2017 PNW ASEE Conference Abstracts

Teaching for Inclusion: Diversity in the Classroom and Beyond, April 6–8, 2017, Seattle University, Seattle, WA

Session 1A (Student Center 130)

Session 1A.1: Knowledge Surveys in Engineering Statics

Eric Davishahl
Whatcom Community College

Knowledge surveys ask students to report on their confidence that they can perform specific tasks associated with course learning outcomes. This approach allows the survey to cover a broad range of topics while demanding relatively short completion time from students. Administering the surveys multiple times during a course offers a context for students to reflect on their own learning progress and provides potentially useful assessment data to the instructor. Knowledge surveys have been reportedly in the science education literature as promising assessment tools, but there is little evidence in the engineering education literature of their use in engineering courses. This paper reports on the development and implementation of a knowledge survey for engineering statics. The survey consists of 122 specific success criteria mapped to eight course-level learning outcomes. This paper explores several uses of the survey and examines potential correlation of survey responses with exam scores.

Session 1A.2: Tracking Student Conceptual Understanding of Dynamics Concepts across Contexts: A Plan for Research

Floraliza Bornasal and Jill Walsh
Saint Martin's University

Mechanics concepts, inclusive of forces and motion of bodies, serves as a foundation for the undergraduate engineering curriculum. However, research indicates persistent misconceptions that adversely affect engineering students' construction of deep understanding of foundational concepts in mechanics. In order to address the difficulties associated with constructing accurate and deep conceptual understanding, we propose a plan that (1) identifies student misconceptions, (2) proposes instructional methods for addressing misconceptions and transfer of knowing across contexts, and (3) measures effectiveness of the instructional methods on students' conceptual knowledge. Two unique aspects of this study are the focus on developing cohesion of representations across contexts for mechanics concepts across subsequent courses (statics and dynamics) at one institution, and the longitudinal tracking of student's conceptual understanding. Data from student responses on concept inventories serve as a baseline for the proposed plan for research. Additionally, ongoing development of instructional material and pedagogical methods will be reported in this study.

Session 1A.3: Fishing Rod Design Analysis: From Term Paper to Research Project

*B. Dalman, J. D. Castro-G*utierrez, & R. A. Budiman
University of Calgary

We discuss a pathway to encourage undergraduate research participation in a third-year mechanical component design course in a Mechanical Engineering program. A course component of group projects can be converted into summer research projects. An example of a fishing rod design project is presented to highlight the lessons we learned in the project conversion process. We also present fishing rod's measurements and modelling data to show iterations we completed, so that the group project becomes more rigorous and at par with a peer-review journal submission. We find the summer research project a valuable experience for undergraduate students wishing to launch a research career or to consider graduate studies. The project may also be a valuable strategy for researchers looking to assess and recruit potential graduate students.

Session 1B (Student Center 210)

Session 1B.1: Cooperative Teaching as an Effective Training Mechanism for Future Instructors

Nikita Taparia, Jonathan Realmuto, Saniel Dong Lim, Gador Canton, & Jim Borgford-Parnell
University of Washington

Currently, there are few effective graduate student training tools that cover the gap between having complete responsibility to design and teach a course and serving as a teaching assistant. Here, we present a detailed training framework for future faculty based on cooperative course development and instruction. The training framework consists of a pedagogy workshop, cooperative course syllabus and lesson development, and course instruction, being these last two elements supervised by an expert in teaching and learning (mentor). The framework includes four forms of feedback: (1) mentor's observation, (2) students' assessments, (3) student mentorship, and (4) co-instructor communication and self-reflection. This feedback allows for real-time development and evolution in teaching techniques. This framework was implemented through a case study of three co-instructors, a mentor, and a middle-sized class. Our results, in the form of course evaluations and student feedback, illustrated positive development throughout the timeline of the course.

Session 1B.2: Implementation and Assessment of New Techniques in Technical Writing

Hani Saad
Eastern Washington State University

Teaching technical writing to engineers is a very challenging task as students are usually very math oriented and are reluctant or hesitant when it comes to so called non-engineering topics. But communication is most definitely an engineering asset that any successful engineer must master. The goals of this research is to compare the performance of the students before and after a series of changes were implemented in the university's technical writing course 'Laboratory Analysis and Report'. These changes include the adoption of new standards and format for homework, labs and assignments throughout the Mechanical Engineering program as well as a series of in class assignments and labs. This is in addition to several steps and methodologies adopted in and outside of the classroom. The results are evaluated by grading a number of student papers from pre and post changes. The grading is done without the grader knowing whether the student is from a class where these changes were implemented or not. This evaluation is on many aspect of the assignment including format, fluency, typographical, mathematical correctness etc. The assignment graded is the student's final comprehensive lab report write up for this particular class since it is the most involved work and worth the most grade points.

Session 1B.3: Why Ethics?

Marilyn A. Dyrud
Oregon Institute of Technology

ABET EAC Criterion 3f requires that engineering programs pay some attention to ethics and professionalism, specifically that students demonstrate "an understanding of professional and ethical responsibility." As knowledge grows and technical courses expand, simply adding a required ethics course might not be feasible.

This presentation will offer several reasons that encourage instructors to consider an "ethics across the curriculum" approach in lieu of a stand-alone course. These include acquainting students with professional expectations, fostering an awareness of ethics in the workplace, nurturing cognizance of professional ethical issues, and providing students with decision-making processes for ethical situations.

Session 1C: Workshop (Student Center 160)

Using Systematic Literature Reviews to Enhance Graduate Student Learning

Branimir Pejcinovic
Portland State University

Systematic literature review (SLR) is a skill assumed to be in the arsenal of all graduate students pursuing thesis options at MS or PhD level. Our initial survey of graduate students shows that they have very little experience in performing SLR. Discussions with other faculty confirm that a more formal training in SLR is needed. Experience with other soft-skills, such as technical writing, suggests that it is very important to provide a specific disciplinary context. Therefore, to learn SLR it would be best to incorporate it in various courses. Recent literature in the area of software engineering has advocated using SLR as a more generic educational tool and a variation of SLR called Iterative SLR (ISLR) was introduced which is more suitable as educational tool than strict implementation of SLR [1].

In this workshop we will discuss why ISLR is a useful educational tool and how to do it in the context of a specific problem in a specific course. Potential educational benefits include improved critical thinking and writing, increased motivation, life-long learning skills, increased breadth of topics as well as depth of coverage. An example of how this was implemented in a graduate solid-state electronics course for MS and PhD electrical engineering students will be presented and discussed. Workshop participants will be asked to bring laptops and will describe a potential research or design problem that can be translated into a search operation. Once we get a handle on a proper scope of the research question we will move on to discussing how to stage the ISLR process over the quarter or semester. Finally, we will discuss a rubric that is being developed to assess student ISLR reports.

Learning Outcomes: Participants will be able to

- Explain the difference between narrative and systematic literature review
- Design a draft research question that fits their course topics and objectives
- Design a draft schedule for ISLR project
- Describe main components of assessment of ISLR reports

Audience: Instructors of graduate engineering courses and mentors of graduate thesis students

Duration: 2 hours

Resources: Laptop and Wi-Fi connection

Other outcome: Potential collaboration on an educational research project related to ISLR

Reference

[1] M. Lavallee, P.-N. Robillard, and R. Mirsalari, "Performing Systematic Literature Reviews With Novices: An Iterative Approach," *IEEE Trans. Education*, vol. 57, no. 3, pp. 175-181, August 2014.

Session 2A (Student Center 130)

Session 2A.1: The Nature of Engineering for K12 Education

Brian Hartman
Walla Walla University

Recent state and national standards have increased interest in engineering at the K-12 level. Despite the increased attention to engineering, the characteristics and uniqueness of the field of engineering are not clearly defined. The goal of this research is to elucidate aspects of the nature of engineering that are appropriate to teach at the K-12 level. Experts in K-12 engineering education were invited to participate in a classic, three-round Delphi study. The participants identified eight aspects of the nature of engineering they believed were important to K-12 education. The present investigation provides an empirical basis for important concepts of the nature of engineering at the K-12 level. This work is important to support development of policy, curriculum, instruction, and to provide a foundation for improved science education.

Session 2A.2: Middle School Students' Understanding of Engineering Empathy

Henriette de Rozario Burns
Washington State University, Vancouver

Student Center 130

Numerous studies suggest affects, like interest and belongingness, rather than ability, are responsible for the overall lack of women in employment in STEM fields. Results from a previous study indicate girls are interested in STEM, social rather than the more analytical topics.

I hypothesize the embrace of empathy in the engineering design process (as a focus on the contributions and needs of the individual), may influence girls' STEM interest and belongingness.

Through an interpretative socio-constructive lens this qualitative case study is conducted in an after-school science club program, within an urban middle school through a framework of interest and otherness. Observations, interviews and surveys will be analyzed to understand how empathy-based projects influence girls' STEM interest and sense of belongingness.

If STEM education represents what appeals to girls and women, more girls may feel welcome and interested in STEM and more women may pursue and persist in STEM careers.

Session 2A.3: Toy Adaptation in Undergraduate Education and Outreach—An Initial Examination into Participant Experience and Perceptions

Molly Mollica
University of Washington

Service learning is a powerful educational method and projects with clear engineering-service components commonly attract a higher percentage of students from underrepresented groups. The objective of this study was to examine our initial efforts to engage engineering students by adapting toys for children with disabilities. Toy adaptation involves toy disassembly, circuit assessment, and alternative switch addition via soldering such that users can activate the toy with their unique abilities. We held three toy adaptation events and received IRB-approved anonymous Likert-scale survey data from 63 participants. Notable results include that participants enjoyed the experience, saw the direct impact of engineering through toy adaptation, and felt more connected to the engineering field as a result. Additionally, although the events were advertised broadly across the College of Engineering (27% female), 64% of engineering students that elected to participate were female, potentially aligning with other findings that service learning effectively engages underrepresented students in engineering.

Session 2B (Student Center 210)

Session 2B.1: Open Engineering Problems - It's about Time!

J. R. Zaworski, T. C. Kennedy, R. J. Zaworski
Oregon State University

Problems based on photographs, videos, audio clips, and animations can add a great deal to a student's experience. The challenge to educators is that it takes much more effort to develop problems than to simply select them from a required text. As an alternative to textbook problems, a website has been created to make it easy to contribute, use, and share the creative efforts of all participating instructors. The site described in this paper addresses Statics, Dynamics, and Mechanics of Materials. It accepts problems, solutions, and artwork in whatever format the contributor prefers, e.g. Word, Google Docs, jpg, mp3, pdf, etc. Preparing an assignment can be as simple as supplying students with links to individual problems. Alternatively, problems can be downloaded and organized into a traditional printed assignment or exam. We are excited about the opportunity to share and learn from the creativity of a broad spectrum of engineering educators.

Session 2B.2: Open-Source Online Homework in Engineering Courses

Eric Davishahl
Whatcom Community College

The Internet Mathematics Assessment System (IMathAS) is a freely available web-based tool for delivering and auto-grading algorithmic problems. IMathAS is the software platform for the Washington Mathematics Assessment and Placement (WAMAP) online homework system. WAMAP is widely used in math courses at Washington colleges and universities. The scripting language, built-in macros, and graphics support make IMathAS a suitable platform for engineering homework problems as well. This presentation will introduce ongoing work toward the development of an open-source online homework library for engineering statics using IMathAS and hosted on WAMAP. The library currently includes over fifty Statics problems covering a breadth of topics ranging from vector analysis to structures to shear force and bending moment diagrams. The library is sufficient to provide the homework content for a typical Statics course. This presentation seeks collaborators to contribute to the Statics library and/or to expand the effort to other engineering courses.

Session 2B.3: Using Competency Grading in a Statics and Mechanics of Materials Course

Kirsten Davis & R. Casey Cline
Boise State University

At Boise State University, many students passing a junior level construction management statics and mechanics of materials course were not able to successfully use that content in follow-on courses. This prompted a change in the course grading from a traditional grading method to one based on competency. Competency grading requires students to prove competency in defined skills in order to pass the course. Twelve objectives were defined as the minimum standards for passing the course (a C- grade). Students were required to demonstrate competency in all twelve. Examples include: Given a beam or truss with loadings, calculate reactions; Calculate the centroid of a composite shape; and Calculate and draw the moment diagram for a simply loaded beam. Students could earn higher grades by demonstrating higher levels of competency with harder skills such as: Given a truss, find the reactions and determine the forces in the members by method of sections. This study provides the details of competency grading used in the course, evaluates the first semester of use, and provides lessons learned for other faculty interested in trying this grading method.

Session 3A (Pigott 309)

Session 3A.1: Improved Student Performance in Computer Programming by Constructing More Visual Assessment

Shanon Reckinger & Bryce Hughes
Montana State University

This work is grounded in the Felder-Silverman learning style model, a model that was developed within engineering education and has been validated and widely used within the field. This model categorizes students' learning styles along four distinct dimensions through the web-based Index of Learning Style (ILS) assessment tool. Along each of these dimensions, students are categorized as having a mild, moderate, or strong preference. This paper will focus on the input dimension, which categorizes students as having a visual/verbal learning style preference. Students were administered a weekly quiz to assess their ability to write code, but construction of this assessment varied by section (each quiz favored visual, verbal, or neutral learners). General linear and multiple regression analysis are both used to determine the effect of assessment design on performance. Findings show that incorporating visual aspects into the quiz design improves student performance, in general, but especially for visual learners.

Session 3A.2: An Assessment Tool for Tracking Design Skills from the Freshman to Senior Year

John Crepeau, Dan Cordon, Michael Maughan, & Steven Beyerlein
University of Idaho

Work has begun on a rubric to measure and track student design skills as they progress through the curriculum. The skills were assessed using freshman, sophomore and senior capstone design projects. The rubric was developed to assess competencies in system design, implementation and project management, and tested during the Fall 2016 semester in the three design courses. Each competency was assessed by the authors with a score from 1 to 5, with 1 representing few design skills and 5 representing exemplary skills. The data showed that the scores improved from the freshman to senior design courses, with the largest increase in system design, followed by implementation, then project management. This presentation gives an update on the work completed thus far and planned refinements to the tool. It is hoped that this presentation spurs robust discussion among participants which lead to improvement of the rubric and regional collaboration on the project.

Session 3A.3: Switching to Rubric-Based Assessment

Jeff Newcomer, Nikki Larson, & Derek Yip-Hoi
Western Washington University

The Engineering & Design Department at Western Washington University recently transitioned its three engineering technology programs into engineering programs. This change required switching ABET commissions from ETAC to EAC, which required adjusting assessment efforts for a different set of student learning outcomes (SLOs). As part of this switch, the Manufacturing Engineering (MFGE) and Plastics & Composites Engineering (PCE) programs decided to switch to rubric-based assessment for assessment of ABET EAC outcomes a-k. The programs developed rubrics for a-k and completed rubric-based assessment to create self-study reports (SSRs) in spring 2016 in preparation for an ABET site visit in fall 2016. While the switch was successful and led to a very positive ABET site visit, it was a challenge and there is still much work to be done to refine the rubrics to take full advantage of the approach. This paper will outline the steps we took to switch to rubric-based assessment, and the results, challenges, lessons learned, and work still to be done as a result of switching to using rubrics for the assessment of SLOs.

Session 3B (Pigott 308)

Session 3B.1: Exploring the Interplay of Diversity and Ethics in an Introductory Bioengineering Course

Celina Gunnarrson, Camille Birch, Dianne Hendricks
University of Washington

Ethics and diversity are important issues for all engineering students, but most programs do not address these issues in-depth. Here, we describe our current "pilot" efforts in our introductory bioengineering course to explore the interplay of diversity and ethics in engineering.

We are adding two class sessions and an assignment to address the following:

1) The importance of diversity and ethics competency in engineering.
2) Historic and current case studies of diversity-related ethical issues in bioengineering, and how historical perceptions and contexts still influence modern scientific thinking and engineering design.
3) Advocacy and representation of minorities in engineering, and the evidence supporting the value of inclusive teaching and diverse teams.
4) Best practices for advocacy and representation of diverse peoples in engineering.

We will assess the effectiveness of these teaching innovations through written student evaluations, student performance on assignment, and instructor observations. Example curricular materials will be provided.

Session 3B.2: Design for an Inclusive Learning Environment at Boeing Structures Engineering University

Antonio Rufin
Boeing Structures University
Patricia Henderson

New Boeing structures engineers come from diverse backgrounds in terms of degree focus, culture, ethnicity, gender, language, values, social network, work experience, interests, and generational perspective. In the past, the new hire training consisted of classroom lecture accompanied by printouts of the PowerPoint slides. Today, Structures University values diversity in all its forms and strives to create a more inclusive learning environment so that all engineers can move to proficiency more quickly. In this presentation, we will show how we are revamping the new hire course to embrace modern learning methods, transition the learning to on-the-job performance, and leverage the diversity inherent in our employee population. We will share our learning architecture model, testimonials from instructors and learners, and plans for the future.

Session 3B.3: Co-Curriculum for Diversity of Aspiration and Enhanced Problem Solving

Mehmet Vurkaç
Seattle University

Big Beacon has argued for adding aspirational diversity to engineering education, emphasizing the creative nature of engineering and stressing a recent ASEE poll on the public's perception of engineers showing that less than a third of Americans think engineers care about people or improve quality of life. A similar report by the National Academy corroborates the acceptance of this view:

> [T]he engineer … has come to be viewed in many respects as an amoral creature, a corporate "yes-man" of conservative views and little social conscience or consciousness—the calm builder of devastating weapons, the untroubled maker of every kind of environmental contaminant.

Considering the damage such perceptions can do to the profession and even to society, and combining this with our research into problem-solving in art-making, we propose a co-curriculum providing numerous problem-solving and design challenges and for increasing the diversity of engineering students and their transferrable problem-solving skills.

Session 3C: Workshop (Pigott 208)

Contributing to and Using a New Open Website for Engineering Problems

Joseph R. Zaworski
Oregon State University

Engineering educators' imagination and creativity represent a source of exercises and problems far larger than those available in any given textbook. An open website has been developed to allow contributions of problems for engineering mechanics and free use of those problems by anyone that is interested. The goals for this workshop are to familiarize participants with the existing site, train them on its use, and then elicit their feedback. It will consist of two parts: (1) an organized program on using the website in its current configuration and (2) a discussion/brainstorming period to review the ideas of the existing site, come up with possible improvements, and collect creative ideas, constructive comments, and approaches to implementation to improve this collaborative, open resource.

The formal program is about an hour in length and will be focused on three activities. The first will be learning the philosophy and architecture of the website. Second, participants that bring their personal computer will be guided through the website and will learn about a variety of problems types including traditional text with figures, problems using photographs, audio problems, and video-based problems. Tips for accessing these problems, customizing them, and using them will be presented. Third, an equal amount of time will be spent on submitting new problems to the site with an emphasis on choosing accessible problem formats.

As the training part of the program nears completion, it will transition into a discussion lasting up to an hour. Participants will be encouraged to provide input to guide the evolution of this site into one that maximizes value and minimizes effort for educators wanting a source of creative and useful problems.

Session 4A (Pigott 309)

Session 4A.1: Case Study: Why Students Chose Electrical and Computer Engineering Major

Agnieszka Miguel & Shiny Abraham
Seattle University

In recent years, enrollments in electrical and computer engineering departments have suffered compared to mechanical engineering and computer science. However, electrical and computer engineering graduates are still in high demand and are expected to play a significant role in solving some of the most pressing issues facing our society in the 21st century such as the National Academy of Engineering Grand Challenges [1]. Similarly, majority of the Greatest Engineering Achievements of 20th Century [2] would not have been possible without the involvement of electrical and computer engineers.

The Department of Electrical and Computer Engineering at Seattle University offers an undergraduate-only program focused on professional formation of each student. Small class sizes provide opportunities for individualized instruction and personal attention, while faculty-led advising helps students navigate the two main options in our programs and encourage them to think about their future beyond the time spent at the university. We offer Bachelor of Science in Electrical Engineering with an option to specialize in Computer Engineering. There are 131 students in our program. 19% of our students are women and 50% are students who transferred to Seattle University from 2-year colleges.

In this paper, we present quantitative and qualitative results of a survey that we conducted in our department in spring 2016. 72 students responded to questions related to their experience of selecting electrical or computer engineering as their field of study. As expected, over 65% of students listed personal interest as one of the reasons why they selected ECE as their major. At the same time, only 35% of students admitted that they were very knowledgeable or knowledgeable about careers in the field of electrical engineering. That number is even smaller for computer engineering: 24%.

We analyze the survey results and report on students' comments from focus groups on engineering recruitment conducted this fall quarter. We offer suggestions on possible modifications to common recruitment strategies and suggest new ways of attracting students to Electrical and Computer Engineering.

References

1. National Academy of Engineering, "Grand Challenges for Engineering", http://www.engineeringchallenges.org/
2. National Academy of Engineering, "Greatest Engineering Achievements of 20th Century", http://greatachievements.org/
3. Maria-Isabel Carnasciali, Amy E Thompson, Terence Joshua Thomas, "Factors Influencing Students' Choice of Engineering Major, Case Study at the University of New Haven," 120th ASEE Annual Conference & Exposition, Atlanta, June 2013.

Session 4A.2: Designing an Exploratory Freshman Course in Electrical Engineering: Some Experiences

B. Pejcinovic & M. Holtzman
Portland State University

It is still hard to design and implement an interesting and effective freshman Introduction to Electrical Engineering course or sequence. We have set up these goals for our introductory sequence:

1. Attract more students into electrical (and computer) engineering
2. Ease students into the rigors of a college engineering education
3. Fill in some holes in students' background, particularly math skills

For item 3, we find that students lack not just basic math skills, but also problem-solving and debugging skills. We will discuss techniques we are using to address this problem. For items 1 and 2, we illustrate applications of engineering by having teams of students work on projects of varying scope. We recently added team mentors recruited from our alumni, and they seem to be effective in increasing student engagement. We will describe the assessment, design and implementation of this introductory sequence, and share our experiences with attendees.

Session 4A.3: Developing Instructional Methods and Materials in an Engineering Graphics Course to Improve Spatial Recognition

Jill Walsh and Floraliza Bornasal
Saint Martin's University

Spatial recognition is the ability to visualize an object from different angles and spaces and plays a critical role in engineering and scientific disciplines. The ability to visualize an object is directly related to the ability to communicate object details. This study aims to develop methods and materials of instruction for improving students' spatial recognition over the semester of an engineering graphics course. The students' existing spatial ability is bench marked via a ten question, unfolded cube test. The test is administered during the first four weeks of the semester and then again at the end of the semester. Spatial recognition-specific instructional methods, in-class activities and homework assignments are implemented over the semester. This paper will detail the activities and instruction methods aimed at improving spatial recognition and plot correlation of spatial recognition ability to class performance.

Session 4B (Pigott 308)

Session 4B.1: Sustainable Energy for Engineers and Non-Engineers Only

Douglas M. Logan & Fred Liebrand
Walla Walla University

An interdisciplinary course in sustainable energy was first offered at Walla Walla University in 2009 and has been offered every year since 2014. A student has the option of taking it as a general studies course or as an engineering technical elective. This year enrollment is evenly split between engineering and non-engineering students. The first half of the term addresses general issues in energy policy such as energy supply and demand, energy economics, principles of sustainability, and the history of U.S. energy policy. The second half covers selected renewable energy technologies such as wind, photovoltaics, and solar thermal power, and includes energy deliverability and end-use energy efficiency. The presentation will outline delivery of the course, assignments, and student feedback, and how the course has evolved to serve the diverse needs of students with various backgrounds.

Session 4B.2: Continuing Development of an Elective Lab Section for Electricity and Magnetism with Transmission Lines

Eve Klopf, Aaron Scher, Mohamed Alhosani, & John-Michael Denton
Oregon Institute of Technology

Although typically offered without a laboratory component, undergraduate electromagnetics classes for electrical engineering students can be significantly improved by the addition of supporting laboratory exercises.

This paper will focus on the ongoing development of laboratory curriculum for an elective lab section which is being offered this year at Oregon Institute of Technology as a supporting course for EE 341, Electricity and Magnetism with Transmission Lines.

These labs focus on improving student understanding of the fundamental concepts of electromagnetics and their connection to the basic design and construction of circuit elements. We will present on the current content of the labs, on the result of running a section of this lab in the fall term, and on the ongoing development of content for these labs involving wearable electronics.

Session 4B.3: Enabling Undergraduate Research Collaboration with a Local Analytical Laboratory

John Bridge, Kaleb Demsey, & Bryce Denis
University of Washington

At the University of Washington, Bothell, undergraduate mechanical engineering students are encouraged to seek out research opportunities as part of their engineering educational experience. A portion of research credits can also be applied in satisfying upper level engineering elective requirements. These research activities are outside what is considered "engineering internships" as they involve short term projects that are not typically paid and whose focus is to contribute to advancing research expertise. This paper addresses activities with one particular analytical laboratory firm where students do tests that support both the company as well as advancing research on a mutually beneficial project. The experiences have been very positive and have resulted in technical journal papers, small levels of external research funding, and summer internships.

Session 5A (Bannan 401)

Session 5A.1: A Project-Based 1st-Year Electrical and Computer Engineering Course: Sensor and Telemetry Systems for High-Altitude Balloons

Jeremy Thomas
DigiPen Institute of Technology

We document an innovative, project-based 1st-year course in electrical and computer engineering recently developed and implemented at DigiPen Institute of Technology as part of an ABET accredited BS in Computer Engineering program. The project consists of sensor and telemetry systems for high-altitude balloons. Students work in teams to design their own microcontroller-based sensor system to measure any property of the atmosphere that changes with altitude, excluding temperature (EM radiation, humidity, wind, pressures, etc.), or instead, they can test an engineering design in the upper atmosphere. The project culminates with student sensor systems being launched on large weather balloons to about 30 km altitude. Students also analyze their data, present their work orally, and write final reports. Student outcomes related to both technical and soft skills are assessed using student surveys and project evaluation rubrics. We discuss these assessment results and highlight some successes and limitations of the experiential 1st-year course.

Session 5A.2: A Project-Based 2nd Year Electrical and Computer Engineering Course: Embedded Systems Design

B. Lorena Villarreal
DigiPen Institute of Technology

This paper describes a project-based 2nd year course in electrical and computer engineering developed and implemented at DigiPen Institute of Technology. The objective of our course is to let students identify, design, implement and test an innovative embedded system as a proper solution for a service, problem or product needed in the industry or the market. They are allowed to choose from different microcontroller platforms and development environments. Nevertheless, they are required to use at least one sensor, one actuator and one communication protocol. The project culminates with a demonstration of an embedded system that interacts with a dynamic-environment and a poster presentation. Students from 3rd semester already acquire practice and new knowledge through design and implementation. This often leads to increased student engagement and retention rates. We also analyze the rubrics to assess the skills of the students and the assessments that we obtained from them regarding the course.

Session 5A.3: Redesign of Labs for Better Outcomes

Al Moser
Seattle University

Our department is in the midst of a redesign of the three required labs in the junior year: circuits, semiconductor devices, and signals & systems. The original labs were disconnected and featured analysis of circuits with little design content. Students were dissatisfied and did not feel well prepared for senior design in the next year. Faculty noted that design skills had not kept pace with analytical abilities. Despite required CS courses, students were uncomfortable about designing programs to solve problems or perform specific actions. The new labs were to be mostly connected to a yearlong design project that would involve a microcomputer to be programmed. More emphasis was to be placed on design as well as analysis.
At this point, two year-long designs have been created and tried out. The first design is a mobile robot with special sensor capabilities and the second is a puppet controller. In either case, the controller is a Raspberry Pi. Initial feedback indicates both pros and cons to this approach, including improved programming abilities and reluctance on the part of some students to committing to the higher level of involvement.

Session 5B: Workshop (Pigott 207)

Getting Started with Cody Coursework: Hands-On with the Online Platform to Auto-Grade MATLAB Programming Assignments

Eric Davishahl
Whatcom Community College

Objective
Participants will get started with an online auto-grading platform for MATLAB assignments named Cody Coursework. They will walk away knowing how to set up auto-graded MATLAB assignments by adopting existing problems from the Cody Coursework catalog, how to modify problems to better suit their assignment goals, and how to develop their own problems that can be automatically graded.

Description
The workshop will start with a brief presentation introducing the Cody Coursework platform and its potential benefits to the learning process. Next, participants will take on the student role and work to solve a sample homework problem in the Cody Coursework environment. After a question and answer session, participants will move to the instructor side. The facilitator will guide participants step-by-step as they work on their laptops to setup a "sandbox course" on Cody Coursework and create an assignment using problems from the Cody Coursework catalog. Once everyone has set up a course and an assignment, the facilitator will demonstrate how to modify a problem and present some perspective and best practices for developing new problems. During the second hour, participants will work independently or in groups to develop their own custom assignments. Workshop facilitators will circulate and offer technical support and advice on assignment design and problem development.

Note that this is similar to a ticketed (but free) workshop planned for the 2017 ASEE National Conference in Columbus, OH.

Duration
2 hours

Required Supplies
Participants should bring a laptop, preferably with MATLAB installed. Note a local MATLAB installation is not required to use Cody Coursework, but does make development work easier. Participants are encouraged to bring an existing MATLAB programming assignment that they would like to adapt to the Cody Coursework environment.

Facilitator
Eric Davishahl is the author of the Introduction to Programming course in the Cody Coursework catalog. Eric has been using Cody Coursework in his Applied Numerical Methods courses since winter 2015. Eric is faculty and engineering program coordinator at Whatcom Community College

Session 6A (Bannan 401)

Session 6A.1: Learning in Groups: Student Characterizations of Exemplary Project Group Members

Jim Borgford-Parnell, David Schipf, & Ken Yasuhara
University of Washington

Our office frequently guest-presents a workshop entitled "Teamwork for learning and project success" in a wide range of engineering courses that involve group projects. The workshop's practical objective is to help students begin group work on the right footing. The fundamental emphasis, however, is on seeing group projects (at least in school) primarily as a context and vehicle for learning. Successful project completion is secondary and is at best a rough proxy measure of learning. In the workshop, students divide into project groups, and each group develops a consensus list of characteristics of exemplary group members. These characteristics become the criteria they later use for peer assessment. We have collected these lists from hundreds of groups and have begun analyzing them for common patterns to examine how they align with the conditions that the group learning and project management literatures identify as contributing to successful learning and project completion, respectively.

Session 6A.2: Learner Perceptions of Increase in Digital Fluency after Participation in a Living Learning Community-Based Mobile Learning Community: A Progress Report

Devshikha Bose, Krishna Pakala, & Lana Grover
Boise State University

Studies indicating the benefits of using mobile devices for educational purposes have shown mixed results and have not yet been conducted in many disciplines, especially with freshmen engineering students. The purpose of this project is to build a yearlong Mobile Learning Community (MLC) that provides strategies to enhance digital fluency. These strategies are intended to help students build real-world skills which they can apply in both their student and professional careers. The inquiry guiding this study was to document student perceptions of an increase in digital fluency after participation in a Living Learning Community based MLC. Pre and post-experience surveys and a year-end focus group meeting will provide the data. Preliminary results from surveys conducted in fall 2016 suggest that use of mobile learning strategies and devices were effective means of improving student communication and digital fluency. Further data will be collected during spring 2017.

Session 6A.3: Integrating Collaborative Writing in an Engineering Class

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Collaborative writing can promote active learning and provide valuable interpersonal and teambuilding skills in the classrooms. Students will work as a team to cope with large and complex problems in their professional and academic pursuits. However, students as a team often work inefficiently and ineffectively and become discouraged due to several reasons. This paper provides background information on collaborative writing in a senior-level engineering lab course, identifies the common problems, and concludes with suggestions for improvements that could be made to the program. We identify the common problems in collaborative writing, such as resistance to group work, inexperience, friction in human interaction, and fairness. Details of students' writing processes and their perceptions of the collaborative writing are also explored. Finally, we provide a rationale and strategies to offer students for experience in writing collaboratively.