One advantage of the web form is that it enables easy grading; a web form is developed with side-by-side windows of the grading rubric in a web entry form and the team project report in the other window. Another advantage is that a summary of all the projects can be easily developed to showcase what the class has done. Potential disadvantages are that the web form does too much for the student (spoon feeds the required parts of the report), and can constrain creativity in presenting results. Overall, the web form has been positive. The concept has been extended so that students submit a planning report and a status report via a web form. The planning report requires students to list any assigned team members that they have not been able to contact, a brief description of their project (with the understanding that this could change as the project progresses), and how the team plans on dividing the work. The status report requires teams to report any team member who is not contributing, the progress the team has made, and any changes the team has made to their original plan.

EXTENDED ABSTRACT - LESSONS LEARNED IN A FRESHMAN EXPLORING ELECTRICAL ENGINEERING CLASS

Melinda Holtzman

We developed a new introductory class for freshman in Electrical Engineering to replace the general introduction to engineering taught by the college. The previous survey class with no lab experience did not provide much inspiration or learning for our students. The class we developed includes a hands-on quarter–long team project, labs, speakers and classroom activities. The goal is for students to: (i) learn about electrical engineering as a

career, and (ii) acquire knowledge and tools that will help them as electrical engineering students. The class has received some negative feedback, however, and we are now considering some major revisions. Some aspects, such as the project and lab experience, are largely successful. Some aspects, such as ungraded, credit-for-completion homework and lab reports, and lack of exams, have led to low expectations and work quality, and a rough transition when students take the next, more rigorous, engineering course. This freshman class was intended as a fun and non-intimidating introduction, where students could learn about the subject without being tested, and learn lab skills without pressure to complete difficult assignments. However, this "warm and fuzzy" approach felt like a "bait-and-switch" when the next class required real work. The challenge we face is how to make this class more rigorous and realistic, while still giving students from diverse backgrounds with different levels of preparation a fair chance. We do not want to promote students who are not ready to proceed, but we do not want to weed out students who just need a little more help or encouragement to get started.

Session F2A: Living and Learning Communities

Chair: Richard L. Kopec, St. Edward's University

Time: Friday August 8, 10:30 a.m. - Noon *Room Frymire Auditorium*

DISCIPLINE BASED LEARNING COMMUNITIES TO ENHANCE STUDENT SUCCESS, BONDING, AND RETENTION.

Ashish Borgaonkar and Jack Gentul

First year students entering New Jersey Institute of Technology (NJIT) join discipline based learning communities. Learning communities is an initiative run by the Office of the Dean of Students focused on increasing student success, bonding and retention. Through the program the students bond with one another and connect with their academic departments. Through Learning Communities---- Students immediately connect and identify as a member of a group, all sharing the same major: On the first day of orientation, resident and commuter students are introduced to their learning community cohort. They meet and learn about one another and begin working together. Students connect with their major and experience deeper learning: Students in each cohort have linked coursework â€" they take together certain courses that have connecting â€œthreads,â€ • allowing individual instructors to explore the same concepts from different perspectives. Students are mentored in and out of class: Two upper-class mentors in the same major are assigned to each cohort. They assist the instructors of linked courses and coordinate tutoring, and study sessions in the LC Lounge as well as social activities. Students are closely monitored: Instructors for the linked courses and academic advisers meet bi-weekly in CASEing meetings to discuss the â€œthreadsâ€ • that link their courses and discuss the progress of individual students in their cohorts. Students feel a sense of belonging: Students, who connect to their college and feel passionately about are more likely to succeed, and contribute to various university programs and undertakings as alumni. Students have access to Study Lounge: Our lounge is a purpose designed group study room sponsored by PSE&G. This lounge allows students to study in groups, prepare for common exams, and otherwise socialize with their cohort mates and peer mentors. In spring semester, students present at a freshman design showcase coordinated through their core humanities class: The freshmen divided into teams and worked on research projects whose central theme this time was multipurpose design. They presented their work at the showcase, where they had to explain their work to judges who evaluated the projects. During AY 2013-14, learning communities comprised of close to 350 students in 16 cohorts across 3 colleges guided by 35 peer mentors and supervised by a group of 50 faculty/staff members. In this year, study lounge saw over 2000 sign-ins and over 40 planned group study and tutoring sessions that fetched 600+ attendance. In a survey conducted in fall 2013 within learning community students 89.8% students said they would recommend learning communities to a friend or a prospective student. Following table presents studentsâ€™ rating on performance of learning communities. 1 (strongly disagree) â€" 5 (strongly agree) of over 240 respondents (75% of all learning community students) Question Average Response I feel that I belong to NJIT community 3.9 I have made friends at NJIT upon whom I can rely 4.3 I have confidence in the university environment 3.7 NJIT provides academic resources that I need 4.1 How satisfied are you with Learning Communities 3.8 Overall performance of Peer Mentors 4.3

ENHANCING ACADEMIC SUCCESS THROUGH A FRESHMAN YEAR ENGINEERING LIVING-LEARNING COMMUNITY

Brian Bielenberg, David Moore, Jeff Seela and Muna Balfaqeeh

The number of students enrolled in engineering degree programs in the United Arab Emirates (UAE) has risen

38% in just three years, a positive response to national calls to develop an "elite corps of scientists, engineers and technicians." This rapid increase in enrollment has led to demographic changes in the recent cohorts of entering engineering students, with larger numbers beginning their studies underprepared in the areas of mathematics, sciences, and the academic skills needed to succeed in engineering studies. The Petroleum Institute, a leading technical university in the UAE, has responded by developing a freshman year experience that integrates academic affairs, residential life, and student affairs. The overall aims of this initiative are to provide a comprehensive process that addresses the intellectual, social, and emotional growth and development of our students. Instructors, peers, advisors, staff and faculty all play a role in promoting enhancement of the skills and attitudes necessary for the attainment of academic, career and life goals, including the competencies needed for success in academic coursework. Following the fall 2013 semester, an extensive assessment of the impacts of this program on student engagement and development was conducted using a mixed methods approach that included student surveys, analysis of reflective writing and statistics on use of student support services and academic performance. This paper reports on the findings of this assessment, highlighting strengths and discussing suggested areas of improvement, suggestions that will enable this, and similar, freshman year experience initiatives to develop engineering undergraduates who possess the required competencies to contribute to a knowledge-based society.

EXTENDED ABSTRACT - COMMUNITY FOR ACHIEVEMENT IN SCIENCE, ACADEMICS, AND RESEARCH: THE CASAR PROJECT

Richard L. Kopec and David A. Blair

The St. Edward's University (SEU) Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) Project: The Community for Achievement in Science, Academics and Research (CASAR) aims to increase the number and retention of students in Science, Technology, Engineering, and Mathematics (STEM) disciplines by creating an interdisciplinary academic living/learning community comprised of faculty, staff, and students. Our ultimate goal is to increase the number of the STEM graduates from St. Edward's University. To obtain this goal, a phased program was implemented: (1) A summer, pre-college academic enhancement workshop, (2) A first-year experience course for students in STEM disciplines directly linked to a Science Living-Learning Community (LLC); and (3) early undergraduate research and interdisciplinary learning opportunities across all STEM disciplines. Awarded in 2010, the project has just graduated 9 STEM majors from its first cohort of 17 students, plus three students from cohort 2. Additionally, one student from the first cohort was accepted into professional school and did not complete a baccalaureate degree while another first cohort student will be graduating in the next academic year.

FROM ORIENTATION TO FIRST YEAR EXPERIENCE - THE TRANSFORMATION OF A FIRST YEAR COURSE, THROUGH CAMPUS COLLABORATION

Shari A. Luck and Terri Lynch-Caris

Freshman students arrive to campus excited and ready to conquer the world. The challenges of college life and academic preparedness often come as a shock to the under-prepared and even to the well-prepared student. The generational changes of the incoming freshmen often come as a shock to seasoned faculty members. In order to meet the challenges, most universities have some kind of orientation program to introduce the rules and policies of the campus and even to introduce students to their peers. Orientation may range from a few hours to a few days to a complete course in the first semester. This paper describes a First Year Foundations course and its transformation from a more traditional orientation style class, to a true first year discussion seminar - developed with three specific learning outcomes and an intentional goal to create a "sense of belonging" to the campus. The learning outcomes were derived through the collaboration of a multi-disciplinary group of faculty, staff and students, all with a shared interest in freshman student success. The course resides within the Center for Excellence in Teaching and Learning to promote best practices in teaching while serving the varied academic needs of multiple disciplines across the campus. First Year Foundations (FYE 101); provides critical information on personal, academic and professional development for first-year students. Class discussions support student engagement in the campus community, help make important connections for students to develop a sense of self-governance, and set a foundation for both critical thinking and a reflective learning mindset. Students learn to interact in the academic and cooperative work environments successfully. Mentoring and interaction with the instructors provides support and guidance for students to be fully integrated into the campus and learning environment. This paper will describe the course instructional model, syllabus development, learning goals and assessment plan along with results from the pilot offering.

Session F2B: Various Pre-Engineering Programs

Chair: Andrea M. Graham, Texas A&M University

Time: The Presidential Dining Room *The Presidential Dining Room*

AN ANALYSIS OF PRE-ENGINEERING GATEWAY COURSES USED IN THE PROGRESSION OF ENGINEERING MAJORS AT THE JOINT FAMU-FSU COLLEGE OF ENGINEERING

Melodee Moore, Reginald Perry and Charmane V. Caldwell

This paper will present findings from an analysis of student academic performance in the gateway classes required as part of the pre-engineering program at the Florida Agricultural and Mechanical University-Florida State University (FAMU-FSU) College of Engineering. The pre-engineering requirements include five gateway courses which are First-Year Engineering Laboratory, Calculus I, Calculus II, General Physics I, and General Chemistry I. Chemical engineering students replace General Physics I with General Chemistry II. This analysis examines the performance of students in the five gateway courses to determine if all five are needed to correctly predict whether a student will successfully complete the pre-engineering program. It will guide any recommendation to revise the pre-engineering program to include only courses significant in determining the likelihood of degree completion. Ultimately, reducing the number of gateway courses should reduce the total time needed by students to complete the pre-engineering program, as well as the overall percentage of engineering students who are classified as pre-engineering majors.

EXTENDED ABSTRACT - DEVELOPING A FIRST-YEAR ENGINEERING SUPPLEMENTAL COURSE FOR STUDENTS UNDERPREPARED IN MATH

Denise H Bauer and Joseph Law

Approximately 42% of the entering first-year engineering students at the University of Idaho are considered underprepared in math; therefore, they must start at least one level behind in Pre-Calculus (MATH 143). MATH 143 is structured so most work is done at the student's own pace, and many of them struggle since they do not have the maturity in the first semester. This struggle sometimes results in the students leaving engineering or continuing to struggle in subsequent math courses. However, although these students may not be math-ready, they possess other critical skills and aptitudes that make a great engineer from their life experiences from working on farms, in the timber industry, etc. Based on other successful programs outside of engineering at the University of Idaho and other institutions, we are developing a course, Engineering Foundations (ENGR 204) specifically for these students. ENGR 204 will not only provide additional guidance in MATH 143, but also introduce the students to various fields of engineering, resources available across campus and in the college, and, most importantly, other engineering students. Forty students will be enrolled in the pilot course offered in Fall 2014. With this course we anticipate students will become better prepared for later engineering courses, get connected with other students earlier, and learn critical skills needed for success.

EXTENDED ABSTRACT - DEVELOPMENT OF A PRE-ENGINEERING PROGRAM FOR HIGH SCHOOL STUDENTS

Stacy K Firth, Milton H Watts and Sean D Firth

A Pre-Engineering Program for high school students is being developed to address the issues associated with student interest and understanding of engineering, as well as student preparation for study of engineering at the college level. The program consists of two courses offered to high school students, "Survey of Engineering" and "Engineering Design". The first course, Survey of Engineering, is a project and experience based course designed to introduce students to the various fields of engineering and give students experience with the engineering design process. The course emphasizes the need for engineers to have good written and oral communication skills. Students gain understanding of important factors in engineering design decisions and see how those decisions affect the outcome of their designs. Through study of the engineering disciplines, students obtain an appreciation for the importance of the subjects of math and science to engineers, how exciting the field of engineering can be, and the ways in which engineers better the lives of people and affect the world. Survey of Engineering has been piloted during the 2013-2014 school year. This extended abstract describes the students' experience with Survey of Engineering, lessons learned during the pilot year, and future plans for this course and the Pre-Engineering Program.

DO IT RIGHT THE FIRST TIME STUDENT DEVELOPMENT NOT REMEDIATION

Matthew Calhoun and Herb Ilisaurri Schroeder

Retention of science, technology, engineering, and math degree seeking students is a national problem in

universities across the country. There are many reasons for this. One is that underprepared students are arriving on campuses. This study explains a successful university driven approach of a pre-college pipeline leading to students being socially and academically prepared for a STEM degree by the time of college matriculation. Universities adopting this approach will not only ensure students are prepared prior to arriving at the university, but will also help with the declining pre-college education rankings for the U.S. Presently, among the 34 countries that are a part of the Organization for Economic Co-operation and Development, the latest findings indicate that the U.S. ranks 27th in mathematics and 20th in science. Furthermore, the U.S. spends more per student than most countries in K-12 education, but that has not translated into better performance. Clearly, spending more money is not the answer. Instead, re-allocating resources to successful approaches that motivate students to complete gateway courses prior to enrolling in STEM degrees at universities is a solution. This paper presents preliminary results from a multi-year case study of a university program that works with pre-college students beginning in middle school through university graduation. This research study focused on answering the following research questions: (1) what programmatic components have been found to encourage students to complete gateway courses prior to university STEM enrollment, and (2) what programmatic components help to retain students at the university level in STEM? The implication of the findings shows that universities can take an active role to motivate and better prepare students prior to STEM enrollment. Through this effort the U.S. K-12 education system can be improved and in turn more students will be arriving on university campuses that have completed gateway courses for enrollment in STEM degree programs.

Session F2C: Novel Techniques for Improving a First Year Course

Chair: Lynn Peterson, University of Texas Arlington

Time: Friday August 8, 10:30 a.m. - Noon *Room: 1011C*

A HYBRID FLIPPED FIRST YEAR ENGINEERING COURSE

Jess Everett, Jenahvive Morgan, Kaitlin Mallouk and Joseph Stanzione

The purpose of the work presented here is to explore the use of online text and exercises in a hybrid flipped course to make class time available for active learning. This work is significant because online resources offer opportunities to increase the efficiency and effectiveness of engineering education. Levels of satisfaction with online aspects of the course were high among students and teachers. Students were satisfied with the ebook content and navigation. They found useful many of the utilities provided with the ebook, e.g., immediate feedback on answers, due date reminders, and scores by problem, chapter, and overall. Faculty were also pleased with the ebook content and navigation. They agreed that the online ebook and exercises constitute a good pedagogical tool. They also reported that many of the utilities were useful, e.g., transferring grades to Excel, reviewing student online work, viewing solutions, etc. The online ebook and exercises were somewhat successful at getting students to prepare for class by creating an atmosphere of expected preparation and making preparation necessary to perform well on the graded online exercises due before related material was covered in class. However, survey results suggest that the graded online exercises were not always rigorous enough to motivate students to prepare for class as desired. On average, students carefully read only 4.5 of the 11 chapters. While a good number of active learning techniques were employed in the Fall 2013 semester, the goal is to have more included in future course offerings. A three pronged approached is suggested: (1) Improve the online exercises to motivate better student preparation; (2) develop more active learning modules for instructor use; and (3) strongly encourage future instructors to replace lecture with active learning.

EXTENDED ABSTRACT - IS STUDENT PREPAREDNESS AND PERFORMANCE IMPROVED BY USING PRE-LESSON VIDEOS?

Amy Hamlin, Amber J Kemppainen and Mary Fraley

Students often come to class without adequately preparing for the day's lesson, despite being given reading assignments and short quizzes over the reading at the beginning of class. Providing additional support materials to be reviewed before class in a format preferred by first-year engineering students may improve their preparedness for class. This paper will focus on the impact of pre-lesson videos piloted in spring 2014 on student preparedness and student performance. Student preparedness was assessed using surveys given at the end of the semester. Students in the pilot group reported that they spent more time preparing for class and felt more prepared than students in the same course in fall 2013. Student performance was examined using exam scores on video content. It was found that the pilot group had better scores on both Exam 2 and the Final Exam, although the differences were not statistically significant. These results suggest that the pre-lesson videos may contribute to both increased student preparedness and student performance.

PRELIMINARY EXPERIENCES WITH "FLIPPING" A FRESHMAN ENGINEERING PROGRAMMING COURSE

Renee Mary Clark, Dan Budny, Karen M Bursic and Mary Elizabe Besterfield-Sacre

We employed the "flipped classroom" in a freshmen engineering programming course taken by nearly 700 first-time freshmen and transfer students during the 2013-2014 academic year. In the "flipped classroom," students are encouraged to watch video lectures outside of class. This enables more class time for active learning, practice and demonstration of programming skills, and one-on-one assistance, with the instructor serving more so as an advisor versus a transmitter of information. Although over 50% of freshmen respondents preferred using class time for problem solving and active learning with the instructor present, we found that the very great majority did not use the videos for first-time instruction as intended with the flipped classroom. Frequently-stated benefits of the flipped classroom by students included access to multiple sources for explanation or clarification, reinforcement of understanding, flexibility and convenience, in-class application of knowledge, and the ability to re-watch videos and self-pace their learning. Based on the College and University Classroom Environment Inventory, freshmen scored this flipped course highest on the personalization dimension, which assesses student-to-teacher interaction. We further evaluated this flipped classroom for the degree of instructor-supported active learning and problem solving using a structured observation protocol known as the Teaching Dimensions Observation Protocol (TDOP). Based on the TDOP, we observed that 40% or more flipped class segments observed over the two semesters involved instructor-led demonstration of programming skills as students actively followed along on their computers as well as active problem solving by students as the instructor or TA circulated throughout the classroom for assistance. The experiences and reflections of multiple instructors in teaching this flipped course will be discussed.

EXTENDED ABSTRACT – ENHANCING ENGAGEMENT IN A FIRST YEAR ENGINEERING COURSE

Denise Martinez

In this effort, new pedagogical and technological components are brought together to create a more active and engaged first year engineering experience. The original structure of the two-course sequence was based on the Foundations of Engineering model disseminated from the Foundation Coalition effort in the late 90s, with content evolving as expectations of the first year experience evolved. Several factors contributed to the choice to implement redesign on the first year engineering sequence. First, there is a constant struggle between the material that needs to be covered versus the class-time available to facilitate higher level problem solving and concept understanding. Second, methods of instruction must continually evolve to keep pace with the engagement styles of the audience. Third, a collaboration has developed across the Texas A&M system which enables sharing of techniques as well as content. Modules developed in this initiative are easily sharable as typicall components of an introduction to engineering sequence. In this session the tools and techniques implemented in this course redesign are presented, including the use of lecture capture for pre-class material and problem demonstration, engagement activities such as crossword puzzles for definitions and terminology, and student response systems (“clickers”) for readiness assessment and quick concept polling. Furthermore, explaining the technique as “shifting” of time spent on various instructional pieces was very successful with the students and will be included in this paper.

Session F2D: Student Development Models

Chair: Ken Reid, Virginia Polytechnic Institute and State University

Time: Friday August 8, 10:30 a.m. - Noon *Room: Hagler Auditorium*

CONNECTING ENGINEERING STUDENTS TO PRACTICING ENGINEERS: NORTHERN ARIZONA UNIVERSITY'S INAUGURAL PAIR OF FIRST YEAR ENGINEERING EVENTS

David Richter

This paper describes a First Year Engineering Event (FYEE) intended to promote networking between engineering students and professional engineers. In addition to networking, the FYEE provides an opportunity for promoting the “pillars” of the Design4Practice (D4P) Program: 1) engineering design, 2) communication, 3) teamwork, and 4) professionalism. The D4P Program courses include students from all engineering disciplines at Northern Arizona University (NAU), which provides additional challenges with project selection and representation of multiple engineering professions. The details of the project, to rescue a dog that has fallen into a well, are included as a non-disciplinary design project. This paper records the initial 2 FYEEs, including modifications and suggestions for future improvements. Lastly, this paper posits initial research questions to identify and measure potential benefits of the FYEE.

EFFECTIVE ORAL COMMUNICATION: AN EXPERIENTIAL APPROACH

Peter J. Shull

Working effectively and efficiently in a team environment is a critical element of engineering as it is in many other fields. Nearly all team/group development methods focus on some combination of The Engineering Design Process, which defines a systematic method that improves the possibility of producing a quality product, and a version of the team development process that was first proposed by B. Tuckman in 1965 that incorporates the concepts of Forming, Storming, Norming, and Performing. Typically, in training, students are told of the importance of conforming to team norms and thus it is assumed they are now equipped with knowledge on how to adjust their behavior. This may seem odd but I have never seen a case where lecturing about Tuckman's process worked except, perhaps, by accident; definitely not by design. In my experience, working with students over the past 12 years in a multitude of different classes at different points in their academic career, I have found that learning the elements that make a team or group function well (functional group dynamics) is extremely difficult for the students. The students' abilities appear to simply mimic their abilities developed prior to college by factors unrelated to their formal education. It is also my experience that functional group dynamics can be learned. Although there are a number of elements of functional group dynamics, I will address functional oral communication. The strategy used is one developed to help students explore both the elements of oral communication that promote and inhibit the exchange and development of ideas. In my experience working with students over the past 12 years in a multitude of different classes at different points in their academic career, I have found that learning the elements that make a team or group function well (functional group dynamicsâ€"FGD) is extremely difficult for the students. The studentâ€™s abilities appear to simply mimic their abilities developed prior to college by factors unrelated to their formal education. It is also my experience that functional group dynamics can be learned. Although there are a number of elements of FGD, I will address functional oral communication. The strategy used is one developed to help students explore both the elements of oral communication that promote or inhibit the exchange and development of ideas.

CONFESSIONS OF FIRST YEAR ENGINEERING STUDENTS: "HOW I NEED TO CHANGE"

Kelvin Kirby

First year and first semester transfer engineering, computer science and technology students were given the assignment to "Design Your Process for Becoming a 'World Class' Engineering Student." The assignment was administered as a design project taken from the 2014 Chautauqua Short Course – "Enhancing Student Success through a Model Introduction to Engineering Course" and the textbook "Studying Engineering: A Road Map to a Rewarding Career" (4th Edition) by Raymond B. Landis. The assignment was modified based on the concept that engineering students are engineering students for life or as long as they are working in the engineering profession. As a practicing engineer, the learning process, problem solving and working in teams will continue with significantly greater outcomes and consequences. Seventy (70) students were administered the project assignment at the end of the spring 2014 semester. The students were completing the one credit hour, Intro to Engineering, Computer Science and Technology course along with modified versions of the four (4) exams provided as faculty resources with the textbook prior to the project assignment. Students were given three weeks to complete the project which required responses to ten (10) selected areas: (1) Establishing Goals, (2) Developing a Strong Commitment, (3) Preparing to Deal with Adversities, (4) Managing Aspects of Personal Life, (5) Changing Your Attitudes, (6) Changing Your Behaviors, (7) Understanding Teaching and Learning Styles, (8) Managing Your Time and Energy, (9) Understanding the Principles of Teamwork and Leadership, and (10) Engaging in Good Health and Wellness Practices. For each of the ten (10) areas, students were required to discuss: (1) Where Am I, (2) Where a 'World Class 'Engineering Student Would Be' and (3) What I Need to do to Move from Where I Am to 'World Class' Engineering Student status. Students confessed their personal shortcomings and fears, along with proposed corrective actions. The responses will be analyzed and presented for future reference. The findings will be presented at the beginning of the next Intro to Engineering, Computer Science and Technology course to help benefit the next cohort of freshmen students.

MODELING RETENTION AND GRADUATION OF ENGINEERING STUDENTS OF DIFFERENCE SEXES

Joe J.J. Lin and P.K. Imbrie

In this study, student success models based on logistic regression are developed to identify important predictors for retention and graduation of female engineering students. Then these findings are compared with the predictors of male engineering students to identify the differences between genders. The results suggest there are clear differences between the significant predictors for retention between female and male engineering students.

For example, deep-learning style and number of semesters of English in high school are significant predictors for female retention in engineering, but not as significant for male students. Also the results show that there are more differences between predictors for retention and graduation of female students than for male students. With the knowledge of differences in predictors for retention/graduation of female and male students, new strategies can be developed in future to help educators develop better programs for recruiting, admitting, retaining and educating female engineering students.

Session F3A: Roundtable Discussions

Chair: Teri Reed, Texas A&M University

Time: Friday August 8, 1:30 p.m. - 3:00 p.m. *Room: 1011 B & C*

Session F3B:

Time: *Room 1011C*

Session F3C:

Time: Friday August 8, 1:30 p.m. - 3:00 p.m.

Session F3D:

Time: Friday August 8, 1:30 p.m. - 3:00 p.m.

Session F4A: Transition to College & Mentoring

Chair: Donald Visco, The University of Akron

Time: Friday August 8, 3:15 p.m. - 5:00 p.m. *Room Frymire Auditorium*

RESOURCE MANAGEMENT IN COMPLETION OF AN ARDUINO ENGINEERING PROJECT AND ITS INDUSTRIAL APPLICATIONS

Antonio B. Mejia, Alyssa Linares, Candice Reyes, Miguel Rosales, Sharon Hall and Nathanial Wiggins

An engineering project is posed to first year engineering students in a Programming for Engineers course. Teams are to develop projects with applications to various fields of engineering. Team ventures are successfully obtained through the implementation of programming integrated development environments (IDE). Students are offered the assistance of peer mentors and open access to resources available through robotics laboratories. Via networking with the robotics club and faculty, fellow engineering students, and industrial production professionals, a team is able to produce a tool that is useful across a plethora of engineering disciplines. In this paper, according to principles of conductive heat transfer, an infrared thermal scanning device is constructed to model the heat distribution along a surface. The team collaborates via peer mentoring and student organizations to gain a deeper understanding of heat transfer principles and develop various codes in SciLab. Newton's first order differential equation for a cooling body is solved to gain perspective into temperature and time relationships for different materials. Additionally, the Gauss-Seidel iterative calculation method is researched for insight into unidirectional heat distribution. Fourier Heat equation is analyzed to understand the mechanism of heat transfer in series. The thermal scanner is piecewise assembled and programmed into Arduino, a Java environment, utilizing General Public Licenses and C/C++ microcontroller libraries. Upon operation of the thermal scanner, data is collected and recorded into the serial monitor in the Arduino IDE. Thermal maps are generated in Microsoft Excel to display the ambient and surface temperature data collected by the scanner. The team researches applications in real world situations and finds that thermal mapping is used to ensure quality control of production processes in industrial environments. The team discovers that with growing interests in safety, identification and repair of deficiencies in production systems using such devices is essential to professionalism in engineering.

EXTENDED ABSTRACT - ASSESSMENT OF PEER MENTORING PROGRAM AT THE UNIVERSITY OF ARKANSAS

Adrienne Gaines, Heath Schluterman and Richard Cassady

This paper will discuss the Peer Mentoring program at the University of Arkansas and how it is perceived by the students. As part of the two semester Introduction to Engineering course sequence, students are required to meet with their assigned peer mentor on a weekly basis. The peer mentors have an assigned discussion topic, but also are encouraged to discuss anything of interest with the student. Students receive a weekly grade for attending meetings and completing any assignments. The peer mentoring aspect constitutes 10 - 15% of their course grade.

Students are given a survey at the end of each semester to evaluate their peer mentor, the topics covered, and the peer mentoring program in general. We will discuss how the University of Arkansas Freshman Engineering Program is structured and some of the information gathered from this survey during the fall 2013 and spring 2014 semesters with plans to compare to previous and future years' survey results.

LEARNING BY SHARING - THE IMPACT OF STUDENTS TEACHING MATERIAL TO CLASSMATES

Isaac J. Tetzloff and Mary K. Pilotte

In two entry-level core courses of a large Midwestern university's First Year Engineering Program, instructors emphasize the use of computer tools, such as Microsoft Excel and MathWorks MATLAB, to make evidence-based decisions and solve engineering problems. Prior to taking these courses, many students have not been exposed to Excel or MATLAB at the same level required to solve engineering problems; therefore, key concepts taught throughout the First-Year Engineering course are reinforced via online modules, lecture instruction, in-class activities, and homework. A section of 35 students in the spring 2014 semester incorporated an active learning pedagogy aimed at exposing students to new and difficult concepts by having students give brief partner presentations to their classmates on weekly course topics. These "Tag Team Topics" introduced an additional tool to help reinforce individual learning, provide a means for developing class notes on all topics covered, and at the same time develop and mature the students professional engineering habits through self-teaching, effective communication of difficult concepts, and technical presentation skills. To help students relate to the new programming concepts, students were asked to represent the concepts by providing an everyday example and also to create a quiz question for their classmates to answer. Individual student performance on quizzes and exams does not seem to reflect a large improvement on the topic presented by the student; however, the performance of the entire section on homework and exams, along with the students' perceived understanding of the topic, appeared to increase with the use of these student presentations.

IMPLEMENTING TEAM BASED LEARNING IN FIRST-YEAR ENGINEERING COURSES

Steffen Peuker and Jennifer Mott

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, e.g. Problem-based Learning or cooperative learning. 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 problems. (4) The students are actively engaged during class time. The Team-Based Learning Student Assessment Instrument (TBL-SAI) was used to assess the implementation of TBL in three sections of an introduction to engineering course at the University of Alaska Anchorage in the Fall of 2013. A total of N=73 students consented to participated in the IRB approved TBL-SAI survey. The TBL-SAI is validated to measure three categories: (1) Student's accountability, (2) preference for lecture or team-based learning, and (3) student's satisfaction with TBL. The results show that all students feel accountable to prepare for class and contribute to their team's learning. Almost all students (99%) prefer team-based learning over traditional lecture, and were satisfied with TBL as a teaching pedagogy (99%). The anonymous end of term student course evaluations showed an increase from 4.3 to 4.7 in the "Excellent Teacher" rating and from 3.9 to 4.2 in the "Excellent Course" rating when comparing to the previous semester (based on a 0-5 point scale), which did not use TBL. In summary, TBL is an ideal tool to be used in first-year engineering courses that are currently taught in a traditional lecture style format.

Session F4B: Including Social Issues in the Curriculum

Chair: John Cole, The University of Texas at Dallas

Time: Friday August 8, 3:15 p.m. - 5:00 p.m. *The Presidential Dining Room*

EXTENDED ABSTRACT - THE FIRST-YEAR OF COLLEGE'S IMPACT ON ENGINEERING STUDENTS' CULTURAL HUMILITY

Lorie Groll, Teri Reed and P.K. Imbrie

Cultural humility is defined as the ability to negotiate shared meaning to create and maintain mutually beneficial cross-cultural relationships [1]. Developing cultural humility is foundational to preparing future engineers need

to work with other employees and stakeholders in a diverse, multicultural workplace [2]. In this work, the researchers consider these attributes within the context of a developmental framework of cultural humility. Understanding where students are starting and the impact of their experience is a critical component of a developmental approach. To determine how the first-year of college impacted engineering students orientation in terms of their Universality-Diversity Orientation (UDO), 1208 first year engineering students completed the MGUDS-s prior to starting their first semester in Fall 2012 and then again in the latter part of the Spring 2013 semester. During this time, all of the students who completed the survey participated in a diversity strand within their first engineering semester course. Results revealed that overall student's total scores declined as did their Diversity of Contact and C0mfort with Diversity sub-scores.

AN ANALYSIS OF CODE SHARING IN A LARGE FIRST YEAR ENGINEERING COURSE

Paul Schreuders and Matthew Whiteacre

This paper takes a social network approach to examine the traits of unauthorized computer program sharing in a large multi-section first year course. The Fundamentals of Engineering course sequence at Texas A&M University consists of a pair of courses, with a significant emphasis on algorithmic thinking taught using three computer languages; LabVIEW, MATLAB, and C++. Programs written in the last two of these languages are amenable to analysis using the "Measure of Software Similarity" (Moss) system. This software allows the examination of large numbers of student programs to identify potential copying. Pairs of programs, which MOSS identified as having significant amounts of similar code, were independently evaluated by the course instructors. Appropriate actions were taken when academic dishonesty was identified. Information on the students authoring the pairs of potentially copied documents were used as the input for social network analysis performed using Ucinet and NetDraw. In addition, comparisons were made of the student population having submitted similar code with those whose code not identified as similar.

EXTENDED ABSTRACT - DETERMINING THE INFLUENCE OF FIRST-YEAR SERVICE LEARNING PROJECTS ON STUDENT RETENTION

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

For the past four years, the MSU CoRe (Cornerstone and Residential) Experience academic program has incorporated service learning projects into its EGR 100: Introduction to Engineering Design course. These projects have been offered to student teams in addition to several more general, somewhat discipline-specific projects (e.g., solar water heater design, robotics challenge, or model solar car competition). Two MSU units, the Resource Center for Persons with Disabilities (RCPD) and the Residential Initiative on the Study of the Environment (RISE) have provided initial service learning project specifications as well as served as customers and consultants to the student teams. The RCPD projects have ranged from individualized aides for persons with disabilities (e.g., a standing desk for a four-year-old experiencing Cerebral Palsy) to assistive learning tools designed to help vision- and hearing-challenged students learn about scientific topics such as anatomy, electronics, physics, and calculus. During the past two years, environmentally-focused RISE projects have been included in the EGR 100 course, covering topics such as sustainable greenhouse heating and mechanisms for collecting and distributing water in urban gardens. To assess the influence of these service learning projects on student retention, we have begun to collect data regarding the academic progress of those EGR 100 students that were members of teams working on the general projects vs. those who worked on the service learning projects. Our goal in assembling and analyzing these data is to determine if the retention of students is significantly different between the two groups. Early results suggest that there are some differences.

EXTENDED ABSTRACT - USING SERVICE-LEARNING TO DEVELOP ENTREPRENEURIAL MINDSET

Sirena Hargrove-Leak

While engineers are best known for their ability to solve complex problems, society and the workplace now require that they are innovative and able to work with business leaders. These contemporary engineers may be described as entrepreneurial engineers. Yet, the majority of formal engineering education consists of solving theoretical problems on paper. This work explores the utility of a first-year service-learning project in developing entrepreneurial mindset. Participating students were administered a pre- and post- entrepreneurial self-efficacy survey and asked to complete reflective journals throughout the project. Analysis of preliminary survey data indicates that the approach did not result in statistically significant gains or losses in confidence doing entrepreneurial minded tasks. However, there is self-reported evidence of the development of entrepreneurial mindset in free journal writing and that data is presented. Therefore, it may be concluded that service-learning may be an effective tool to include entrepreneurial mindset in the education of engineers to

prepare them for today's society and workplace.

Session F4C: Design in the First Year

Chair: Natalie Van Tyne, Colorado School of Mines

Time: Friday August 8, 3:15 p.m. - 5:00 p.m. *Room: 1011C*

ANALYSIS OF FEATURE DEVELOPMENT DURING ITERATIVE DESIGN IN FIRST YEAR ENGINEERING COURSE

Jessica Swenson and Ethan Danahy

University engineering programs have been recently implementing more first year cornerstone courses [1] aimed at introducing students to engineering experiences while teaching them basic technological skills, problem solving techniques, and communication strategies. Many of these include hands-on project work, leveraging this opportunity to engage the students in more authentic engineering practices. Detailed in this paper is a case-study analysis of the designing and building of a robot during a first year introduction to engineering course, to better understand idea fluency and the process of feature development within the group's solution, as measured throughout the iterative creation of the robot. Presented here is an analysis of how the team worked through the major problems associated with the assignment and how self-defined sub-problems related to their personalized solutions were brainstormed, developed, evaluated, and then ultimately rejected, refined, or completed. Results show many initial ideas never revisited, each negotiated within a set of constraints under which the students are operating (assignment requirements, time limitations, team member skills, etc). For the original feature ideas included throughout the duration of the project, an analysis of the feature development during iterative design is included, highlighting transition moments within the engineering design process associated with each feature.

INTRODUCTION TO ENGINEERING DESIGN: PILOTING DESIGN PROJECTS FOR THE FIRST YEAR ENGINEERING EXPERIENCE

Jonathan Gaines, Babu Joseph and Garrick Aden-Buie

The University of South Florida is converting its present 1-credit Freshmen Engineering course into a 3-credit course in order to provide a stronger foundation for entering engineering students. The new course, entitled Introduction to Engineering Design, will be introduced in the Fall of 2015 and is designed to provide more effective course content, improved assessment of outcomes, and higher student retention. The course is designed around hands-on engineering design projects to provide students with a fun and useful introduction to the engineering profession. In order to determine the effectiveness of the new course, its lab component will be piloted during the Fall 2014 semester. The pilot will consist of 50-60 students completing 4 four week design projects in small groups. Each project is selected to provide students with an exposure to the design process while introducing basic engineering skill sets. In this paper, course objectives and expected outcomes for the pilot course are presented, followed by the course structure and overview of the selected design projects. Future work will include the creation of assessment tools for the pilot program, analysis of assessment data, and details on the assimilation of the course into the engineering curriculum.

GAMING WITH LABVIEW: AN ATTEMPT AT A NOVEL SOFTWARE DESIGN PROJECT FOR FIRST-YEAR ENGINEERS

Emily M. Helber, Matthew L. Brockman and Rachel L. Kajfez

To ensure first-year students remain interested in engineering, it is essential to create authentic and course level appropriate projects. For a LabVIEW specific first-year engineering programming class, a software design project (SDP) was developed around Engagement Theory that required students to work in pairs to create an interactive game for middle school students to increase interest in STEM fields and programming. The semester after completing the project, a survey was conducted on the LabVIEW section and on one of the standard C/C++ sections to compare students' perceptions and feedback regarding the impact of their SDP on their second semester design project. The purpose of survey was to assess the impact and effectiveness of the nature of the LabVIEW SDP compared to the standard C/C++ SDP. The results of the survey provide avenues for future modifications to the SDPs that may allow for greater engagement and better preparation for the second semester design projects students participate in during their first-year.

EXTENDED ABSTRACT - RE-DESIGN OF AN INTER-DISCIPLINARY FIRST-YEAR INTRODUCTION TO ENGINEERING COURSE FOCUSING ON ACTIVE LEARNING AND TECHNOLOGY IN THE CLASSROOM

Chelsey Z. Hargather

The freshmen year, first semester "Introduction to Engineering Design" course was re-designed at New Mexico Tech as part of a 5-year US Department of Education (DoED) Title III grant. An integrated lecture-lab course replaced the traditional free-standing lecture and lab courses with the goal of increasing engagement and retention of all engineering students but emphasizing the need to reach Hispanic engineering students. The class is held in a new state-of-the-art Engineering Design Lab created through the DoED grant funding with the goal of enhancing student collaboration and teaming. Since first implementation during the spring 2013 semester, this course has evolved from a one-section pilot to a full-scale, three-section pilot, to a permanent course at New Mexico Tech. Metrics for success of this re-designed course for the DoED purposes focus primarily on the reduction of failure rates of two groups of students, Hispanic students and all engineering students. While the failure rates of the classes are important, what is more important is the students' access to modern technology, group work, and open-ended assignments in the classroom. Based on end-of-year surveys of all four pilot sections, students reported that working in groups and having the class in the Engineering Design Lab not only helped them to "learn engineering" but also made them "feel like engineers." Finally, further institutional research is in progress. This research relates to concepts such as math preparedness and first-year success and should quantify the effect of the present course and its predecessor on the educational attainment of New Mexico Tech students.

Session F4D: Let's Talk: Open Discussion on First Year Issues

Chair: Dan Budny, University of Pittsburgh

Time: Friday August 8, 3:15 p.m. - 5:00 p.m. *Room: Hagler Auditorium*