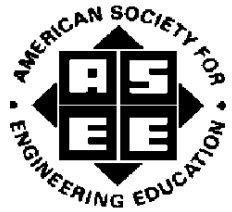
Innovations in Engineering Education

Illinois
Indiana
Sectional
Conference

Purdue
University

West
Lafayette,
Indiana

April 9-10,
2010



PURDUE
UNIVERSITY

Program Summary

2010 IL/IN ASEE Sectional Conference

Friday, April 9

Reception 7-8:30 p.m. Atrium Armstrong Hall of Engineering

Saturday, April 10 – Armstrong Hall of Engineering (ARMS)

<table>
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<tr><td>8:45- 9:45</td><td>A1: Room: ARMS 1103
Innovations in engineering education
• Group Design Projects, Scott Post, Bradley University
• Open-Source VLSI CAD Tools: A Comparative Study, L. Jin, C. Liu and M. Anan, Purdue University Calumet
• Students' Misconceptions in Science, Technology, and Engineering, Tatiana Goris, Michael Dyrenfurth, Purdue Univ.
• Contextualizing Energy Balance Problems to Introduce Design and Engage Relevant Environmental, Economical and Societal Impacts, J. Thompson, B. Jesiek Purdue Univ.
• Virtual Prototyping of Mechatronics for 21st Century Engineering and Technology, Ryne McHugh, Henry Zhang, Purdue University</td><td colspan="2">A2: Room: ARMS 1109
Presentation Session: Innovative approaches to K-12 Education
• Improving Outreach Programs using the Perspective of Current Engineering Students' Pre-Engineering Activities, Ida Ngambeki, Diana Bairaktorova, Purdue U.
• Improving K-12 students achievements in STEM contents by designing musical instruments, Marcelo Caplan, Science Institute – Columbia College Chicago
• Identifying Engineering Interest and Potential in Middle School Students: Developing an Instrument, Michele L. Strutz, Purdue University
• Guitar Building Course Gives High School Students: A Taste of Engineering, D. Perez, Jim Gibson, S.C. Opsal, R.M. Lynch, Illinois Valley Comm. College & Richard Mark French, Purdue University</td></tr>
<tr><td colspan="4">Morning Break</td></tr>
<tr><td>10:00 - 11:00</td><td>B1: Room ARMS 1021
Discussion Session, Opportunities for Collaborative Efforts in Engineering and Technology for Haitian Relief</td><td>B2: Room: ARMS 1103
Research & Assessment in Engineering Education
• Preliminary Results of Integrating Graphical Programming into a First-Year Engineering Course, Gregory Bucks, Purdue University
• Formative Assessment for Online Chemical Engineering Simulation Modules: Teachings from the Students, Phil McLaury, George Bodner, Purdue University
• Self-efficacy for cross-disciplinary learning on team design projects, Xiaojun Chen, Scott Schaffer, Purdue Univ.
• Can Ethics Be Taught?: An Authentic Approach to Ethics Pedagogy
• Titus, Craig and Carla Zoltowski, Purdue U.</td><td>B3: Room: ARMS 1109
Panel Session and Discussion: K-12 Programs and Approaches
Moderators:
• Johannes Strobel, Director of INSPIRE, Purdue University
• Pamela Dexter, National Coordinator of EPICS High</td></tr>
<tr><td>11:00 12:00</td><td colspan="3">Student Posters Session – Graduate and Undergraduate posters will be presented in ARMS B098 in the basement level</td></tr>
</table>

<table>
<tr><td>12:00 - 1:15</td><td colspan="3">Lunch in ARMS Atrium
Section Business Meeting
Speakers, David Radcliff, Interim Head of Engineering Education
Sarah Rajala, ASEE Past President, Dean of Engineering, Mississippi State University</td></tr>
<tr><td>1:15 - 2:15</td><td rowspan="5">Workshop: room ARMS 1021
Messy Engineering Problems: Not Just Authentic but Strategic Fulfillment of Multiple Learning Objectives

Heidi Diefes-Dux, Matthew Verleger, Amani Salim, Mark Carnes

Students graduate into a world where we know they will work on messy problems. So we are obligated to give them experiences that simulate engineering practice in our courses, and we map these activities to multiple national and institutional program outcomes and course learning objectives. But how can we develop, implement, and assess these experiences to better ensure and document student learning? This workshop will engage participants in a messy engineering problem. Through this problem, participants will be introduced to a means of framing open-ended problems, will discuss elements of delivery that tackle multiple learning objectives, and will experience a feedback and assessment strategy that has meaning for engineering practice. The content of this workshop is the result of eight years of NSF funded research on open-ended problems in engineering.</td><td colspan="2">C1: Room: ARMS 1109
Panel Discussion on Capstone Experiences in Engineering and Technology Programs
• Mark Johnson, Purdue University
• John Nolfi, Purdue University
• Karl Zimmerman, Valparaiso University
• Stephen Chenoweth, Rose-Hulman Institute of Technology</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td>2:30 - 3:30</td><td colspan="2">D1: Room: ARMS 1109
Presentation Session: Global Experiences in Engineering Education
• Civil Engineering Global Programs A Success Story, Becky Hull, Purdue University
• Earthquake Engineering-Istanbul at the Threshold: A Successful Global Experience Course Offered Through Collaboration, Ayhan Irfanoglu, Yating Chang, Purdue U.
• Green Buildings and Sustainability in China: A successful Study Abroad Program in Civil Engineering at Purdue, Ming Qu, and Becky Hull, Purdue University,</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td>3:45- 4:45</td><td>E1: Room: ARMS 1109
Presentation and Discussion Session: Service-Learning in Engineering and Technology Education

E. Sener, IUPUI
W. Oakes, Purdue
G. Madey, N. D.
P. Linos, Butler Univ.
T. Jacobius, IIT</td><td>E2: Room: ARMS 1103
Panel and Discussion Session: Overcoming Obstacles to Innovative Instructional Technology Use

Moderator: Joanne Lax, Purdue University

Panelists:
Mimi Boutin, Purdue
Mark Johnson, Purdue
Yung-hsiang Lu, Purdue
Gerhard Klimeck, Purdue</td></tr>
<tr><td colspan="4">Closing Plenary – ARMS Atrium
Carmine Polito
2009 ASEE IL/IN Section Teaching Award Winner
Informal Networking Dinner (Atrium)</td></tr>
</table>

Illinois/Indiana Section Officers 2009-2010

Name	Position	Institution	E-mail
Steffen, Gary D	Awards Chair	Indiana University Purdue University, Fort Wayne	steffen@ipfw.edu
Polito, Carmine P.	Chair	Valparaiso University	carmine.polito@valpo.edu
Sauer, Sharon G.	Chair-Elect	Rose-Hulman Institute of Technology	Sauer@rose-hulman.edu
Steffen, Gary D	Past Chair	Indiana University Purdue University, Fort Wayne	steffen@ipfw.edu
Johnson, Mark C	Secretary	Purdue University, West Lafayette	mcjohnso@ecn.purdue.edu
Pfile, Richard E.	Section Campus Representative	Indiana University Purdue University, Indianapolis	rpfile@iupui.edu
Johnson, Eric W.	Treasurer	Valparaiso University	eric.johnson@valpo.edu
Johnson, Mark C	Webmaster	Purdue University, West Lafayette	mcjohnso@ecn.purdue.edu

2010 IL/IN Section Award Winners

2010 Outstanding Campus Representative

J. Bruce Elliott-Litchfield, Ph.D., Assistant Dean and Professor, University of Illinois at Urbana-Champaign

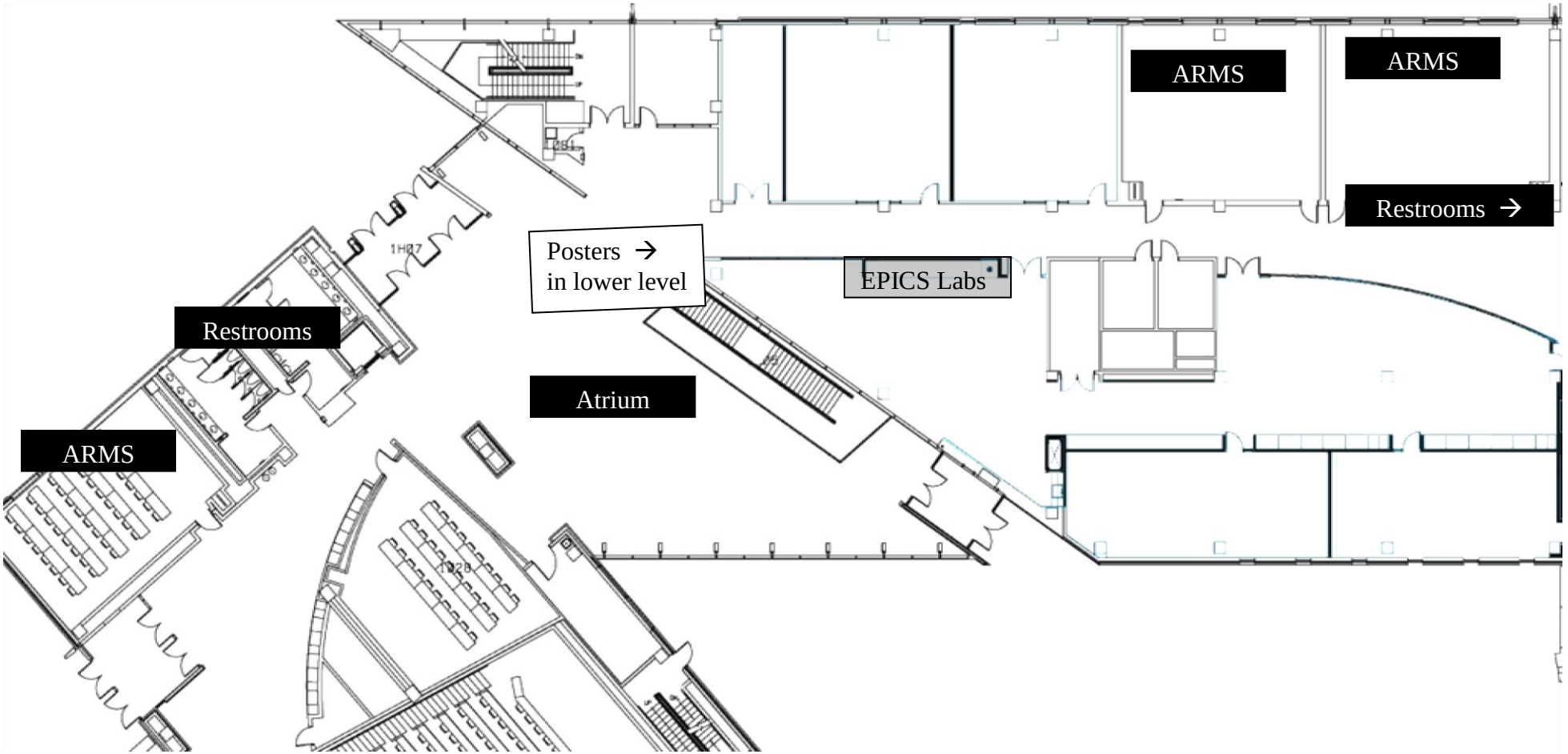
2010 Outstanding Service Award

Mark C. Johnson, Ph.D., School of Electrical and Computer Engineering, Purdue University

2010 Outstanding Teacher Award

John M. Torkelson, Ph.D. , Walter P. Murphy Professor of Chemical and Biological Engineering and Materials Science and Engineering, Northwestern University

Map of ASEE Rooms in Armstrong Hall of Engineering



Abstracts for Presentation and Panels

A1: Innovations in engineering education
Room: ARMS 1103

Group Design Projects
Scott Post, Bradley University

In the junior-level fluid mechanics course in mechanical engineering at Bradley University, three different semester-long group design projects have recently been used. The first project is a rocket design project, in which student teams have to design and build a small model rocket that must travel a specified horizontal distance. While this project has many desirable attributes, it is not truly an open-ended design project, in that all successful rockets will have basically the same design. To improve upon this, a new design project was developed in which teams build foam gliders, with the highest score going to the team whose glider travels the furthest. No constraints are placed on the design of the glider, other than it must be made from a standard piece of foam that all teams receive. A third project is being implemented this semester in which each team will have to build a scale model wind turbine that will be tested in a wind tunnel. Grading will be based on the amount of power generated by each turbine. A comparison of the three projects with the advantages of each will be presented, along with a list of the required hardware to perform each project, and a description of the relationship of the projects to ABET learning outcomes.

Open-Source VLSI CAD Tools: A Comparative Study
L. Jin, C. Liu and M. Anan, Purdue University Calumet

The design of electronic circuits can be achieved at many different refinement levels from the most detailed layout to the most abstract architectures. Given the complexity of Very Large Scaled Integrated Circuits (VLSI) which is far beyond human ability, computers are increasingly used to aid in the design and optimization processes. It is no longer efficient to use manual design techniques, in which each layer is hand etched or composed by laying tape on film due to the time consuming process and lack of accuracy. Therefore, Computer Aided Design (CAD) tools are heavily involved in the design process. In today's market, there are plenty of VLSI CAD tools; however, most of them are expensive and require high performance platforms. Selecting an appropriate CAD tool for academic use is considered as one of the key challenges in teaching VLSI design courses. In this paper, number of open-source and freeware CAD tools are presented and evaluated. Based on the objectives of the user, this paper furnishes guidelines that help in selecting the most appropriate open-source and freeware VLSI CAD tool for teaching a VLSI design course.

Students' Misconceptions in Science, Technology, and Engineering
Tatiana Goris, Dr. Michael Dyrenfurth, Purdue University

There is some evidence that suggests that when students learn a new material, many of them already have some kind of understanding of the problem. They also may have pre-conceptions or naïve theories in their mind about the new or experienced concept. These

pre-conceptions are also called alternative conceptions or misconceptions. Misconceptions also can be identified as students‟ prior knowledge, which are embedded in a system of logic and justification, albeit it may be incompatible with accepted scientific understanding (Tomita, 2008, p.10). Usually misconceptions are robust, very resistant to change, and deeply rooted in everyday experience. Often new information, presented by instructor, comes to conflict with already existing student‟s mental models. Therefore, to overcome existing misconceptions, some kind of conceptual change has to occur in the student‟s mind. For the successful conceptual change, a new concept has to be "(a) *intelligible* - the new conception must be obvious to make sense to the learner; (b) *plausible* - the new conception must be seen as reasonably true; (c) *fruitful* - the new conception must appear potentially productive to a learner for solving current problems. The major goal of teaching methods is to create a cognitive conflict to make a learner dissatisfied with his or her existing conception" (Posner et al., 1982, p.352). "The goal of conceptual change theories is to understand and propose a way to overcome…stubborn resistance to change" (Ohlsson, 2009, p.68). In general, the research on misconceptions and the research on conceptual change are intertwined very closely. There are many theories that explain mechanisms of conceptual change in different ways; therefore, depending on definitions of "what misconceptions are," each theory offers particular ways for removing (or at least clarifying) misconceptions. During last two decades, a significant amount of research was conducted to investigate students‟ misconceiving in science. Most of the literature is related to correct/incorrect explanations of physical phenomena (like heat, force, energy, etc). But research about misconceiving in technology and engineering is very limited. According to constructivist theory, which states that humans generate knowledge and meaning from their previous experiences, the same concept might be recognized differently by people who have a core focus in their education on scientific fundamental knowledge, comparing to people, which education is more orientated to technological needs and development of procedural knowledge as well. In short, scientists and technologists might perceive the same task, concept or phenomenon in different ways. It follows that, "science" and "technology" students also might have different misconceptions about the same phenomena.

Work in Progress – Contextualizing Energy Balance Problems to Introduce Design and Engage Relevant Environmental, Economical and Societal Impacts

Julia Thompson, Brent Jesiek, Purdue University

Recent reports show the future engineer must be knowledgeable about contemporary issues and society.[1] To achieve these goals, engineering education must prepare engineers to understand social context while also maintaining a strong technical core.[2] This work in progress will present two problems of a type typically found in physics and dynamics courses. The first problem is based on an energy balance and force diagram in abstract form while the second situates a similar diagram in a more realistic context. The second problem also poses additional discussion questions focused on design and societal impact. Within this interactive session, the audience will be asked to review and respond to the two different questions and provide feedback on both the specific problems and the more general challenge of contextualizing engineering problems. To help frame the discussion, the author will review other previous and ongoing efforts to make engineering problems more realistic and engaging.

Virtual Prototyping of Mechatronics for 21st Century Engineering and Technology

Ryne McHugh, Henry Zhang, Purdue University

Mechatronics is defined as the synergy of mechanical and electrical systems featuring their precision, electronic control with intelligence in product design and manufacturing processes. Further, these disciplines can be rendered down to the functional structure of Mechatronics, reflecting the product's six aspects: the microcontroller, power supply, mechanical body, sensing apparatus, precision mechanical actuators, and their communication. With that said, it becomes important to address why a synergistic combination is useful and necessary in engineering and industry. 21st century products demand it. Intelligent mechatronics products are becoming more prevalent. Therefore, the students must be prepared to meet the needs to design such products in near future. They must be capable of creating products with increased functionality, reduced costs, and optimized performance thus achieving higher product value. Mechatronics and its virtual prototyping can aide the manufacturer in all these ways. This paper will first look at virtual prototyping. Dassault System's SolidWorks in combination with National Instruments' LabVIEW and the NI SoftMotion Module provide a very effective way of virtually prototyping. The value of which lies in the reduction of cost, time, effort, and materials needed to produce physical prototypes. Secondly, the paper will show how virtual prototyping can give a company more dexterity in the marketplace. This is achieved through another advantage of mechatronics virtual prototyping. The physical prototype is only produced after its virtual counterpart has the optimized performance, and the designer can achieve the best product with less design iterations. Thus, it takes less time to adapt and produce products that better suit the marketplace. Risk is present in all business. Businesses must make decisions that may not result in a desired outcome. Therefore, it is important to keep risk to a minimum. It is especially important to reduce risk with respect to new products. Virtual prototyping can significantly reduce risk through a combination of all the previously mentioned advantages of mechatronics and its simulation. Finally, this paper will present a number of useful examples of mechatronics and virtual prototyping in industry and engineering. These examples are shown through the use of virtual design tools including, but not limited to: efficiency, optimization, CAD integration, and tuning analysis.

A2: Presentation Session: Innovative approaches to K-12 Education
Room: ARMS 1109

Improving Outreach Programs using the Perspective of Current Engineering Students' Pre-Engineering Activities, Ida Ngambeki, Diana Bairaktorova, Purdue University

There are many examples of engineering outreach activities designed to educate students about the wide variety of jobs available with an engineering degree, demonstrate the accessibility of engineering knowledge and encourage those students who would otherwise have steered clear to take another look at engineering. Early outreach also allows students to start thinking about the possibility of engineering far enough in advance to make sure they take the requisite high school courses to enter an engineering program. The most effective way to assess the success of such outreach programs is to follow the participating students and determine whether they successfully entered engineering programs.

This is however, difficult to do because outreach programs often do not have the resources necessary to keep track of students. An alternative way to achieve the same objective is to consider the pre-engineering experiences of currently enrolled students. An examination of these experiences to determine how and why they led to successful enrollment in engineering provides an indicator of what components are most effective in an outreach program. 974 students in their first year of engineering were asked to describe the experiences and interactions that had the most influence when they were contemplating an engineering career. A narrative analysis is being performed to identify why certain interactions and experiences were particularly compelling. Results indicate that pre-engineering knowledge and experience, and therefore the reasons that students go into engineering, vary greatly. At the same time, there are commonalities unique to certain groups of students, particularly those with the same social background, and those who choose certain engineering disciplines. The final results of this study will provide valuable insight into why students find particular incidents and interactions so persuasive. We are particularly interested in the experiences reasons women and minorities are attracted to engineering.

Improving K-12 students achievements in STEM contents by designing musical instruments

Marcelo Caplan, Science Institute – Columbia College Chicago

Music is an artistic expression familiar to everyone. Young learners generally have positive attitudes toward music and music-related events. For this reason, music and musical instruments provide an encouraging framework for introducing and developing STEM concepts and skills in the K-12 population. At the same time, large parts of national and state mathematics and science tests are based on the interpretation of collected data. National and state exams in mathematics and science include many questions where students must interpret collected data in order to make an educated decision. One way to develop data interpretation skills is to solve problems that involve experimental design and data collection and analysis. Students learn from this process, especially if they use their analysis and results to design and produce their own product. Through these processes students practice a large number of skills. These include designing experiments to answer questions relevant to their problem, collecting and presenting data in a variety of forms (numerical, graphical and algebraic), and analyzing the results of the experiment to provide necessary information for the design of their final product. As part of the learning process the learners will be introduced to the physical principles of basic musical instruments such as chordophone, aerophone and idiophone and the engineering concerns in their design. They will explore the basic mathematical relationship between the physical length of the instrument and the frequency produced and with this information they will design and build a final product, according to the musical requirements (e.g. producing the desired frequencies) when testing its capabilities. In the presentation, a complete learning unit will be presented. The unit deals with the design of an informal instrument based in the scientific experiments designed by the students. The effects of its implementation in a classroom will be discussed.

Identifying Engineering Interest and Potential in Middle School Students: Developing an Instrument

Michele L. Strutz,

Due to the projected U.S. market demand in 2014 for 1.64 million engineering educated and trained individuals, it is vital that we help children understand engineering concepts, explore career choices in the field of engineering, and determine if pursuing engineering would be a good fit for them. Today's curriculum is very focused on mathematics and writing due to the demands of standardized testing, however with a national interest in Science, Technology, Engineering, Mathematics (STEM) education, there is a movement to incorporate engineering into the curriculum. Since children make career choices by 7th grade[56], integrating engineering concepts and engineering college education and career options into the K-6 curriculum are a necessary change. One way to determine if engineering is a good fit is for a student to use a self-assessment instrument. A self-assessment tool helps an individual discover more about him/her self. In making career choices, an assessment of one's skills, interests, personality, and values influences career decisions. Exploration of the literature reveals that an instrument for self-assessment of young engineering talent, interest, and fit does not exist. The purpose of this research is to create an instrument to help fifth and sixth grade students identify themselves as having engineering interest and potential. The purpose of this instrument is to raise awareness of student interest and potential in engineering and is not intended to serve as a screening instrument. This work describes the instrument development and the input from the engineering and education communities in the context of a content validity of the draft version of the instrument.

Guitar Building Course Gives High School Students: A Taste of Engineering

Dorene Perez, Jim Gibson, Sue Caley Opsal, Rose Marie Lynch, Illinois Valley Community College and
Richard Mark French, Purdue University

High school students are getting a taste of engineering and earning college credit by building electric guitars. Illinois Valley Community College (IVCC) is offering a Taste of Engineering Careers (TEC) course on guitar building modeled after a Purdue University workshop and supported by a National Science Foundation (NSF) grant. The course is part of an NSF grant-funded project to recruit people into engineering and engineering technology careers. In fall 2009, 12 students completed the first TEC course. For a minimal fee, each student emerged with the guitar he or she designed and built. Evaluations of that first class are promising, with assessments indicating the class met its objective of building interest in and commitment to engineering-related careers. Additional sessions are being scheduled with one just for high school women being planned.

B1: ***Opportunities for Collaborative Efforts in Engineering and Technology for Haitian Relief***

Room ARMS 1021

This discussion session will explore opportunities and challenges in efforts to meet the vast needs of Haiti as it recovers from the recent disasters. Faculty and officials from Habitat for Humanity who are working in Haiti will be present to share their experiences and guide discussions. The intent of this session is to develop concrete plans for collaborations across departments and universities to enrich the educational experience of our students while addressing the compelling human needs of the nation of Haiti.

B2: Research and Assessment in Engineering Education

Room: ARMS 1103

Preliminary Results of Integrating Graphical Programming into a First-Year Engineering Course, Gregory Bucks, Purdue University

Many first-year engineering curricula either include a course on computer programming or integrate programming within one of the introductory courses. The development of the skills inherent in computer programming is essential for our engineering students. These skills will be used throughout their academic and professional career for both their disciplinary work as well as enabling them to effectively utilize computing technologies in both the design of products and within the products themselves. Unfortunately, there is significant evidence that students in these introductory programming courses have difficulty both learning the concepts as well as applying those concepts in the writing of code. This is especially prominent among engineering students. One reason for this discrepancy between the learning outcomes desired by instructors and student performance is that the instructional methods used and the very nature of the material does not match well with the learning styles of most engineering students. Many different models and assessment instruments have been developed to understand the learning styles of students. The most commonly used within engineering is the Felder-Silverman learning styles model, with its associated assessment, the Index of Learning Styles (ILS). Most programming languages taught in introductory courses are text based. It has been shown that interpretation of the written word is processed in the same manner as spoken words and favors verbal learners over visual learners. In addition, interpreting the meaning of words favors students who tend more toward the intuitive end of the sensing-intuitive scale. This can lead to significant problems for engineering students, as studies have found that engineering students tend to be more visual and sensing in terms of their learning styles. Another issue that faces many students when beginning to learn computer programming is that they have no basis on which to build appropriate mental models of the inherent concepts. Programming is abstract, with no physically realizable phenomenon on which to begin to develop a model. In addition, since most text based languages utilize English language terms, students may resort to incorrectly employing natural language models in place of models of programming concepts. This can lead to many problems, both in the students understanding of the concepts as well as their ability to use them in the development of code. One promising avenue to explore in an attempt to address this issue is the use of graphical programming environments. Graphical programming environments allow the user to create programs by connecting together graphical icons representing different functions, similar to flowcharts. A hypothesis is that using environments such as these could help students who tend to learn better from visual presentations, because the graphical nature of the program will help to make the structures easier to comprehend. The potential to enhance first-year student learning

motivated a pilot approach at a large university's introductory engineering class to use graphical programming as the dominant computer tool within the class. Design was taught through the use of a graphical programming language that culminated in a service-learning project in which students developed computer programs designed to excite middle school students about math and science. This presentation will discuss the curricular structure, the implementation of the graphical programming language, examples from the class and initial assessments from the experience.

Formative Assessment for Online Chemical Engineering Simulation Modules: Teachings from the Students, Phil McLaury, George Bodner, Purdue University

Engineering students may exit college with little or no understanding of processes and phenomena on the molecular level. Recognizing and addressing this deficit, researchers have developed web-accessible chemical engineering computer simulations. The first of these visually models the kinetic behavior of gas molecules when acted upon by a moveable wall in an enclosed space. Students at two universities participating in this study were given suggestions for input parameters for and permitted to run the simulation on their own time as an alternative to a more traditional laboratory exercise. These exercises were graded, and students were asked to complete an online survey regarding their experiences with the lab and simulation. Our group has been involved in the formative assessment for these modules, initially observing interesting differences in student responses, both qualitative and quantitative, between the two sites using this first module. These differences are possibly a result of variation in the classroom instruction provided, perhaps indicative of student preferences for specific ways in which this simulation was presented. Initial survey responses reveal students, in general, are positively inclined towards computer simulations, feel that this simulation helped them visualize molecular processes, and feel the simulation was reasonably easy to use. However, concerns about crashes and amount of time the simulation required to generate usable results were expressed by students. Preliminary results indicate the potential usefulness of these modules to instructors while highlighting a need for users to surmount real-world challenges in implementation. Future work will focus on maximizing each module's instructional benefits while minimizing their shortcomings, either real or perceived. This is to be accomplished by a systematic, thorough, and continuing evaluation of on-site student feedback in order to suggest further changes in modular designs or instructional presentation.

Self-efficacy for cross-disciplinary learning on team design projects
Xiaojun Chen, Scott Schaffer, Purdue University

The ability to participating in cross-disciplinary teams as an engaged member is an important competency for undergraduate engineering students. A major component of team work is learning to work with others from different disciplines. This type of learning is intended to help students transcend their own disciplinary boundaries, appreciate different frameworks, and (eventually) broaden their perspectives to include those of other disciplines. The current study is a focus on identification of cross-disciplinary learning objectives and related

behaviors, attitudes, and understandings. A mixed-methods design was used to address two major research questions: what is students' understanding of cross-disciplinary team learning, and how students' levels of self-efficacy change through participation on cross-disciplinary design teams. Two cross-disciplinary teams with 14 students participated in this initial validation study. In 2010 Spring semester, more cross-disciplinary teams with about 200 students participated in the semester-long study. Researchers developed two instruments: 1) a self-efficacy questionnaire and 2) a mid-semester reflection. The self-efficacy measure contains five items aligned with the four major CDTL learning objectives. Results indicated that students' understandings of cross-disciplinary team learning were influenced by their prior experience working on such teams, as well as their disciplinary and design knowledge. Results also indicated that students' confidence in working on a design team with members from different discipline has increased. Cross-disciplinary team learning discussions were evidenced in reflections and open-ended survey responses as well.

Can Ethics Be Taught?: An Authentic Approach to Ethics Pedagogy
Titus, Craig and Carla Zoltowski, Purdue University

Our research team, comprised of members with backgrounds in Electrical Engineering, Mechanical Engineering, Engineering Education, Philosophy and English, takes as its starting point the premise that engineering students often have too little curricular exposure to instruction in ethics, and even less exposure to a controlled environment for application. We see this as a significant gap in modern engineering curriculum, a gap which leads to students in design courses who often lack the skills they need in order to engage in beneficial moral reasoning and decision making, both in class and in their intended professions. We interpret this as an opportunity to create curriculum aimed at developing the skills needed in the engineer of the future. In the context of a large, multi-section, interdisciplinary service-learning design course—with students from nearly 40 different majors and all four grade levels— we have designed measures to integrate the instruction and assessment of moral decision making into the regular curriculum. We have so far created a large-scale lecture, small-group workshops, and an assessment instrument to measure moral decision making. We would like to demonstrate our most direct methods of instruction—the lecture and the workshop in condensed form—to show how we have addressed the unique situation of working with such a diverse body of students as they learn about ethics and moral decision making in a real-world, service-learning environment.

B3: Panel Session and Discussion: K-12 Programs and Approaches
Room: ARMS 1109

Moderators:

- Johannes Strobel, Director of INSPIRE, Purdue University
- Pamela Dexter, National Coordinator of EPICS High

This session will provide overviews of successful P-12 programs in education and research. Overviews of Purdue's INSPIRE and the EPICS High School Programs

will be provided to stimulate discussions. Opportunities will be provided for audience members to offer success stories and explore challenges engaging pre-university programs and research.

Workshop Messy Engineering Problems: Not Just Authentic but Strategic Fulfillment of Multiple Learning Objectives
Room ARMS 1021

Heidi Diefes-Dux, Matthew Verleger, Amani Salim, Mark Carnes

Students graduate into a world where we know they will work on messy problems. So we are obligated to give them experiences that simulate engineering practice in our courses, and we map these activities to multiple national and institutional program outcomes and course learning objectives. But how can we develop, implement, and assess these experiences to better ensure and document student learning? This workshop will engage participants in a messy engineering problem. Through this problem, participants will be introduced to a means of framing open-ended problems, will discuss elements of delivery that tackle multiple learning objectives, and will experience a feedback and assessment strategy that has meaning for engineering practice. The content of this workshop is the result of eight years of NSF funded research on open-ended problems in engineering.

C1: Panel Discussion on Capstone Experiences in Engineering and Technology Programs
Room: ARMS 1109

This panel will present models for Capstone Experiences in Engineering and Technology. Innovative approaches will be presented as well as challenges and future opportunities. Discussions will focus on best practices and challenges common to capstone courses.

Panelists include:
Mark Johnson, Purdue University
John Nolfi, Purdue University
Karl Zimmerman, Valparaiso University
Stephen Chenoweth, Rose-Hulman Institute of Technology

D1: Presentation Session: Global Experiences in Engineering Education
Room: ARMS 1109

Civil Engineering Global Programs A Success Story
Becky Hull, Purdue University

The Civil Engineering Global Programs Office (GPO) is dedicated to developing civil engineers with a global consciousness. The CE Global Programs Office promotes understanding and respect among all races, religions, and cultures through international exchange of students, education, and ideas. The GPO was created in response to a request for "engineers who have been outside the state of Indiana" made in a 2006 meeting of the CE Advisory Council. Phase I of the program promoted participation within the existing framework of students studying abroad for one or more semesters. Phase II implemented a model that consisted of a semester long course taught on Purdue's campus by a Civil

Engineering faculty member that culminated in a 10 day trip abroad to the focus country/project. The program is a resounding success. GPO's first international experience was with Dr. Ayhan Irfanoglu. Dr. Irfanoglu, a faculty in CE-Structural Engineering, led a group of 21 students to Istanbul, Turkey for 10 days in March 2008 to study Earthquake Engineering. The second trip was to Beijing and Shanghai, China, in May 2009. Led by Dr. Ming Qu, a faculty in CE-Architectural Engineering, the focus of the visit was Green Building and Sustainability. Eighteen students participated in the 14 day trip. In August of 2010, the GPO is planning a trip to London, England to study the site preparation for the 2012 Olympics and the England-France Channel Tunnel (Chunnel). The paper describes the vision of the program, administrative aspects of the program, courses offered to date, and future program plans. Dr. Ayhan Irfanoglu and Dr. Yating Chang will submit a supporting paper on the abroad experience with Turkey and Dr. Ming Qu will submit a supporting paper on the abroad experience with China.

Earthquake Engineering-Istanbul at the Threshold: A Successful Global Experience Course Offered Through Collaboration, Ayhan Irfanoglu, Yating Chang, Purdue University

In Spring 2008, a semester-long earthquake engineering course that incorporated a 10-day study abroad experience to Istanbul, Turkey was offered as part of an effort to introduce international engineering experience in the Civil Engineering curriculum at Purdue University. The course was developed by a Purdue civil engineering/structures faculty as a collaborative effort between the Global Engineering Program (GEP) and the Civil Engineering Global Programs Office (GPO) at Purdue University and the International Association for the Exchange of Students for Technical Experience (IAESTE-USA and IAESTE-Turkey). Structural engineering perspective formed the core of the course but a range of earthquake related topics such as geology, seismology, and architecture were also incorporated. The course was offered to students= nationwide and attracted 21 students from a wide range of fields including civil, mechanical, mining and mineral, and geophysical engineering. Majority of students were recruited from Purdue University; but there were four from other universities. The group had three sophomore, ten junior, six senior, and two graduate (doctoral) level students. Through distance virtual learning technology, students from all institutions were able to participate in real-time semester-long classroom meetings before and after the actual study abroad experience in Turkey. Anonymous surveys from Spring 2008 and a follow-up anonymous survey of the participants after one-and-a-half year suggest that the students had a very enjoyable learning experience and achieved high learning outcomes throughout the course, and have since seen long-term benefits from the course and the international experience it offered. The paper describes the course, expected and observed learning outcome, and program logistics in light of international institutional partnerships. The Earthquake Engineering-Istanbul at the Threshold became the first course offered by the Civil Engineering Global Programs Office (see accompanying paper by Hull), which

has since firmly established itself. The Earthquake Engineering-Istanbul at the Threshold course is to be offered again in Spring 2011.

Green Buildings and Sustainability in China: A successful Study Abroad Program in Civil Engineering at Purdue, Ming Qu, and Becky Hull, Purdue University,

A three credit study abroad program, which focuses on the design and technical aspects of Civil Engineering related to sustainability in China, was offered as part of an effort to introduce international engineering experience in the Civil Engineering curriculum at Purdue University in May of 2009. The course was developed by a Purdue civil engineering/Architectural Engineering faculty and the Civil Engineering Global Programs Office (GPO) at Purdue University. The objectives of this program are to teach students sustainable building design from both theoretical and practical perspectives, and to provide a unique opportunity for students to experience international culture. This wonderful study abroad program attracted 18 students from a wide range of fields in the Civil Engineering. In this program, sustainable design was addressed in classroom and some notable sustainable built environment practices were explored in field trips from May 14 to May 27, 2009. Anonymous surveys at the end of the program indicated that the students had a very enjoyable learning experience and achieved better understanding of sustainable building design and Chinese Culture. The paper describes the course, expected and observed learning outcome, and suggestions for future similar program. Green Buildings and Sustainability in China became a successful study program offered by the Civil Engineering Global Programs Office. It has been encouraging more and more faculty to develop Global Engineering Programs.

E1: Discussion and Panel Session on Service Learning
ARMS 1109

New Frontiers in Service Learning: City – University Collaboration for New Product Review, Erdogan M. Sener, IUPUI

If there is one thing that we have been convinced over and over in my 20+ years of teaching is that there is no substitute for service learning if one can be arranged meaningfully. This project focuses on involving both graduate and undergraduate students from the Construction Engineering Management Technology (CEMT) Program at IUPUI in a New Product Review (NPR) process that is being undertaken for the Department of Public Works (DPW) of the City of Indianapolis. Within the context of this program, CEMT students provide technical evaluation of new materials, technologies, and services to the City through a University – Public entity collaboration. As the City of Indianapolis continuously updates or adds to its infrastructure, new materials, processes, and technologies ("products") are frequently introduced to the City by various outside Vendors. For the Department of Public Works these are often products that deal with sanitary sewer and storm water infrastructure systems. Previously the City's new product review process was facilitated by outside consultants but as the City grew DPW began to experience a need for help with the process from a non-partial third party. So, when they were presented with a system that would provide excellent service learning outside the classroom for students, as well as, provide "product" evaluation resulting in lower costs, shorter review times, and a number of other benefits, they were

happy to entertain the idea and thus the collaboration between the City DPW and IUPUI/CEMT was born. The presentation focuses on how the process is being implemented, what kind of reviews have been conducted to date, and how has this undertaking impacted student learning and in which ways.

Overviews of Service-Learning Projects and Programs

IPRO Program – Illinois Institute of Technology
Tom Jacobius, Director of IPRO

EPICS Projects at Notre Dame
Greg Madey, Computer Science and Engineering

EPICS Projects at Butler University
Panos Linos, Computer Science and Software Engineering

EPICS Program at Purdue University
William Oakes, Director of EPICS Program

E2: Panel/Discussion Session: Overcoming Obstacles to Innovative Instructional Technology Use

Room ARMS 1103

Moderator: Joanne Lax, Purdue University

Despite the plethora of innovative instructional technology applications available for use in undergraduate engineering classrooms, not all faculty choose to implement them. Research has shown that there is a variety of reasons—including structural constraints in classrooms and characteristics of the instructors themselves—that keep faculty from adopting new technology. This panel brings together several early and later adopters of classroom technology to discuss any challenges they have encountered, either in persuading other faculty members to use new technology they either developed or championed or learning to use it, respectively. This technology may include handheld student response units ("clickers"), an interactive wiki, and the nanoHub, a multifaceted internet resource tool.

Panelists Include:
Dr. Mimi Boutin, Purdue University
Dr. Mark Johnson, Purdue University
Dr.. Yung-hsiang Lu, Purdue University
Dr. Gerhard Klimeck, Purdue University

Graduate Posters

Title: Identifying Student Conceptions of Design using a "6 Most and Least Important" Assessment Tool
Autor: Bethany Fralick, Purdue University

The Design Knowledge Assessment study was implemented in five sections of a yearlong freshman level course in a First Year program for honors students interested in engineering. In this course students were placed in teams of 3-4, and engaged as a team in three design projects. During the first week of the spring term, students were given a pre-test on what activities were most or least important in design. The ranking activity asks students to identify six design activities (from a list of 23) as "most important" and "least important" for design. This instrument was based on prior research on design cognition and has been used with novice designers as well as practicing professionals. During the last two weeks of class students were given an identical post-test. Overall, 115 pairs of students completed both the pre and post test. Analyses explored group effects at the paired level.

In this poster we present results from this study that both confirm and challenge our initial hypotheses. For example, considerable research suggests that "understanding the problem" is a key marker of moving from less novice to more expert conceptions of design. However, this was not a statistical difference in the pre to post data, but 83% of the students agreed this was among the most important activities. As another example, there was a dramatic increase in responses for "iteration" as important to design that substantially supports one of our hypotheses. Overall, study findings identify improvements to the instrument and support the utility of the instrument as an assessment tool.

Title: Organizational Readiness for Change in Engineering Education Transformation
Authors: Junaid Siddiqui, Purdue University

"Organizational Readiness for Change" is among the measures which may be useful to assess the potential of an organization at a given point in time to adopt a given change. In the literature "Organizational Readiness for Change" is conceptualized as an organizational level construct which is formed by the perceptions of individual organizational members towards a change. These perceptions are in turn determined by the organizational context, what is being changed and how the change is being implemented.

The results of research on engineering education lead to recommendations that in many cases require an organizational change. However, translating research results to a practical implementation on an organizational level often prove to be a significant challenge for widespread adoption.

This poster will present work in progress on studying organizational readiness for change in engineering education transformation. This includes a synthesis of the literature which highlights aspects of "Organizational Readiness for Change", a concept that has been studied in business and health care organizations, and how this concept relates to and informs theories of educational change in higher education and K-12 education settings. The poster also includes a summary of instruments for assessing "Organizational Readiness for Change" and a description of a research study to investigate these ideas in engineering education organizations.

Title: Identifying interpersonal mechanisms for accelerating embedded knowledge transfer across engineering generations.

Authors: Sirui Hu, Purdue University

The oldest engineering professionals of the Baby Boom generation are beginning to retire from their career posts. Their retirement will clear a huge pathway for young and energetic engineers to enter the workplace at significant rates. It remains unclear how firms will be financially impacted by these demographic changes and the onslaught of retiring workers (Le & Bronn, 2007), yet it is reasonable to believe that continuing to ignore the knowledge drain could foster a period of significant performance risk and instability during the workforce transformation, and the loss of corporate know how during the transition.

The purpose of this mixed method research is to compare communication styles, mechanisms, and preferences between generations of practicing engineers in the field, specifically, those in the generational categories of Baby Boomers and Millennials. The objectives of this study are to:

1. Identify communication characteristics of target engineering generations that could assist or impede engineering experience/knowledge sharing and learning transfer.

2. Determine individual communication technology (ICT's)(Sørnes, Stephens, Sætre, & Browning, 2004) preferences by each target engineering generation, for expressing ideas, rendering opinions and assessing value/fitness of engineering systems. Individual Communication Technologies (ICT's) are defined technology based communication ranging from phone calls and voice mail, through the use of internet based email, as well as all personal hand held communication devices (Sørnes, et al., 2004). Results of this study are intended to benefit the industrial sector by generating insights for increasing knowledge transfer amongst their transitioning engineering workforce. Additionally, benefits are expected to reach current engineering students of the Millennial generation as they contemplate entry into the workforce. Educators will also benefit from the research by identifying new attributes from which sharply focused teaching pedagogies can be developed - aimed at enhancing and accelerating in-firm operational efficacy of novice engineers departing their institutions.

Title: Application of traffic simulation and animation modules for transportation engineering undergraduate courses: A Case Study

Authors: Jiguang Zhao, , Southern Illinois University Edwardsville

Most transportation-related courses are still addressed in a traditional way with "chalk and talk" lectures, "paper and pencil" problem-solving, and class projects or papers on related topics, failing to motivate students and preventing them from effectively assimilating and applying knowledge in their future work. Visualization with computer simulation and animation can help solve the problem and is particularly valuable in transportation education. However, it has not been widely adopted in the education of transportation engineering yet. To promote visualization techniques in transportation engineering education, a set of modules that can be easily incorporated in the undergraduate transportation courses were developed with traffic simulation software and

other visualization techniques. Basic concepts on driver and pedestrian behavior, such as perception-reaction time, gap acceptance, were developed with proper simulation/animation techniques. Also included were some basic concepts on traffic flow such as velocity, density, etc. Some videos on application of Intelligent Transportation System, such as automatic driving, Electronic Toll Collection, and automatic traffic surveillance, were be collected, archived and presented to the class. A series of modules were developed to help students better understand the signal timing and control logic of signalized intersections such as signal synchronization, actuated signal controlling, etc. Comparative studies were conducted on two groups of students across multiple semesters. The control group received the traditional case study-based assignment and the treatment group took visualization-based assignments. Learning outcomes were measured with three criteria: time taken to complete the assignment, achievement of learning objectives, and students' reflections on the learning experiences with the assignments. Results indicated that the modules contributed to strengthening the undergraduate civil engineering education curricula as a whole and aligning them with the concurrent civil engineering practice of the twenty-first century business environment. The outcome will improve the undergraduate transportation engineering courses for about 100 civil engineering juniors and seniors per year.

Title: Global Design Team: Concept, Assessment, & Case Study

Authors: Anne Dare, Rabi H. Mohtar, P.K. Imbrie, Ayse Ciftci, John Lumkes, Anshuman Didwania, Charlie Dewes, Jennifer Lai, Josh Seidner, Dulcy Abraham,

Global Design Team (GDT) is the flagship global service-learning opportunity of Purdue University's Global Engineering Program. The GDT experience offers intense, international cultural exchange woven into service-learning projects that address global grand challenges. GDT engages students and faculty in international development projects to provide a real-world, full-cycle design experience and raise global awareness. The GDT model includes: the identification of need which translates to learning experiences which enable students to solve real-world problems, on-campus expertise, partnership with an international entity which provides local expertise, positive impact on and abroad, and a sustainable effort with regard to the partnership and deliverable. Students participating in this program are invited to participate in assessment of their experiences through completion of pre- and post- assessments and reflective journals to identify which global engineering competency attributes are addressed by the GDT experience. The poster uses the example of a project undertaken in the spring semester of 2010 to illustrate the key concepts of the Global Design Team. A multidisciplinary team composed of students from Purdue University's College of Engineering is partnering with the Palestinian Hydrology Group, a non-governmental organization operating in the Palestinian territories, to address pressing issues facing the region. The goals of this project are to: (a) assess the current water infrastructure, (b) develop methods to distribute water in an equitable and optimal manner to consumers within Jericho City, and (c) develop recommendations for improvements or modifications in the current infrastructure. Towards achieving these goals, this team will construct models to study demand as well as supply considerations of water resources in the city of Jericho. Using these models this team will present possible pricing structures that aim to resolve conflicts between various stakeholders of water in Jericho City and provide suggestions to facilitate higher cooperation between these entities.

Title: Engineers Global Competencies

Authors: P.K. Imbrie, Rabi H. Mohtar, Ayse Ciftci, Stephanie Tanner, Anne Dare, Purdue University

To develop solutions to grand challenges, engineers must be prepared to work effectively in and with the complexities of new and diverse environments, and analyze problems holistically, from various cultural frames of reference. This research team proposes a conceptual model of global competency for engineers which considering the factors that influence global competence and the attributes by which we may measure global competence. The influencing factors include: 1) institution(s) at which the individual studies/studied, 2) characteristics of faculty at that institution, and 3) an individual's personal background. The attributes by which we may develop an instrument for measuring global competence include: 1) technical competencies, 2) professional competencies, and 3) individual factors. This team is looking not only at the relevant attributes, but also at the appropriate methodologies for assessing how well Purdue Engineering global offerings help students achieve these attributes.
While this model is in development, preliminary assessment of programs within Purdue's College of Engineering has begun using a set of global competency attributes mapped from Purdue's Engineer of 2020 Target Attributes. This information is being used to evaluate how well these programs help students achieve core global competencies. Initial results from these assessments indicate that the target programs are addressing many of the competencies being evaluated.

Title: A Titanium And Carbon Fiber Hybrid Repair Patch Using Vacuum Assisted Resin Transfer Molding

Authors: Bryan Rahm, Purdue University

This study is one step in a series of projects, all with the end goal of creating a set of repairs for any sort of typical damage that may occur to aircraft made primarily from carbon fiber. The goal is to develop a patch that restores the strength of the original structure, using a process that is predictable, repeatable, and clean. A four ply carbon fiber patch combined with a titanium patch is infused with resin using the VaRTM process to achieve the aforementioned goals.
The purpose of this specific study is to determine the characteristics and relative strength of a repair made to a carbon fiber structure utilizing the VaRTM method on a titanium/ carbon fiber hybrid patch. The traditional method for repairing minor damage to a composite aircraft structure is the wet layup approach. The wet layup method has several undesirable characteristics, stated as follows: the potential for significant variation from one layup to the next, the tendency for a resin rich product, and the exposure of the technician to the resin used for the wet layup approach. The goals of utilizing the VaRTM method in this study is to: 1.) design a predictable repair process; 2.) design a repair that contains a proper resin to fiber ratio; and 3.) reduce or eliminate the technician's direct contact with any chemicals associated with this repair.

Title: Designing Ethics Curriculum: *Teaching and Assessing Moral Decision Making in a Service-Learning Design Course*

Authors: Craig Titus, Carla Zoltowski and William Oakes, Purdue University

Our poster will outline our work in designing ethics curriculum for engineers. We see that university students often have little curricular exposure to instruction in ethics, and even less exposure to a controlled environment for application, both of which mean that students in design courses often lack the skills they need in order to engage in beneficial moral reasoning and decision making. We see this as an opportunity to create curriculum components aimed at developing the skills needed in the engineer of the future. In the context of a large, multi-section, interdisciplinary design course, we have designed measures to integrate the instruction and assessment of moral decision making into the core curriculum. This poster will provide an overview of our work currently in progress. We will describe the foundational frameworks we explored, the existing instruments we considered, and the processes we used to design the curriculum. In order to measure the effectiveness of our curriculum's ability to accurately address our learning objectives, we considered a number of existing instruments that could indicate where students are in their ethical development. But since the existing instruments did not align well with the learning objectives of our course—and the peculiarities of the service-learning experience—we are designing an assessment instrument to measure pre- and post-instruction moral development and decision making. We have created a batch of questions rooted in authentic, engineering-based, service-learning experiences to increase the ability for students to identity with the scenarios. The answer choices for each question are deliberately worded to map to stages in developmental moral psychology which indicate to us, when student responses are analyzed, their predominate psychological stage of moral decision making. Our goal with our curriculum components is to help students advance to higher and more sophisticated levels of moral decision making and we aim to assess their progress with our assessment instrument.

Title: Development of a Course in Geotechnical Aspects of Energy Infrastructure

Authors: Ruth Wertz Purdue University

Words like "sustainability", "globalization" and "alternative energy" have become very familiar words in both the academic and professional sectors. Reports by The National Academy of Engineering such as The Engineer of 2020 and Educating the Engineer of 2020 put further emphasis on the need to prepare engineering students for the challenges that lay ahead. Purdue has shown its support for the recommendations provided by these reports by creating the Purdue Engineer of 2020 Initiative in 2004. Yet currently, in the spring 2010 Purdue University course catalog, there are only 11 courses within the 12 engineering disciplines that offer both undergraduate and graduate degrees that include the aforementioned keywords in the course title or description. Of the 11 courses currently on the books, none address how the issues of alternative energy, sustainability or globalization will directly affect the field of geotechnical engineering. This poster will highlight the development of a new course which will focus on the role of geotechnical engineering in the infrastructure of alternative energy sources such as wind farms, bio-fuels, geothermal energy and nuclear power facilities. There will also be concurrent themes in sustainable practices and impacts of globalization on the profession of geotechnical engineering. The poster will not only focus on the elements of the course, but also the pedagogical frameworks used in its development.

Title: Spiraling towards 2020: Project Based Spiral Curriculum as a model for developing Purdue's Engineer of 2020

Authors: Alice Robinson, Purdue University

This project focuses on developing undergraduate students' technical and professional skills through the development of project-based spiral curricula in the Agricultural & Biological Engineering department at Purdue. Through this curriculum, Purdue engineers will be prepared for leadership roles in responding to the global technological, economic, and societal challenges of the 21st century by exposure to the relationships between engineering and its impacts on real world needs and challenges. Project-based learning uses projects as the focus of instruction and a springboard for understanding deeper principles and has shown increased understanding, motivation, and confidence through application of engineering principles to real-world problems. The strength of a spiral curriculum is that it continually revisits basic ideas and themes with increasing complexity and sophistication. Our spiral curriculum incorporates the target attributes of the Purdue Engineer of 2020 through project based courses during sophomore, junior, and senior year. The Engineer of 2020 (NAE and Purdue) target attributes include strong technical and professional skills to solve societal and technological burdens. A prototype course has been developed, taught, and evaluated during the previous two fall semesters in the sophomore level of the Biological and Food Process Engineering curriculum. The target students met 3 hours a week in a traditional lecture setting plus 2 hours a week in a project based lab setting. The control group met only 3 hours a week in a traditional lecture setting. Peer and self assessment results from student surveys show increased confidence in every area surveyed. Focus groups revealed student reactions to the course. Students enjoyed the course but felt it difficult to handle ambiguity with project work. Future work includes course revisions to the content, assessment, and pedagogy of the prototype class, development of the remaining project courses in the curriculum, and increasing graduate student instruction in the courses to gain teaching experience.

Title: Engineering and philosophy, a course module

Authors: George Ricco, Purdue University

Engineering and Philosophy is structured as a four or eight-week module for engineering students. It is intended to be presented well into the beginning of their major courses, or perhaps half-way through their major course of study; as such, the audience is sophomores and juniors in engineering. The content selected for the course draws from topics endemic to the overarching concerns of all developing engineers: the mission of the university and the role of the professional major pathway (Gassett 1944); the lost construct of the university as a spiritual center (Heidegger 1985); the question of purpose in a career (Frankl 1967); and core concepts from existentialism. A variety of assessment protocols from various educational paradigms are discussed in order to facilitate a broad discussion over how to best judge student progression in such a course (Facione 1990, Ontario 2009, Ross 2006, and Shepard 2000). Currently, there are few examples of teaching philosophy to undergraduate engineers at this level. I have found that a program directed specifically towards engineers that is designed to teach them existential concepts and self-awareness in the context of their discipline does not exist at this time at any major institution. While various individuals have recently laid out concepts in philosophy as it applies to engineers or called for a philosophy of engineering, (Bonasso

2001, Bucciarelli 2003, Downey 2007, Goldman 2004, Lewin 1983, Moser 1997), the question of how do we prepare engineers to think philosophically is an open subject. The more important question of, how do we prepare engineers to change the field of professional engineering using philosophical constructs is even more daunting, and I address it within this work.

Title: The Creation of the Digital Logic Concept Inventory

Authors: Geoffrey Herman, University of Illinois

The engineering education community is continually developing new, innovative teaching methods for engaging students in the classroom. These methods are developed in attempts to increase student learning, satisfaction, and retention. While there are readily accessible and accepted means for measuring satisfaction and retention, reliably assessing achievement of student learning can sometimes be elusive and complicated. Rigorous assessment of learning is elusive because differences in topic coverage, curriculum and course goals, and exam content do not allow for direct comparison of two teaching methods when using tools such as final exam scores or course grades. Because of these difficulties, computing educators have issued a general call for the adoption of assessment tools to critically evaluate new teaching methods. One effective way to assess and compare teaching methods is to focus on assessing students' conceptual knowledge and judging which teaching methods increase conceptual knowledge. Increasing conceptual learning is important, because students who can organize facts and ideas within a consistent conceptual framework are able to learn new information quickly and are able to more easily apply what they know to new applications. By accurately assessing conceptual understanding, instructors are also able to match instruction to their students' learning needs. One solution for assessing students' needs is a concept inventory (CI). CIs are standardized assessment tools that evaluate how well a student's conceptual framework matches the accepted conceptual framework of a discipline. In this poster, we present our process for creating and evaluating a CI to assess student conceptual knowledge of digital logic. We have checked the validity and reliability of the CI through an alpha administration, follow-up interviews with students, analysis of administration results, and expert feedback. To date, the feedback on the digital logic concept inventory is positive and promising.

Title: Model of Students' Success: Important Factors of Students' Persistence in Engineering

Authors: Joe Lin, Purdue University

Every year a group of quality graduates from high schools entered the engineering programs across this country with remarkable academic record. However, as reported in literatures, the substantial number of students switching out of engineering programs continues to be a major issue for most engineering institutions in United States. Engineering students' cognitive data from high school and their non-cognitive self-beliefs can be influential factors affecting their academic success and retention decision. In order to effectively study the influences from these factors, a Model of Student Success (MSS) in engineering has been developed in a large Midwestern university. The cognitive attributes in this MSS include high school GPAs, standardized test scores, and the grades and number of semesters in math, science and English courses in high school. The non-cognitive variables were collected through Student Attitudinal Success Instrument

(SASI). The original version of SASI studied the following nine constructs: Leadership, Deep Learning, Surface Learning, Teamwork, Academic Self-efficacy, Motivation, Meta-cognition, Expectancy-value, and Major Decision. Later in 2007, five new constructs were added into SASI. These new constructs are: Goal Orientation, Implicit Beliefs, Intent to Persist, Social Climate and Self Worth. Cognitive and non-cognitive data, as well as students' retention status after first year have been collected from the freshman cohorts of 2004-2009. Several modeling methodologies have been applied to study the relations between these factors and student's success. These methods include neural networks, logistic regression, discriminant analysis and structural equation modeling (SEM).

Title: Vertically integrated projects

Authors: Mandoye Ndoye, Purdue University

The objective of the VIP project is to provide an opportunity for undergraduates to explore and develop comprehensive applications of electrical and computer engineering, especially as they relate to active research of Purdue faculty members. Participating students learn about the underlying research and work on teams with the help of graduate student mentors to formulate applications of the research that address real world needs. The VIP courses, ECE 495T, ECE495U, and ECE 495V, create a vertical project track under which students work in multidisciplinary teams on long-term engineering projects. Each team consists of a balanced mix of sophomores, juniors and seniors. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with advisors who are Purdue faculty members, representatives of industry or the end-user populations. Participating students gain valuable engineering research and design skills from the VIP experience.

Title: Development in Graduate Teaching Assistants' Teaching Philosophies in Engineering Laboratories

Authors: Jonathon Hicks, Purdue University

In the fall of 2008, graduate teaching assistants (GTAs) took a course entitled ENE 595-Effective Teaching in Engineering: Linking Theory and Practice. The course was designed to provide GTAs with an opportunity to extend their teaching professional development by making connections between education theory and practice. One entity of the course was assigning GTAs with the tasks of creating graphical representations (concept map) and written statements (teaching philosophy) concerning their beliefs about effective teaching practice in engineering at the beginning and end of the semester. In turn, with the assignment of concept maps and teaching philosophy statements, an objective of the course was to provide personal deliverables that allowed GTAs to reflect upon relationships between pedagogy and engineering. To date, artifacts (i.e., concept maps and teaching philosophies) from five engineering GTAs enrolled in ENE 595 have been analyzed to see how the GTAs' teaching philosophies evolved over the course duration. Grounded theory and a constant comparative method were used to generate themes for the pre- and post- teaching philosophy statements. Some themes connected partially with dimensions of the "How People Learn"(HPL) framework, which was an essential content of the course. This poster describes the background of ENE 595 and the purpose of this study, and it also describes methods, data analysis, and overall findings of

GTA pedagogical development. These findings offer insights for GTAs' professional development and training in engineering education.

Title: Consulting Between Interdisciplinary Teams

Authors: Jessica Rebold, Purdue University

In the aerospace industry, consulting takes place all the time. Sometimes it is between people of different disciplines within the same company, and sometimes it is between people of many separate companies with different backgrounds. In an effort to provide experience to students in working with interdisciplinary teams in this manner, an Aeronautical & Astronautical Engineering class (AAE 454: Design of Aerospace Structures) was teamed with an Aviation Technology class (AT 408: Advanced Aircraft Manufacturing Processes). The AAE class was a design of aerospace structures course and the AT class was a design-build-test project course. Each class was broken into teams and the AAE teams were to provide consulting services to an AT team. The interaction between the teams was to be conducted in a professional client and consultant relationship. In developing the client and consultant relationship, first, the AAE team created a team resume that described the qualifications of the team and discussed specific services that could be provided for the AT teams. Then, the AT team chose theircon sultant based on the AAE team resumes. The AAE team and the AT team then met to agree on a specific statement of work (SOW). The SOW contained the duration of the consulting services, the exact number of hours to be provided, the tasks needing to be performed, requests for information, the preferred way of communication, the frequency of communication, and a list of final deliverables. The tasks were then carried out as stated in the SOW. At the end of the consulting term, the AAE team prepared a final report. The major lesson learned was how difficult communication was between the two teams. The physical separation and the different backgrounds of the teams impacted the difficulty
in the communications. The AAE team learned how important it was to have concise technical information which is contained in drawings, documents, and all other forms of communication.

Title: Intentional serendipity, cognitive flexibility, and fluid identities: Cross-disciplinary ways of thinking, acting, and being in engineering

Authors: Robin Adams, Purdue Univesity

Engineering is inherently cross-disciplinary – a professional practice that involves thinking and working across different perspectives, cultures, and disciplinary training. Here, "cross-disciplinary" refers to a broad spectrum of practices including multidisciplinary, interdisciplinary, and transdisciplinary. Although facilitating cross-disciplinary practice has become a national agenda that has generated substantial investments in cross-disciplinary education, there is surprisingly little empirical research that may guide the success of these efforts. This project seeks to advance a scholarship of cross-disciplinary teaching and learning by:
• Conducting empirical longitudinal studies into the nature and development of cross-disciplinary ways of thinking, being, and acting in engineering contexts, and
• Building a sustainable and energizing community of practice, an "Cross-disciplinary Commons", to enable a scholarship of cross-disciplinary teaching and learning.

This poster includes a summary of the work-to-date: (1) findings from an in-depth study into how individuals experience cross-disciplinary practice as a framework for interpreting the longitudinal study data, (2) recruitment data for a two year longitudinal study, and (3) an overview of expected outcomes.

Title: Towards Socially Sustainable Design

Author: Lindsey Nelson

Engineers seeking to understand a holistic impact of products and processes can use life-cycle assessment methodologies. Most generally, life-cycle assessment considers the associated costs and impacts of a product from natural resource extraction in its production to waste management at the end of its life. Modeled in the ideal sense as a "cradle-to-grave" analysis, life-cycle assessments trace the impacts of a product through manufacturing, distribution, use, and end-of-life stages. The current best practices in industry rely on life-cycle assessment techniques to understand the environmental impacts of various products (ISO 14044, 2006). However, a holistic definition of sustainability includes not only environmental sustainability but also economic and social sustainability. The purpose of this poster is to review the current practices of articulating the impact of a product or process on society and to highlight places of potential synergies between distinct disciplinary perspectives. Distinct perspectives, drawing on engineering, economic, development and sociology disciplinary frameworks, guide the development of social life-cycle assessment methods. The producer of the product has a greater social impact then the product itself during the manufacturing, whereas this relationship is inverted during the use stage (Jorgenson *et al*, 2008; Swidler and Watkins, 2009). Little work connects these analyses over the entire life of a product. Definitions of social sustainability require a delicate, dynamic balance between conceptual, contextual, academic and geopolitical perspectives (Osorio *et al*, 2005; Vanderburg, 2009). Identifying the creative tensions present in the conversation around social sustainability will help engineering educators engage students with this important contemporary issue in its sociotechnical context. This paper models various perspectives found in the literature on socially sustainable design as a conversation and proposes a unifying framework to connect the seemingly disparate paradigms.

Undergraduate Posters

Title: Green Roof Gray Water Filtration System

Authors: Elizabeth Freije, Nicholas Snyder, Purdue University

The poster for the Green Roof Gray Water Filtration System will illustrate the goals of the research, which are to collect and purify gray water through a green roof system to achieve adequate filtration. The purpose of the filtration process is to provide safe, potable drinking water in an eco-friendly, self-sufficient way. The project will examine the effectiveness of a vegetative roof system at removing pathogens from gray water and compare industry standard water filters with a sustainable charcoal and sand filter. The green roof research is one component of the larger DORMaTECHture project, created by Joe Tabas, an ET graduate student. This multidisciplinary project is a timely, sustainable (green), self-sufficient, energy efficient and energy neutral dorm room made out of a shipping container for two students on the Indiana University Purdue University Indianapolis (IUPUI) campus. The project will involve the design and construction of the space, which will serve as a living, on-campus laboratory of green approaches to residential architecture in Indiana. It will physically proclaim the school's commitment to careful stewardship of the planet's resources, partnership with industry experts and manufacturers, and IUPUI's involvement in this type of education, service, and research. It will be steeped in multi-discipline activity, service learning, and community engagement, and will be a testament to the principles of experiential learning. The poster will include an exploded view of the water filtration system and will compare and contrast a Green Roof Gray Water Filtration System process with that of a standard municipal wastewater treatment process. The poster will explicitly state research goals, results to date, methodology, and expected outcomes. The poster will also describe the technology of the green roof system by exhibiting the green roof substrate, sprinkler system, gray water collection, drainage, and filtration processes.

Title: Cell phone electromagnetic radiation detection and display

Authors: Cory Ocker, Spencer Erekson, Purdue University

Many Purdue University professors made significant contributions to the electrical engineering field, but the history and further application of these technologies has fallen through the cracks. The College of Electrical and Computer Engineering wanted an exhibit that promotes engineering to high school student, educates Purdue students, and honors Purdue alumni. The design of an interactive exhibit that demonstrates concepts of electrical engineering that were developed at Purdue University targeting Roscoe H. George's rectenna was developed to accomplish this goal. Under this theme an array of antennas are being designed to detect magnitude and phase of cell phone signals on all networks ranging from both 2G and 3G communication. The data obtained by the antennas is then analyzed through a computer processor and the radiation pattern will be outputted on an LCD screen in a colorful scheme. Transmitters will also be used to illustrate constructive and destructive interference for different types of antennas. This project has the potential to promote not only Purdue University, but also the electrical engineering field to the next generation of potential engineers. The display effectively integrates the design process with the end goal of using it as a teaching aid for high

schools and undergraduates. The exhibit will be modular allowing it to move from its normal home in the MSEE building at Purdue to various other locations.

Title: CED EPICS Team

Authors: Kris Miller, Purdue University

We are the Cellular Engineering Demonstration (CED) Team from Purdue University's Engineering Projects In Community Service (EPICS). Currently, we are working with the Indianapolis Children's Museum's Biotechnology Learning Center, which has asked us for interactive models to complement science lessons and to increase the interest in science for children ages six to thirteen. The two projects we are currently working on are a model for gene expression and a model for an animal cell. First, the model for gene expression will be a helpful and interactive visual aid that explains how gene expression works. The model breaks down the process of gene expression into multiple steps to help simplify the process. Our other project, the cell model, will be used to help children understand the basics of what is inside a cell. The model will be a transparent cube, with a sphere cell model in the center that is cut into several sheets that are able to rotate out of the cube, exposing the internal parts of a cell.

Title: Efficient natural light

Authors: Ian Smith, Olivet Nazarene University

A preliminary design for a lamp that uses Light Emitting Diodes (LEDs) was developed and tested. The project measured the light output of several commercial desk lamps, including an LED and a color-balanced fluorescent desk lamp to develop baseline performance levels. The operating currents, voltages, and light output of individual LEDs were determined. Comparing individual LED outputs with the area and illumination of conventional lamps suggested that 100 "high efficiency" LEDs were needed to make a good lamp. Circuits allowed adjusting the output of different colored LEDs and experiments attempted to match the color spectrum of the best "natural light" fluorescent lamp. By changing the output and number of white, blue, red, green, yellow, and amber LEDs, it was determined that a simpler combination of white, green, and yellow LEDs could be mixed to create a well-balanced "natural" white light. A prototype circuit with 100 LEDs was built, and personal-preference tests were used to evaluate the color balance of the light for different green and yellow LED currents. A 5x5 level surface-response experiment with white LEDs at full brightness and varying the green and yellow lights was used to identify an optimal lighting level. The color output of the LED prototype and the best lamp were compared using an A-B side-by-side box comparison. Results demonstrated that a LED desk lamp can be built that provides light levels similar to a good desk lamp and with an excellent color balance.

Title: DORMaTECHture Green Database Development

Authors: Ronda Dufour, IUPUI

The problem one is immediately faced with when trying to select green materials for construction projects is that product information tends to be conventional rather than empirical.. To date there are only a few reliable online databases that store information on green materials. Many of these databases require user fees, are difficult to navigate, focus only on a few products, or are tailored for a particular region. In addition, there are currently no materials listings or databases tailored to meet the unique building requirements of using intermodal shipping containers as dwelling spaces. In an effort to streamline this process we created a customized database to store information on green products and materials specific to the DORMaTECHture prototype. The initial structure of the database was based on existing examples adding specific selection criteria for materials used in the design of the DORMaTECHture project. The selection/rejection criteria combines a three tiered approach to ranking products and manufactures based on product sustainability, the manufacturing process and overall commitment of the company to addressing and/or producing sustainable products and materials. Products or manufactures failing to meet at least one of these criteria were excluded from the database altogether. The database was uniquely tailored to address the needs of current and future DORMaTECHture prototypes. It provides designers, architects and builders with a dynamic source of easy to understand information on green building products. The database is meant to be expanded upon as more green materials enter the market and selection criteria are further refined.

Title: Energy Collection from Thermal and Photovoltaic Solar Energy Systems

Authors: Daric Fitzwater, Amir Abdollahi, Baihaqi Ismail, IUPUI

The purpose of the study was to determine the feasibility of connecting solar photovoltaic and solar thermal systems for use as an energy provider to housing markets. A modified version of the ASHRAE 93 testing method was utilized to determine the amount of energy that can be collected and stored, and the system efficiencies. The solar photovoltaic and solar thermal collector systems were simulated and tested separately and then combined for further testing. The research results and analysis (will) determine if significant increases in efficiency or thermal storage capacity are possible due to combining solar photovoltaic and solar thermal systems.

Title: Third Cumulant Statistical Control Of the First Generation Structural Control Benchmark Problem

Authors: Logan Storrer, Ron Diersing , University of Souther Indiana

As part of the Early Undergraduate Research Program at the University of Southern Indiana, the purpose of this research project was to develop a cumulant controller and apply it to a structural control problem. Cumulants are gaining popularity for use in stochastic control and game theory. They also have been effective in applications to building and vibration control problems. Here cost cumulants are used on a discounted cost function. If all moments of a cost are minimized, the cost itself will then be minimized. Cumulants are derived from their respective moments, but have several advantages over moments. Cumulants yield linear controllers and decrease in importance

as the number of cumulants increases. Therefore, we can dramatically reduce the cost by minimizing only the first few cumulants. We will focus on the first three cumulants, the mean, variance, and skewness. Riccati equations for these cumulants are developed and used to determine an optimal control law. The linear quadratic Gaussian (LQG), minimum cost variance (MCV), and minimum cost skewness (MCS) controllers seek to minimize the first, second, and third cumulants respectively. These controllers are applied to a three story building subject to a seismic disturbance. The optimal control law will be used to determine a control signal sent to an active mass damper (AMD) within the structure. Through use of First Generation Structural Control Benchmark Problem simulations, data is collected for the LQG, MCV, and MCS controllers and multiple aspects of the performance are evaluated through a series of performance criteria. These criteria are then compared for each controller.

Title: Charity Changer

Authors: Adam Schuetz, Ben Beres, Christian Rippe, Daniel Blood, Disa Walden, Mark Budnik, Stephen Dolph , Valparaiso University

After purchasing goods and services with cash, one often receives loose coins as change. This coinage accumulates and will have to be spent or exchanged. Because of busy schedules, people may avoid using coins when purchasing products. More time is required to locate, sort, and count coins than the time required to make purchases with a combination of bills. While this difference in time is only a few seconds, it is enough of a deterrent for many to not use coins. Exchanging coins for bills requires even more time. For those who feel inconvenienced using loose change, the Charity Changer alleviates the burden. Rather than counting out change at a store or exchanging it at the bank, why not donate it to a noble cause and donate this loose change to one of three charities using the Charity Changer?

The Charity Changer identifies and stores coins to be collected and donated to charities. It does so while rejecting foreign and unacceptable coinage. The Charity Changer also allows the user to select and donate to one of three charities or to make a general donation, one in which the donation is split equally among all three charities. Additionally, the Charity Changer displays the amounts donated to each charity, the total amount of donations it has collected, and the amount collected from the last donor. Because some donations might be large, the Charity Changer accepts many coins simultaneously. Once collected, donations are stored inside the Charity Changer until they are exchanged at a bank.

Title: Catalytic Oxidation of Glycerol to High-Value Chemical Dihydroxyacetone

Authors: Brian Lowry, Purdue University

The increasing global energy demand has led to the development and deployment of alternative energy sources, including biofuels such as biodiesel. In this context, the recent dramatic increase of biodiesel production has resulted in oversupply of the byproduct glycerol (~$0.02/lb; produced in 1:10 ratio with biodiesel) on the market, which makes it essential to identify new ways to utilize glycerol. In this work, glycerol selective oxidation to high-value chemical dihydroxyacetone (DHA; ~$20/lb) was investigated systematically in a semi-batch reactor over Pt-Bi/C catalyst. Catalysts with different metal loadings, supports and preparation methods were synthesized, tested and characterized. The sequential impregnation of Pt then Bi, followed by NaBH4 reduction,

was the optimum synthesis method for high oxidation rate and maximum DHA yield. The optimum catalyst was determined to be 3 wt% Pt-0.6 wt% Bi, supported on Norit Darco 20-40 mesh activated carbon. With the optimum catalyst, the optimum reaction conditions were also identified as 80 °C, 30 psig, and initial pH=2. Under these conditions, a maximum DHA yield of 48% was obtained at 80% glycerol conversion, which is currently the highest yield reported from a semi-batch reactor. The catalysts were characterized by using BET, ICP-OES, TEM, XRD and XPS techniques. The measurements show that Pt0 and Bi3+ were the major states in the catalysts, and they did not alter under the reaction conditions described above. Further, the dissolution of Pt and Bi was negligible, both < 0.2%, indicating that metals were stable in the reaction media. From TEM micrographs, the Pt/Bi metal particles were about 4.5 nm in size. XRD measurements of the support itself and the catalyst indicate that the metal particles are in amorphous state. The results described in this work can be used to design a commercial scale reactor, to enhance the economics of biodiesel production.

Title: F-109 Test Cell Start Up Procedures

Authors: Kent Ballard, Adam Berning, Chris Scheckel, Ashley Meuleman, Purdue University

The purpose of the project is to rebuild a start procedure for the test cell so that the students that operate it are safer and it can be used as a more efficient lab tool. Currently the procedure is very vague and the professor has to walk every student step by step through the procedure. The goal of the project is to decrease the time it takes the students to get completely through the procedure by also reducing the number of questions asked. Students were observed as they walked through the previous procedure and were recorded on time it takes to complete all four stages of the process, the number of questions that were asked of the professor and the number of safety violations or major problems that were created by them. The procedure showed a great lack of clarity and empty holes that needed to be addressed. The new procedure is accompanied by color coding of switches, and a PowerPoint familiarization video. These steps along with a newly written procedure showed an improvement in the time it takes to start the engine, the number of questions asked and number of safety violations. This project helped the lab time for the classes that use the test cell perform more efficiently by helping more students get the through the lab experience.

Title:

Authors: Pramukh Nagabhushan, Purdue University

The airline industry seems to be at the mercy of volatile costs and the cyclical nature that is the travel market. At the present moment, airlines are not fully aware of all the possibilities to minimize the amount of risk with respect to maintaining a constant revenue stream. This paper details the research conducted to produce a method whereby airlines will be able to hedge their revenue streams by utilizing the Aero100 airfare index and virtually ensure that a profit can be made. In this paper, we will discuss how an airline can create a revenue hedging program that when combined with the airline's existing hedging program increases the financial stability in terms of revenue and cost.

Title: Wireless Surround Sound System

Authors: Ben Rafferty, Purdue University

The goal of the project is to create a 5.1 channel surround sound system solution that is completely portable and requires no installation. Transmitting the sound wirelessly eliminates the need for the user to route cables connecting the satellite speakers to the central module. The addition of high capacity lithium ion batteries enables an entirely wire-free surround sound experience. Standard 5 volt D.C. power adapters allow for easy recharging of the speakers as well as a semi-permanent installation if desired. The system is comprised of a base module which contains the center channel speaker and subwoofer, as well as four small satellite speakers that receive the audio signal via a wireless connection. A simple user interface including a graphical LCD display is located on the base module. The audio signals is accomplished through the use of DWAM80 wireless audio modules, which are based on the STS DARR80 digital audio baseband processor. The wireless audio modules are interfaced via I2C, and are capable of providing full CD quality audio over all four surround sound channels in addition to bi-directional data traffic. Audio signals are converted into I2S format prior to being transmitted, and converted back into analog by the satellite speakers before being amplified. The final product was capable of simultaneously transmitting all four surround sound channels, although only one satellite speaker was completed due to time constraints.

Title: RCD Laser System Presentation

Authors: Daniel Barjum, Purdue University

The Real-Time Capture and Display ("RCD") Laser System is an innovative device which captures a laser's reflection off a screen and sends the position of the laser to a computer. The computer will then process this information and display (through the use of a projector) the laser's path back onto the screen. It is analogous to drawing on a white board, but a laser pointer is used instead of a marker. The main purpose of the system is to allow annotation of presentations or other screen content, but its applications do not stop here. The system could also be used for various entertainment purposes such video game interfacing or simply drawing on flat surfaces.

The system is composed of two modules; a camera module used to capture the laser and a computer module which is used to process and display the images. The camera module uses a PIC18 microcontroller that manages the various features of this module. A PixArt camera with built-in tracking capability was used for laser tracking and is capable of tracking up to four lasers. Bluetooth was used to enable communication between the camera module and the computer.

The computer used in the project is a small single-board Intel Atom-powered PC which runs Windows XP. The software used for the laser image creation is an open source programming language called "Processing". The program was custom made and has an elegant, powerful and simple user interface which allows interaction with other computer programs and applications; this is what makes the RCD Laser System unique, attractive and powerful.

Title: Purdue Interactive Kiosk (PIKO)

Authors: Travis Safford, Purdue University

The Purdue Interactive Kiosk (PIKO) is a web-enabled, touch screen information portal for students, faculty, and campus visitors. The device has internet capabilities and data is scraped from many online sources and aggregated into a cohesive and unified form. The features include an ability to check e-mail, search the electronic directory, check computer lab availability, display a campus map, find football scores, and read campus news feeds. These features are all accessible from a main page that has large, descriptive icons for each. The kiosk is navigated primarily by a touch-screen over the monitor, with the exception of the e-mail feature. When signing in to your Purdue e-mail account, you can either swipe your PUID in the card reader to the right of the monitor, or you may type your user name in manually. The password must be entered manually, for security reasons. The kiosk runs embedded Linux on a high performance, low-power single-board PC. A support PCB interfaces the external peripherals (magnetic card reader, resistive touch screen, and occupancy sensor) with the PC. Since the kiosk is an "always-on" device, we use an infra-red occupancy sensor to cause the monitor and PC to enter a low power state when there are no users present. The project objectives were to provide an inexpensive, low-power information kiosk that has a rich graphical interface to display dynamic web-content.

Title: Blinkers++

Authors: Ian Oliver, Purdue University

Blinkers++ is a project designed to enhance communication between drivers on the roadway in the same vein as existing horns and headlight flashing. That is to say, the output of the system is human-readable and far more intuitive and precise than existing communication solutions. Because it is built using off-the-shelf parts, it offers a low-cost, high-impact communication solution. The goal of Blinkers++ is to deliver color-coded pulses to a specific side of the vehicle. For example, Blinkers++ enables the rear of one's vehicle to pulse blue as easily as causing the front-left to pulse orange. Colors indicate intent, with blue meaning gratitude, green used to grant right-of-way, yellow indicates caution, orange shows displeasure, and red warns of dangerous driving. Any color can be output on any side or corner of the vehicle. User input is one of the defining aspects of Blinkers++. To simplify user input, we have built and employed a multi-touch input pad. The user then swipes the number of fingers corresponding to the color he aims to light in the direction that he want to output it. User input takes less than a second and does not require looking at the device at any point. Blinkers++ is implemented here with a large array of capacitive sense buttons for the user input module, a wireless link between user input and system output, and a remote-controlled model Cadillac Escalade equipped with the output subsystem. The high-level operation of the system is easily understood. The user input module detects a gesture by the user and determines what gesture was made. It then encodes this gesture for transmission to the output module and sends it over the wireless link. The output module recognizes a valid gesture and lights the appropriate LEDs. Neighboring drivers observe the output and the message is conveyed.

Title: Persistence of Vision Machine

Authors: Eric Glover, Purdue University

The Flying Bits project is an electronic display device that uses a single column of rotating tricolor LEDs turned on and off at specific time intervals to create the illusion of a stationary image floating in the air. This is done through the phenomenon of persistence of vision. Persistence of vision is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. This allows the eye to see a continuous image if the update rate is fast enough. The project has the capabilities to project an image in a specified direction, update the image while in operation, allow a user to select a desired image to be displayed, and the capability of displaying short animations. The package includes a user interface through an OLED screen and five pushbuttons. The purpose of the project is to create a unique, eye catching display based on the theory of persistence of vision. The device is designed for both recreational and professional use. The device can be used as a fun addition to any household to display images in a creative way. Professionally, the project can be used to display company logos, or serve as an inviting and attention catching display in any store shop window. Images can be programmed onto the microcontroller and then selected through the user interface. Animations can also be displayed by cycling through a series of pre-programmed images in software.

Title: Green Engineering thru Automated Recycling (GEAR)

Author's: Demi Hutchinson, Fred Landavazo IV, Daniel Miller,
Jeremy Ross, Nathan Taylor

Our mission is to create an automated recycling device that
will sort, compact, and store paper, aluminum, and plastic. Through use, we hope to motivate students in the Mechanical Engineering building to recycle and gain an appreciation for applications of simple mechanical devices. The poster breaks down the main components of the device: the input and crushing chambers, the frame and sliding door, the electrical controls, the waste storage, and the analysis. Details are given about how each portion functions and works together to accomplish the goal of automated recycling.

Title: Adding Customizability to Automobile Interiors via an Electromechanical Interface

Authors: Matthew Plumlee, Christopher Summers, Caitlin Chandler, Sridhar Tamminayana, Frank Hettlinger, Travis Smith

Imperative to design in a modern setting is ability for consumers to create additional functionality to a product post-sale, which adds value to the product without increasing cost to producer. Companies such as Apple have elevated this concept to new heights in recent years by creating a platform that eases the installation of third-party applications (or “apps”) with minimal burden to users. The automobile industry has not yet fully realized this potential expansion of product usability. A redesign of an automobile interior creates a universal interface that allows outside manufacturers to improve the functionality of a Chrysler vehicle through easily attachable, useful, and aesthetically pleasing applications. The interface is composed of typical car interior ABS plastic and possesses the ability to lock-in and power any application under 70 pounds though

rollover situations. Additionally, the interface has no moving parts thus does not suffer fatigue problems. This design could be applied to a wide range of vehicles, creating a large producer base for applications.

Title: Drainergy

Authors: Anthony Keil, Kane Wu, Nick Deutsch, Carlos Castillo, Michell Niekamp, Ben Moeller

Drainergy has designed and developed an innovative energy system that will collect rain water atop tall buildings and direct the water down through a series of mini-hydro plants. Although the energy generation from each individual plant is small, the collective generation could be substantial. With this system we will contribute to the effort of becoming less dependent on non-renewable natural resources and helping the planet become Green.

Title: Recycling Solutions Automated Material Sorter

Authors: Ray Bond, Jamie Cook, Trenton Newsom, George Aaron Reed, Keith Verner, David Wilson

Abstract: An automated recycling sorter has been designed to feed, sort and distribute aluminum, tin coated steel, plastic and glass containers. The device is designed to fit within the competition constraints of the 2010 ASME student design competition, which will take place on April 9, 2010. To this end, the device is designed to be very compact, lightweight, and accurate. To feed items, an extending inclined conveyor belt is designed that is able to separate items such that only one item enters a testing chamber at a time, and at a desired orientation. Pulse induction metal detector cores in the floor of the testing center are able to detect metals, and force sensitive piezoelectric resistors which are mounted with magnets behind are able to detect a magnetic object, thus separating between tin coated steel, aluminum and non metals. In order to sort between non metals, the length of the object is determined with infrared beam sensors, which define planes that measure the length of the object. For this competition, the plastic container must always be larger than the glass, so discrimination by means of length only is possible. Once the item is determined, servo controlled distribution gates direct the item into the correct bin, and feed the next item. This design presents an efficient effective solution for automating the process of sorting recyclable items.

Title: Sidewalk Printing

Authors: Jake Johnson, Christopher Blake, Tommy Woroszylo, Jose Gomez, Nora Flood, Shaofei Xu,

In 2007 fliering on Purdue campus sidewalks was banned. Since then, the degree of passive marketing for its students has significantly diminished, leaving tedious hand chalking as the only effective method. To bring back effective fliering, the Purdue Sidewalk Printing Team consisting of 4 mechanical engineers and 2 industrial designers has developed an aesthetically pleasing and environmentally friendly device that will transfer standard .jpg and .gif images of flyers onto sidewalks using liquid chalk. The user need only plug a USB drive into the handle, choose upload from the visual interface, and select a flyer to begin printing.

Title: Wake Winch

Authors: Greg Bauman, Kim Bruder, Curt Kennedy, Justine Roemer

Wake Winch has developed a unique wake boat tower accessory that will allow wake boarders to reel in and out line while riding. The product includes a digital read out of the line length, the ability to adjust the line length while riding, and adjustable clamps for mounting to various sized wake boat towers. The poster breaks down Wake Winch into controls and its 4 subsystems: motor/drive train, mounting, line guide, and braking. As illustrated, the motor is packaged inside of the spool. An ACME lead screw, driven off the motor, will guide the line evenly across the spool. Each clamp adjusts to fit tower diameters ranging from 1.75"-2.5". The brake system consists of a ratchet, pawl, and solenoid. For the controls, an Arduino microcontroller interfaced with a MC-7 motor controller will allow the user to adjust line length using various rocker switches on the dash. The serial enabled LCD will read out the line length to the user. This marinized, light weight, aesthetically appealing device will revolutionize the watersports industry.

Title: Overhead Transparency Cleaner

Authors: Andrew Crandall, Nathan Flatt, Matthew Frye, Drew Henderson, Eric Moon, Matthew Prowant, Joshua Vandergraff

This poster displays the Overhead Transparency Cleaner, an automated washing machine for acetate overhead rolls (often called transparency rolls) as used in Purdue overhead projectors. The display also shows the design specifications and workings of the washer in a step-by-step fashion.

Title: Basic Utility Vehicle

Authors: Kyle Bazur, Mackenzie McNamara, Courtney Freeland, Erik Cowans, David Roberts, Austin Witt, and Dan Norton

There is a need for affordable transportation and sustainable technologies for developing countries. In Cameroon there is often abundant food and water, but little of the water is suitable for drinking without first treating it. Also, up to 40% of the food is discarded during the wet season because farmers are unable to transport extra food to larger markets and due to the lack of food preservation technologies and refrigeration. Global design projects will involve smaller groups of students working on technologies to solve these problems, including frequent correspondence with the African Centre for Renewable and Sustainable Technologies (www.acrest.org) in Bangang, Cameroon, and optional travel to Cameroon in May 2010 to work with ACREST on local implementation and teaching area residents how to build and use the project results. Designing and building a basic utility vehicle (www.drivebuv.org) is one of the components within the overall Cameroon project. The primary goal is to design a simple vehicle that can be manufactured, supported, implemented, and utilized by the people living in Cameroon and surrounding countries with local resources. The project includes research on available automotive parts and tooling in ameroon,and design, fabrication, and testing of the BUV at Purdue. The project concludes with a trip to Cameroon to present the vehicle and work with the locals on vehicle design and replication.