UNIVERSITY OF CALIFORNIA, RIVERSIDE

UC RIVERSIDE UNIVERSITY OF CALIFORNIA

Bourns College of Engineering

## 2013 American Society for Engineering Education
## Pacific Southwest Section Conference
**University of California, Riverside, April 18-20, 2013**

# 2013 ASEE PSW Conference Program

**University of California, Riverside**

**Thursday April 18th – Saturday April 20th, 2013**

*"Engineering Education in a Global Context"*

**Conference Website:** http://www.smccd.net/accounts/enriquez/asee-psw/

**ASEE PSW Section Website:** http://www.csupomona.edu/~sparisay/ASEE/PSW/

**Host Institute Website:** http://www.engr.ucr.edu/

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*"Engineering Education in a Global Context"*

# Conference at a Glance

**Thursday, April 18th, 2013**

**3:30pm – 6:00pm Registration – Winston Chung Hall, Room 205**

**6:00pm – 8:00pm Welcome Reception – Winston Chung Hall, Room 232**

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**Friday, April 19th, 2013 – Highlander Union Building (HUB), 3rd Floor**

**7:30am – 8:30am Breakfast and Check-in (HUB 302 South)**

**8:30am – 8:45am Welcome by Dean Abbaschian**

**8:45am – 9:00am ASEE Report, Dr. Ray Haynes ASEE VP**

**9:00am – 12:15pm Technical Sessions**

**12:15pm – 1:45pm Lunch and Poster Sessions**

**1:45pm – 5:30pm Technical Sessions**

**6:00pm – 7:00pm Dean's Reception (HUB 302 North)**

**7:00pm – 9:00pm Banquet & Awards (HUB 302 North)**

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**Saturday, April 20th, 2013**

**9:00am – 9:30am Breakfast – Winston Chung Hall, Room 232**

**9:30am – 11:30am Technical Sessions – Winston Chung Hall, Room 205/206**

**11:30am – 1:00pm Lunch**

**1:00pm – Conference End**

**1:00pm – 4:00pm ASEE PSW Executive Board Business Meeting**
**Winston Chung Hall, Room 443**

# Maps and Directions

**Directions to UC Riverside**

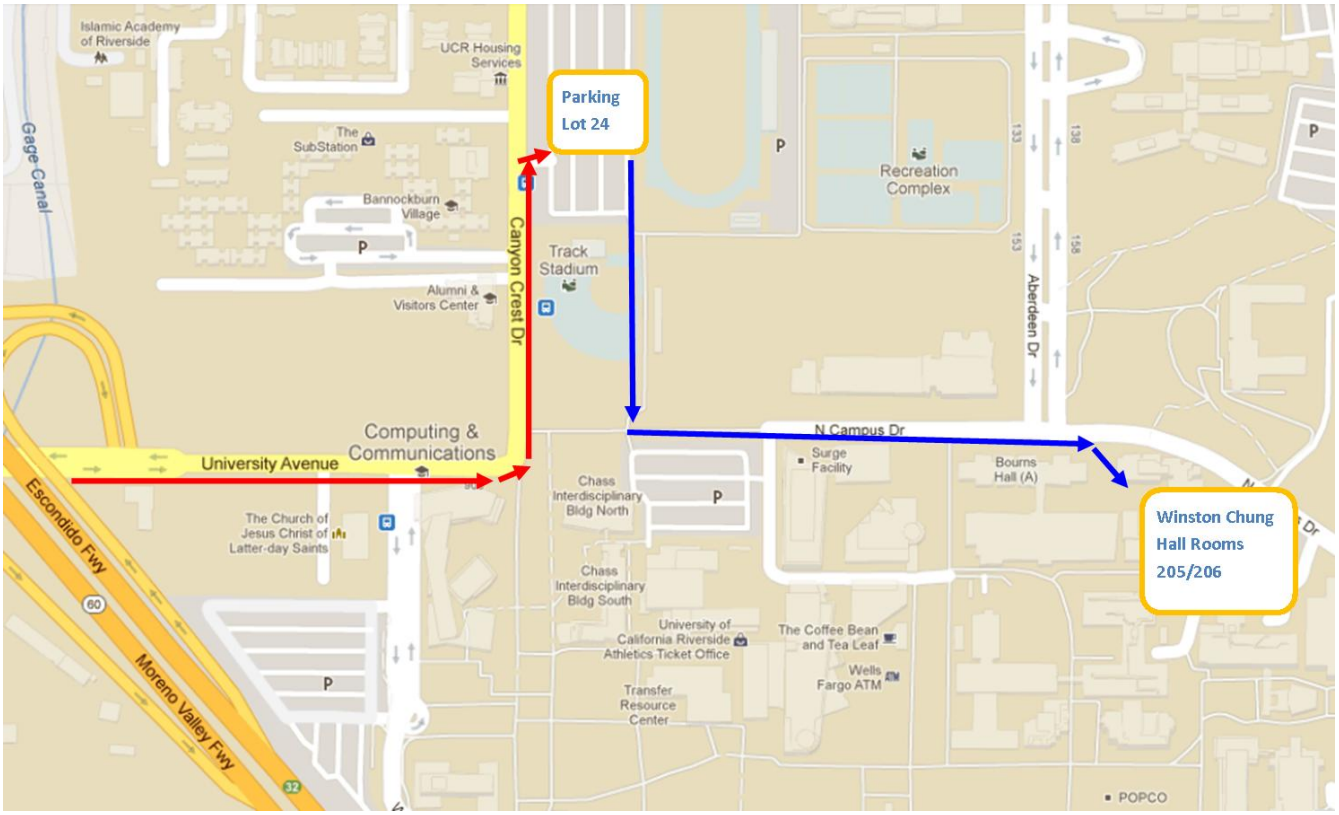
**From the 91 Freeway:** Take CA-91 east to the CA-60 east. Exit at University Avenue and turn left. At the second light, take a right onto West Campus Drive.

**From the 10 Freeway:** Take the I-10 east to the I-15 south and then to CA-60 east. Exit at University Avenue and turn left. At the second light, take a right onto West Campus Drive.

**From the 60 Freeway:** Take the CA-60 east. Exit at University Avenue and turn left. At the second light, take a right onto West Campus Drive.

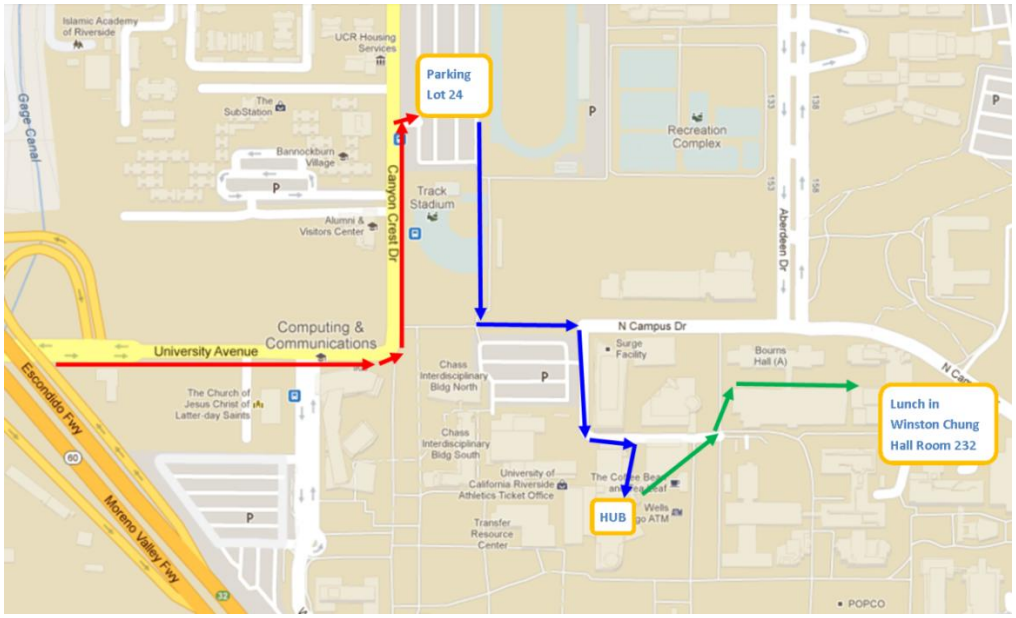
**Thursday, April 18th, 2013**

1. Please stop at main entrance of Lot 24 and see attendant to pay for the daily parking permit.
2. Please follow the direction to Winston Chung Hall (WCH) Room 205-206 for registration.



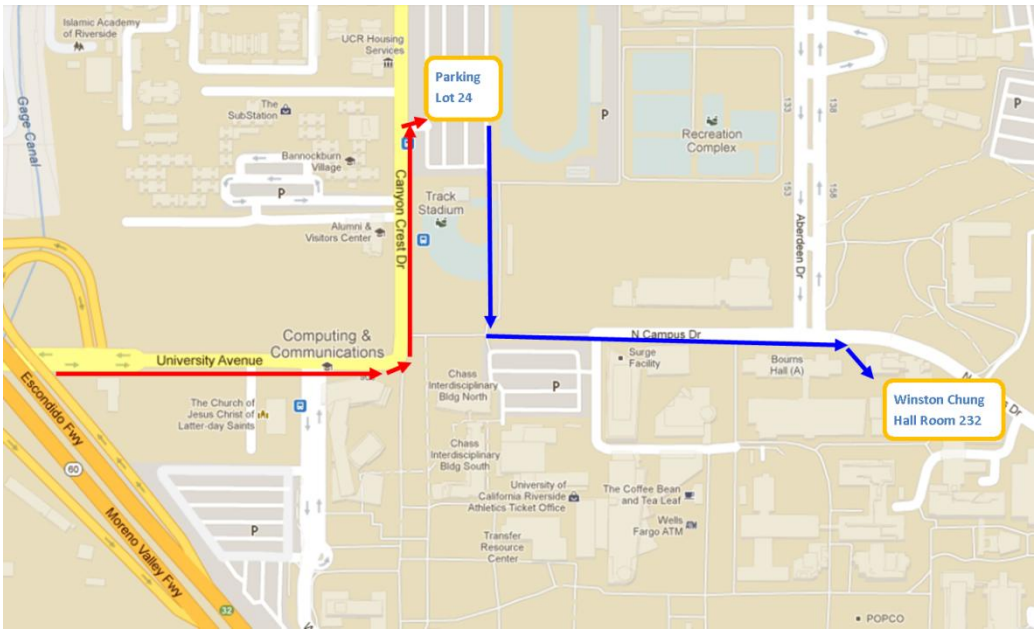
**Friday, April 19th, 2013**

1. Please stop at main entrance of Lot 24 and see attendant to pay for the daily parking permit.
2. Please follow the direction to Highlander Union Building (HUB) 3rd Floor to check-in.




**Saturday, April 20th, 2013**

1. Please stop at main entrance of Lot 24 and see attendant to pay for the daily parking permit.
2. Please follow the direction to Winston Chung Hall (WCH) Room 232 for breakfast and remarks.



# Hotels Addresses and Contact Info

**Mission Inn Hotel**
Address: 3649 Mission Inn Ave, Riverside, CA 92501
Phone: (951) 784-0300

**Riverside Downtown Marriott**
Address: 3400 Market St, Riverside, CA 92501
Phone: (951) 784-8000

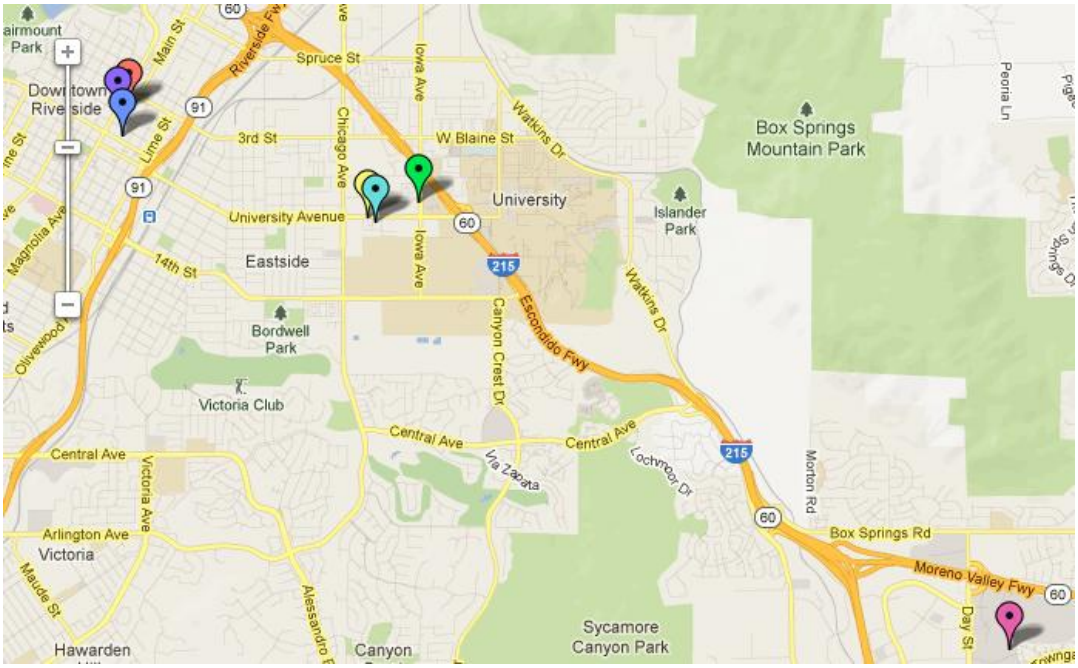
**Ayres Hotel & Spa**
Address: 12631 Memorial Way, Moreno Valley, CA 92553
Phone: (877) 650-4141

**Dynasty Suites**
Address: 3735 Iowa Ave, Riverside, CA 92507
Phone: (951) 369-8200

**Courtyard by Marriott**
Address: 1510 University Ave, Riverside, CA 92507
Phone: (951) 276-1200

**Comfort Inn**
Address: 1590 University Ave, Riverside, CA 92507
Phone: (951) 683-6000

**Hyatt Place Riverside/Downtown**
Address: 3500 Market St, Riverside, CA 92501
Phone: (951) 321-3500



**2013 American Society for Engineering Education Pacific Southwest Section Conference**

**April 18-20, 2013**
**University of California, Riverside**
**Riverside, CA**

# Conference Program

## Thursday, April 18th, 2013

**Registration opens at 3:30pm in the Winston Chung Hall (WCH), Room 232**

| Time | Agenda | Location |
|---|---|---|
| 3:30pm – 6:00pm | Registration | WCH 205/206 |
| 6:00pm – 8:00pm | Welcome Reception | WCH 232 |

## Friday, April 18th, 2013

**Check-in starts at 7:30am at the Highlander Union Building (HUB) 3rd Floor**

| Time | Agenda | Location |
|---|---|---|
| 7:30am – 8:30am | Check-in & Continental Breakfast | HUB 302 South |
| 8:30am – 8:45am | **1A.** Welcome Address: Dr. Reza Abbaschian, Dean, Bourns College of Engineering, UCR | HUB 302 South |
| 8:45am – 9:00am | **1B.** ASEE Report, Dr. Ray Haynes ASEE VP | HUB 302 South |
| 9:00am – 10:30am | **Concurrent Technical Sessions** | |

| HUB 260 | HUB 265 | HUB 367 | HUB 379 |
|---|---|---|---|
| **2A. Technology and Students**<br>**Chair: Nilgun Ozer**<br>▪ Alexander Dekhtyar, Teaching Bioniformarics in Concert: an Interdisciplinary Collaborative Project-based Experience<br>▪ Gene Fisher, Can Students Build Production-Quality Software?<br>▪ Keith Level, Using Mastering Engineering Software-Based Homework System in Statics and Circuits Classes | **2B. Establishing New Standards Through Learning**<br>**Chair: Reza Raeisi**<br>▪ Amelito Enriquez, Creating Accelerated Educational Pathways for Underprepared STEM Students through an Intensive Math Placement Test Review Program<br>▪ Richard Phillips, Professional Practice and the Engineering Curriculum<br>▪ James Helbling, Ethics in Engineering: Preparing Our Students to Meet Societal Obligations | **2C.Global Context**<br>**Chair: John Tester**<br>▪ Frank Jacobitz, Compact International Experiences: Two-year Reflections on Short-term Study-abroad Elective Engineering Courses<br>▪ Antonella Sciortino, A Novel Approach to Expose Students to Global Issues in Civil Engineering and Construction Engineering Management<br>▪ Slobodan Urdarevik, Using Models to Teach and Learn Engineering | **2D. Global Context**<br>**Chair: Panadda Marayong**<br>▪ Liang Li Wu, The Middle East Initiative – Expanding Education in a Global Context<br>▪ Muge Mukaddes Darwish, Towards Gender Balance in Engineering for an Expanding Global market Place<br>▪ Jesus Acosta-Iriqui, Development of International Mobility Program in Micro and Nanotechnology: Lessons Learned |

| | | |
|---|---|---|
| 10:30am – 10:45am | **Coffee Break** | Session Rooms |
| 10:30am | **Expo (open until 6:00pm)** | HUB 3rd Floor Lobby |

10:45am – 12:15pm Concurrent Session Presentations

| HUB 260 | HUB 265 | HUB 367 | HUB 379 |
|---|---|---|---|
| **3A. Development at Community Colleges**<br>**Chair: Amelito Enriquez**<br><br>▪ Cheng Chen, Integrating Earthquake Engineering into Community College Student Educational Experience through a Summer Internship<br>▪ Larry Owens, A Community College Perspective of the Development of Engineering Transfer Model Curricula under the California Student Transfer Achievement Reform Act (SB 1440): An Update on Work in Progress<br>▪ Hao Jiang, Engaging Underrepresented Community College Students in Engineering Research | **3B. K-12 Engagement in Engineering**<br>**Chair: David Lanning**<br><br>▪ Binod Tiwari, Summer Research Opportunity for University-Community College-High school Partnership: A Great Motivation for Engineering Education Pathways<br>▪ Vladimir Prodanov, Identifying At-Risk Students: How Use of Optional Study Materials and Collection of Graded Work Correlate with Academic Performance<br>▪ Kurt McMullin, Professional Development of University Engineering Faculty through a Math-Science Partnership | **3C. Technology and Distance**<br>**Chair: Domoinic Dal Bello**<br><br>▪ Thomas Korman, Development and Use of and Construction Engineering Gaming Simulation in the Global Environment<br>▪ Frank Vahid, Interactive Web Activities for Online STEM Learning Materials<br>▪ Kiran George, CoursePedia for Engineering Courses | **3D. STEM Education & Retention**<br>**Chair: Sima Parisay**<br><br>▪ Raman Unnikrishnan, Retention Strategies for Engineering and Computer Science-Proven practices during first year in college<br>▪ Seema Shah-Fairbank, Implementation of a Proactive and Effective Advising Program in a Large Civil Engineering Program In the Face of Budgetary and Organizational Constraints<br>▪ Matthew Siniawski, Stepping Back and Letting Students Take the Lead: Improving Engagement Through Student-led Projects for an Introduction to Engineering Course |

12:15pm – 1:45pm **Lunch** WCH 232

**4A. Poster Sessions**

- John Maxwell DeAndreis, Seismic Analysis of Special Moment-Resisting Frames
- Jose Carrillo, Low Switching Frequency AC-DC Boost Converter for Wireless Powered Miniature Implants
- John Paulino, Analysis of Performance Degradation of Integrated Circuits Due to Transistor Aging Effects in Nano-scale
- Stephanie Maxwell, Science Detectives: a novel approach to exposing children to STEM topics
- Xiaomin Jin, International Research/education Collaboration on GaN LED/LDs between Cal Poly (USA) and PKU (China)
- Ziliang Zhou, Preparing Future Engineering Students through local MATHCOUNTS Competition in Inland Area

1:45pm – 3:45pm Concurrent Session Presentations

| HUB 260 | HUB 265 | HUB 367 | HUB 379 |
|---|---|---|---|
| **5A. Technology & Class Design Innovation**<br>**Chair: J. Richard Phillips**<br><br>▪ Jin-Lee Kim, Framework for Sustainability Practices in Construction Education Curriculum using BIM<br>▪ Bridget Benson, Teaching Introductory Digital Design Online<br>▪ Ibraheem Kateeb, Community Attitudes Related to Telecommunications Cables<br>▪ Phillip L. Nico, PolyFS: An Extensible, Underspecified and Pedagogical File System and Disk Emulator | **5B. Class Design Innovation**<br>**Chair: Amir Rezaei**<br><br>▪ Nina Robson, Enhancing Discovery Learning Techniques in Undergraduate Mechanical Design Classes<br>▪ Harmonie Hawley, Incorporating Field Experiences into Environmental Engineering Lab Courses<br>▪ Anne Beug, Teaching Introductory Programming Concepts: A Comparison of Scratch and Arduino<br>▪ Harmonie Hawley, Encouraging Women to Transfer into Engineering Programs from 2-Year to 4-Year Colleges | **5C. Integration and Student Success**<br>**Chair: Lily Cossage**<br><br>▪ Mary Cardenas, The Decline of the Car Enthusiasts: Implications for Undergraduate Engineering Education<br>▪ Binod Tiwari, Engaging Engineering Students in Research from Early Stage of Their Student Career<br>▪ David Lanning, Analysis of Aerospace Engineering Students Who Repeat Degree Requirements<br>▪ Tina Smilkstein, Increasing Lab Participation and Content Retention Through Supportive Laboratory Preparation Assignments | **5D. Student Engagement**<br>**Chair: Sean Gallagher**<br><br>▪ Hamid Mahmoodi, Engaging Community College Students in Research using Summer Internship on Analysis of Performance Degradation of Integrated Circuits Due to Transistor Aging Effects in Nano-Scale<br>▪ Cheng Chen, Engaging Undergraduate Students into Advanced Earthquake Engineering Research<br>▪ Kiran George, Evaluating the Impact of ECS Academic Catalyst for Excellence (ACE) Scholarship Program |

3:45pm – 4:00pm **Coffee Break**
**Expo (open until 6:00pm)**

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4:00pm – 5:30pm Concurrent Session Presentations

| HUB 260 | HUB 265 | HUB 367 | HUB 379 |
|---|---|---|---|
| **6A. Project Learning**<br>**Chair: Shaahin Amini**<br><br>▪ Matthew Siniawski, A Project-based Approach for a Design and Manufacturing Laboratory Course<br>▪ Mohammad Amin, Easy Tracking System: A Valuable Outcome of a student Capstone Project<br>▪ James Guthrie, Bringing Design and Construction into Elementary School Classrooms with Sandcastles | **6B. Project Learning**<br>**Chair: Jun Wang**<br><br>▪ Nicholas Rhodes, Using a Lexical and Temporal Analysis of a Student's Self-Explanations to Predict Understanding<br>▪ Taufik, Work In Progress: Enhancing Students' Learning in Introductory Power Electronic Course Using an LED Driver Project<br>▪ Jeffrey Ashworth, Practical Lecture, Research, and Projects Based Engineering Education | **6C. Project Learning**<br>**Chair: Eric Wang**<br><br>▪ Bhaskar Raj Sinha, Analysis of an Android Based Student Project: Remote Medical Monitoring Station<br>▪ Ramachandran Radharamanan, Project-Based Innovation and Entrepreneurship Education in Engineering<br>▪ Kevin Anderson, Using Arduino Projects to Teach Mechatronics | **6D.Technology in the Classroom**<br>**Chair: Reza Raeisi**<br><br>▪ Gustavo Menezes, Active Learning in Computer-Aided Engineering Courses (WIP)<br>▪ Ibraheem Kateeb, Protection Considerations for Telecommunications Network<br>▪ Ibraheem Kateeb, The Fundamental Component of Telecommunications Cabling |

| | | |
|---|---|---|
| **5:30pm – 6:00pm** | **Break**<br>**Expo (open until 6:00pm)** | HUB 3rd Floor Lobby |
| **6:00pm – 7:00pm** | **Dean's Reception** | HUB 302 South |
| **7:00pm – 9:00pm** | **2013 ASEE PSW Section Banquet & Awards Ceremony** | HUB 302 South |

**7A. Keynote Speakers:**
Professor Jane Close Conoley, Interim Chancellor, University of California, Riverside
Professor Collie Conoley, University of California, Santa Barbara
**Awards:**

- **ASEE PSW Outstanding Teaching Award**
  Dr. Avelino Eduardo Saez, University of Arizona, department of Chemical and Environmental Engineering
- **ASEE PSW Outstanding Community College Educator Award**
  Dr. Ann-Marie Vollstedt, Truckee Meadows Community College
- **ASEE PSW Best Paper**
  "Teaching Bioinformatics in Concert: an Interdisciplinary Collaborative Project-based Experience", Alex Dekhtyar, Anya L. Goodman, and Aldrin Montana from Cal Poly, San Luis Obispo
- **ASEE PSW Outstanding Student of the year Award**
  Jose Garcia, a senior from Embry-Riddle Aeronautical University
- **Section Outstanding Campus Representative:** Dr. David Lanning, Embry-Riddle Aeronautical University, Prescott

## Saturday, April 20th, 2013

**Check-in starts at 8:00am at the Winston Chung Hall, Room 205-206**

| Time | Agenda | Location |
|---|---|---|
| 9:00am – 9:30am | **Breakfast** | WCH 232 |
| 9:30am – 11:30am | **Concurrent Technical Sessions** | WCH 205-206 |

| WCH 205 | WCH 206 |
|---|---|
| **8A. Technology Integrated Styles**<br>**Chair: Amelito Enriquez**<br><br>▪ Jeff Georgette, Inquiry-Based Learning Activities in Dynamics<br>▪ Brian Self, Psychometric Analysis of the Dynamics Concept Inventory<br>▪ Sergio Mendez, Simple Experiments and COMSOL Simulations to Enhance the Learning of Transient Heat Transfer<br>▪ Eniko Enikov, From Step-Response to State-Space Controller-Observer Design in Twenty Minutes: A Hands-On Workshop on the Use of Matlab/Simulink to Control a Low-Cost Aerodynamic Pendulum | **8B. Standards in Grading**<br>**Chair: Shaahin Amini**<br><br>▪ Jim Herold, A Data-Driven Approach to Categorizing the Spatial Organization of Homework Solutions<br>▪ Milica Markovic, Computer Aided Teaching and Learning in an Undergraduate Electromagnetics Class<br>▪ S. Jimmy Gandhi, An Innovative Approach to Educating Engineers in Entrepreneurship<br>▪ George Law, New Technology and Design Methodology for Micromouse: Challenges and Solutions |

| | | |
|---|---|---|
| 11:30am – 1:00pm | **Lunch** | WCH 232 |
| 1:00pm | **Conference Ends** | |
| 1:00pm – 4:00pm | **ASEE PSW Executive Board Business Meeting** | WCH 443 |

# ASEE PSW 2013 Conference Vendors & Exhibitors

The EXPO will be held in **Highlander Union Building (HUB) 3rd Floor Lobby** from 10:30am – 6:00pm on Friday, April 19th, 2013

| Organization | Link |
|---|---|
| **University of California Riverside, Bourns College of Engineering** | **http://www.engr.ucr.edu/** |
| **Southern California Edison** | **https://www.sce.com** |
| **LAB Corporation** | **www.LABCorpEdu.Com** |
| **University of Southern California, Viterbi School of Engineering** | **http://viterbi.usc.edu/** |
| **California State University, Fullerton, College of Engineering and Computer Science** | **http://www.fullerton.edu/ecs/** |
| **California Polytechnic State University, San Luis Obispo** | **http://ceng.calpoly.edu/** |
| **Harvey Mudd College** | **www.hmc.edu** |
| **California State University Northridge** | **www.csun.edu** |

# ASEE PSW Executive Board

| Position | Name | Term Ends | Email |
|---|---|---|---|
| Chair | Amelito Enriquez | 2013 | enriquez@smccd.edu |
| Past Chair | Eric Wang | 2013 | eric.wang@unr.edu |
| Chair Elect | Reza Raeisi | 2013 | rraeisi@csufresno.edu |
| VC Faculty Awards | John Tester | 2014 | John.tester@nau.edu |
| VC Student Awards | Panadda (Nim) Marayong | 2014 | marayong@csulb.edu |
| VC New Faculty | David Lanning | 2014 | lannind@erau.edu |
| VC Membership | Jose Macedo | 2014 | jmacedo@calpoly.edu |
| VC Community Colleges | Dominic Dal Bello | 2014 | ddalbello@hancockcollege.edu |
| Treasurer | Allen Plotkin | 2014 | allen.plotkin@sdsu.edu |
| Executive Secretary | J. Richard Phillips | 2014 | rich_phillips@hmc.edu |
| Director | Walt Loscutoff | 2013 | walter_loscutoff@csufresno.edu |
| Director | Amir Rezaei | 2013 | agrezaei@csupomona.edu |
| Director | Elizabeth J. Orwin | 2013 | elizabeth_orwin@hmc.edu |
| Director | Thomas Impelluso | 2014 | timpellu@mail.sdsu.edu |
| Director | Reza Abbaschian | 2014 | rabba@engr.ucr.edu |
| Director | Lily Gossage | 2014 | Lily.gossage@csulb.edu |
| Director | Karen Bangs | 2014 | krbangs@calpoly.edu |
| Director/Webmaster | Sima Parisay | 2013 | sparisay@csupomona.edu |
| Relations w/Industry South | Sean Gallagher | 2013 | Sean@lsai.net |
| Relations w/Industry East | Emmanuel (Manno) Simeus | 2014 | ejsimeus@raytheon.com |
| Relations w/Industry North | Al Rajput | 2014 | AL@Rajputs.us |

# Conference Organizers

## Chair

- Reza Abbaschian, Dean, College of Engineering, University of California, Riverside

## Conference Committee

- Karen Bangs, Industrial and Manufacturing Engineering, Cal Poly, San Luis Obispo
- Dominic Dal Bello, Engineering, Allan Hancock College
- Amelito Enriquez, Engineering and Mathematics, Cañada College
- Sean Gallagher, VP and CTO, UVP, Inc
- Lily Gossage, Mechanical and Aerospace Engineering, CSU, Long Beach
- Trevor Harding, Material Engineering, Cal Poly, San Luis Obispo
- Jose Macedo, Industrial and Manufacturing Engineering, Cal Poly, San Luis Obispo
- James Moore, II, Industrial and Systems Engineering, Civil and Environmental Engineering, University of Southern California
- Panadda (Nim) Marayong, Mechanical and Aerospace Engineering, CSU, Long Beach
- Elizabeth J. Orwin, Biomedical Engineering, Harvey Mudd College
- Nilgun Ozer, Electrical Engineering, San Francisco State University
- Sima Parisay, Industrial and Manufacturing Engineering, Cal Poly, Pomona
- Al Rajput, Orange County Engineering Council
- Amir Rezaei, Mechanical Engineering, Cal Poly Pomona
- Reza Raeisi, Computer Engineering, CSU, Fresno
- John Tester, Mechanical Engineering, Northern Arizona University
- Eric Wang, Mechanical Engineering, University of Nevada, Reno

## Conference Coordinators

- Jun Wang, Conference Coordinator, Bourns College of Engineering, University of California, Riverside
- Eilene Montoya, Conference Coordinator, Bourns College of Engineering, University of California, Riverside

# Conference Reviewers

| Last Name | First Name | University or Institution |
|---|---|---|
| Abbaschian | Reza | University of California, Riverside |
| Amin | Mohammad | National University |
| Amini | Shaahin | University of California, Riverside |
| Bangs | Karen | California Polytechnic State University San Luis Obispo |
| Benson | Bridget | California Polytechnic State University San Luis Obispo |
| Brian | Self | California Polytechnic State University San Luis Obispo |
| Cardenas | Mary | Harvey Mudd College |
| Celik | Ozkan | San Francisco State University |
| Chan | Tammy | California State University, Los Angeles |
| Costea | Ileana | California State University, Northridge (CSUN) |
| Dal Bello | Dominic | Alan Hancock |
| Darwish | Muge Mukaddes | Texas tech University |
| Demiryont | Hulya | Eclipse Energy Systems Inc. |
| Enriquez | Amelito | Cañada College |
| Gossage | Lily | California State University, Long Beach |
| Hawley | Harmonie | California State University, Fullerton |
| He | Nannan | Minnesota State University at Mankato |
| Herold | Jim | University of California, Riverside |
| Jacobitz | Frank | University of San Diego |
| Jiang | Hao | San Francisco State University |
| Kateeb | Ibraheem | North Carolina A&T State University |
| Kim | Jin-Lee | California State University Long Beach |
| Lande | Micah | Arizona State University |
| Lanning | David | Embry-Riddle Aeronautical University |
| Lu | Stephen | University of Southern California |
| Macedo | Jose | California Polytechnic State University San Luis Obispo |
| Marayong | Pannada | California State University, Long Beach |
| Naish | David | California State University Fullerton |
| Orwin | Liz | Harvey Mudd College |
| Ozer | Nilgun | San Francisco State University |
| Phillips | Richard | Harvey Mudd College |
| Prodanov | Vladimir | California Polytechnic State University San Luis Obispo |
| Radharamanan | Ramachandran | Mercer University |
| Rezaei | Amir | Cal Poly Pomona |
| Rice | Dennis | University of California, Riverside |
| Shafahi | Maryam | California Polytechnic State University |
| Shiller | Barry | San Francisco State University |
| Sinha | Bhaskar Raj | National University |
| Smestad | Greg | Sol Ideas Technology and Development |
| Taufik | Taufik | California Polytechnic State University San Luis Obispo |
| Teh | Kwok Siong | San Francisco State University |
| Tiwari | Binod | California State University, Fullerton |
| Vahid | Frank | University of California, Riverside |
| Wang | Jun | University of California, Riverside |

# Conference Index/List of Authors & Presenters

| Last Name | First Name | University or Institution | Time Slot | Day |
|---|---|---|---|---|
| Abbaschian | Reza | University of California, Riverside | 1A | Friday |
| Acosta-Iriqui | Jesus | The University of Arizona | 2D | Friday |
| Amin | Mohammad | National University | 6A | Friday |
| Anderson | Kevin | California State Polytechnic University, Pomona/College of Engineering | 6C | Friday |
| Ashworth | Jeffrey | Embry-Riddle Aeronautical University, Prescott Campus | 6B | Friday |
| Benson | Bridget | California Polytechnic State University San Luis Obispo | 5A | Friday |
| Beug | Anne | Ancestry.com | 5B | Friday |
| Cardenas | Mary | Harvey Mudd College | 5C | Friday |
| Carrillo | Jose | Cal Poly SLO | 4A | Friday |
| Conoley | Jane | University of California, Riverside | 7A | Friday |
| Chen | Cheng | San Francisco State University | 3A | Friday |
| Chen | Cheng | San Francisco State University | 5D | Friday |
| Darwish | Muge Mukaddes | Texas Tech University | 2D | Friday |
| DeAndreis | John Maxwell | San Francisco State University/Canada College/NASA CIPAIR | 4A | Friday |
| Dekhtyar | Alexander | California Polytechnic State University, San Luis Obispo | 2A | Friday |
| Enikov | Eniko | University of Arizona | 8A | Saturday |
| Enriquez | Amelito | Canada College | 2B | Friday |
| Fisher | Gene | Cal Poly San Luis Obispo | 2A | Friday |
| Gandhi | S. Jimmy | California State University, Northridge | 8B | Saturday |
| George | Kiran | California State University, Fullerton | 3C | Friday |
| George | Kiran | California State University, Fullerton | 5D | Friday |
| Georgette | Jeffrey | California State Polytechnic University | 8A | Saturday |
| Guthrie | James | California State Polytechnic University | 6A | Friday |
| Hawley | Harmonie | California State University, Fullerton | 5B | Friday |
| Haynes | Ray | DaVinci Charter High Schools | 1B | Friday |
| Helbling | James | Embry-Riddle Aeronautical University | 2B | Friday |
| Herold | Jim | University of California, Riverside | 8B | Saturday |
| Jacobitz | Frank | University of San Diego | 2C | Friday |
| Jiang | Hao | San Francisco State University | 3A | Friday |
| Jin | Xiaomin | California Polytechnic State University | 4A | Friday |

# Conference Index/List of Authors & Presenters Continued

| Last Name | First Name | University or Institution | Time Slot | Day |
|---|---|---|---|---|
| Kateeb | Ibraheem | NC A&T SU | 5A | Friday |
| Kateeb | Ibraheem | NC A&T SU | 6D | Friday |
| Kim | Jin-Lee | California State University Long Beach | 5A | Friday |
| Korman | Thomas | California Polytechinic State University | 3C | Friday |
| Lanning | David | Embry-Riddle Aeronautical University | 5C | Friday |
| Law | George | California State University, Northridge | 8B | Saturday |
| Level | Keith | Las Positas College | 2A | Friday |
| Mahmoodi | Hamid | San Francisco State University | 5D | Friday |
| Markovic | Milica | California State University, Sacramento | 8B | Saturday |
| Maxwell | Stephanie | Arizona State University | 4A | Friday |
| Mendez | Sergio | California State University, Long Beach | 8A | Saturday |
| Menezes | Gustavo | California State University, Los Angeles | 6D | Friday |
| McMullin | Kurt | San Jose State University | 3B | Friday |
| Nico | Phillip | California Polytechnic State University | 5A | Friday |
| Owens | Larry | College of the Sequoias | 3A | Friday |
| Paulino | John | Canada College | 4A | Friday |
| Phillips | Richard | Harvey Mudd College | 2B | Friday |
| Prodanov | Vladimir | Cal Poly, San Luis Obispo | 3B | Friday |
| Radharamanan | Ramachandran | Mercer University | 6C | Friday |
| Rhodes | Nicholas | University of California Riverside | 6B | Friday |
| Robson | Nina | California State University, Fullerton | 5B | Friday |
| Sciortino | Antonella | California State University, Long Beach | 2C | Friday |
| Self | Brian | Cal Poly - SLO | 8A | Saturday |
| Shah-Fairbank | Seema | California State Polytechnic University, Pomona | 3D | Friday |
| Sinha | Bhaskar Raj | National University | 6C | Friday |
| Siniawski | Matthew | Loyola Marymount University | 3D | Friday |
| Siniawski | Matthew | Loyola Marymount University | 6A | Friday |
| Smilkstein | Tina | California State University, San Luis Obispo | 5C | Friday |
| Taufik | | Cal Poly State University, San Luis Obispo | 6B | Friday |
| Tiwari | Binod | California State University, Fullerton | 3B | Friday |
| Tiwari | Binod | California State University, Fullerton | 5C | Friday |
| Unnikrishnan | Raman | California State University Fullerton | 3D | Friday |
| Urdarevik | Slobodan | Western Michigan University | 2C | Friday |
| Vahid | Frank | University of California, Riverside | 3C | Friday |
| Wu | Liang Li | University of California Irvine | 2D | Friday |
| Zhou | Ziliang | California Baptist University | 4A | Friday |

# Awards

**ASEE PSW Outstanding Teaching Award**
Dr. Avelino Eduardo Saez, University of Arizona, department of Chemical and Environmental Engineering

**ASEE PSW Outstanding Community College Educator Award**
Dr. Ann-Marie Vollstedt, Truckee Meadows Community College

**ASEE PSW Best Paper**
"Teaching Bioinformatics in Concert: an Interdisciplinary Collaborative Project-based Experience", Alex Dekhtyar, Anya L. Goodman, and Aldrin Montana from Cal Poly, San Luis Obispo

**ASEE PSW Outstanding Student of the year Award**
Jose Garcia, a senior from Embry-Riddle Aeronautical University

**Section Outstanding Campus Representative:** Dr. David Lanning, Embry-Riddle Aeronautical University, Prescott

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# POSTERS

**International Research/education Collaboration on GaN LED/LDs between Cal Poly (USA) and PKU (China)**

**Xiaomin Jin and Xiao-hua Yu**
**Electrical Engineering Department**
**California Polytechnic State University, San Luis Obispo, CA**

**Xiang-Ning Kang and Guo-Yi Zhang**
**School of Physics and State Key Laboratory for Artificial Microstructures and Mesoscopic Physics, Peking University, Beijing, China**

**Abstract**

We initiated and established an international collaboration with institution in China. This is one of the international programs at California Polytechnic state University (Cal Poly) that emphasizes on both research and educational aspects. Our international partner is Professor Guoyi Zhang in the School of Physics at Peking University (PKU), Beijing, China. This project started by the Prof. Jin's summer visit to PKU in 2006 which is supported by Wang Faculty Fellowship at Peking University in Beijing, China, 2006-2007 through California State University (CSU) International Programs, and then expanded to include several teams of Cal Poly students international visit from 2007 to 2012, which was also supported by Department of the Navy, under Award # ONR 6-N00014-07-1-1152 (2008) and Award # ONR 7-N000140811209 (2009); "ChunHui" exchange research fellow through Chinese Educational Department (2008), respectively. In summer 2009, Simeon Trieu, one of Prof. Jin's graduate students, was awarded an NSF EAPSI summer and won the 1st place CSU research competition on graduate engineering and computer engineering level in 2010, because of working on the project. Now Prof. Jin is supported by 1) NSF Grant OISE Award #1029135 from year 2010 to 2013 and 2) Chinese National Key Research Lab Collaboration Grant 2010-2011 and 2011-2012. Those grants enable Prof. Jin to bring more US students to work in China. This paper will discuss how those activities are running in the past years and what the key issues of the program are. The paper also emphasizes participates (students and faculty) learning outcome in both technical aspect and culture aspect.

**********

**Seismic Analysis of Special Moment-Resisting Frames**

**John Max DeAndreis, Peter Moala, Agustin Robles, Jose Valdovinos**
**San Francisco State University/Cañada College/NASA CIPAIR**

**Abstract**

This project involves designing a five-story steel moment–resisting frame structure in the earthquake-prone San Francisco Bay Area location of Fremont, California near the Hayward fault. The structural engineer's main priority is safety; buildings have to be designed with a strong infrastructure such that they will be able to withstand high magnitude earthquakes. The objective of this research is to understand how to implement today's technologies of seismic design into the infrastructure of a building to construct a cost-efficient and environmentally friendly structure. Computer-aided analysis program such as SAP2000 (Structural Analysis Program) and MS Excel are used to simulate and analyze the structure. This research internship program allows for the development of project management, time management and teamwork skills, all of which help strengthen students' knowledge of seismic design in Civil Engineering and enhance preparation for academic and professional practice. The project intends to provide community college students research opportunities and make recommendations on improving engineering curriculum at San Francisco State University and Cañada College.

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**********

**Low Switching Frequency AC-DC Boost Converter for Wireless Powered Miniature Implants**

**Jose Carrillo, Alam Salguero, Ellaine Talle, Enrique Raygoza, Xenia Leon**
**1Cañada College, Redwood City, CA**

**Hao Jiang and Ben Lariviere**
**School of Engineering, San Francisco State University, San Francisco, CA**

**Abstract**

Providing wireless electrical power to an implantable medical device (IMD) is critical to an implant's efficacy. Wireless power transfer based on magnetic coupling is the primary approach to powering an IMD. Reducing the size and improving the efficiency are the two primary design goals for the power-harvesting component of an IMD. A pulse-width-modulated (PWM) boost converter converts a low-voltage AC power generated by a miniaturized receiving coil to a desired high-voltage DC power. However, in the traditional PWM boost converter, the switching frequency is much higher than the frequency of the input AC power.The high switching frequency not only dissipates more power on the switch, but also prevents the circuit from handling high-frequency input AC power. Consequently, a low switching frequency AC to DC boost converter is achieved by aligning the PWM signal with the input of the AC boost converter. The experimental verification of the optimal delay and duty cycle of the PWM control signal was made possible by a microcontroller based Printed Circuit Board (PCB) test platform that we re-designed using surface-mounts. This research attempts to prove that the converter significantly improves the conversion efficiency by reducing the dissipated power associated with the PWM switch.

**********

**Analysis of Performance Degradation of Integrated Circuits Due to Transistor Aging Effects in Nano-scale**

**John Paulino, Jesus Garcia, Joshua Lohse, Hector Prado, Hamid Mahmoodi1**
**Cañada College, Redwood City, CA**

**Atul Balani, Sridevi Lakshmipuram**
**School of Engineering, San Francisco State University, San Francisco, CA**

**Abstract**

Integrated Circuits, or ICs, work behind the scenes to make people's lives better from common appliances, such as refrigerators and dish-washers, to the most sophisticated computers. IC performance has dramatically improved since their first creation. However, with scaling of ICs to Nano-scale, an ideal integrated circuit delivering reliable performance over its lifetime is almost impossible. All ICs experience degradation over time due to the aging of underlying transistors. In this research, analysis of transistor breakdown is performed through computer simulations using the Custom Designer SE tool to understand effects on circuit power and performance. To simulate the effect of transistor breakdown, a ring oscillator circuit is utilized. This breakdown is modeled by resistors placed between the transistor terminals. The values of the resistors represent the severity of breakdown; large resistors represent fresh transistors, whereas low resistors represent a fully broken transistor. In addition to computer simulations, real ICs are studied by taking power measurements. This research aims to offer better insight into the impact of transistor breakdown and to improve IC design in Nano-scale.

**********

**Science Detectives: a novel approach to exposing children to STEM topics**

**Stephanie Maxwell**
**Barrett, the Honors College/Arizona State University**

**Abstract**

Effective education in STEM (Science, Technology, Engineering, and Math) topics is globally lacking, especially in the K-12 arena. Not only is the intelligence of children often severely underestimated, but all around the world students are not even given any exposure to the sciences. Lack of exposure frequently leads to intimidation and lack of confidence, and Science Detectives (SD) addresses this challenge of how to educate in a rapidly changing world. Our current model consists of groups of undergraduate students leading weekly after school lessons at local elementary schools. Each SD lesson is in the format of a mystery, in which students play the role of detectives investigating everyday questions like "how do airplanes fly?" and "why do we need two eyes?". This model allows us to bring together the expertise of University students and the enthusiasm of elementary school students to renew excitement about science education. By turning simple situations into scientific investigations we hope to capture our students' attention and awaken their daily scientific curiosity. The desired impact of SD is to increase interest in and familiarity with basic scientific principles among elementary school students. We have worked with 400 elementary school students at 5 different schools, as well as 50 college students. According to a recently conducted survey at Rover Elementary, all parents agree that Science Detectives improved the quality of their child's education. However, STEM topics are not only neglected in the United States. Our hope it to take SD to other countries and establish science camps so that students all around the world have the opportunity to investigate and realize their potential. We aim to eliminate the intimidation surrounding the sciences and show that STEM topics help explain the world around us.

**********

**Preparing Future Engineering Students through local MATHCOUNTS Competition in Inland Area**

**Ziliang Zhou**
**College of Engineering, California Baptist University**

**Abstract**

MATHCOUNTS is a national program aimed at promoting math excellence for middle schools students through a series of competitions at the local, state and national levels. Currently in its 30th year, MATHCOUNTS is one of the country's largest and most successful education partnerships involving volunteers, educators, industry sponsors and students. Extracurricular activities, such as MATHCOUNTS, recognize and reward students for pursuing a deeper understanding of science, technology, engineering and math (STEM) fields. This paper describes the effort made by the College of Engineering of California Baptist University in organizing the annual MATHCOUNTS Chapter competition for Inland Empire area and to promote engineering careers among the local middle school students. After initial background introduction of the MATHCOUNTS program, the paper will focus on the growth of local middle school involvement during the last four years, the detail aspects of organizing this important competition, and the linkage between the competition and the career choices among the students involved in the competition. The long term goal of organizing this competition is to further promote and improve K-12 STEM education so that more students will choose engineering as their future careers and more students will be better prepared for the engineering careers they choose.

# PAPERS

**Engaging Community College Students in Research using Summer Internship on Analysis of Performance Degradation of Integrated Circuits Due to Transistor Aging Effects in Nano-Scale**

**Atul Balani, Sridevi Lakshmipuram, Cheng Chen, Hao Jiang, Hamid Mahmoodi, Wenshen Pong, Hamid Shanasser**
**School of Engineering, San Francisco State University, San Francisco, CA**

**Jesus Garcia, Joshua Lohse, John Paulino, Hector Prado, Amelito G. Enriquez,**
**2Cañada College, Redwood City, CA**

**Abstract**

Integrated Circuits, or ICs, work behind the scenes to make people's lives better from common appliances, such as refrigerators and dish-washers, to the most sophisticated computers. IC performance has dramatically improved since their first creation. However, with scaling of ICs to Nano-scale, an ideal integrated circuit delivering reliable performance over its lifetime is almost impossible. All ICs experience degradation over time due to the aging of underlying transistors. Working on latest technology issues is typically an opportunity available only to graduate level students working on related research projects. To address this gap, using a NASA Curriculum Improvements Partnership Award for the Integration of Research (CIPAIR) grant, we have created a summer internship program that engages community college students in research projects on the latest challenges of circuit design in nano-scale semiconductor technology. Through this program, four community college students were mentored by two graduate students in a research project to analyze performance degradation of integrated circuits due to transistor aging effects in nano-scale. In this research, analysis of transistor breakdown is performed through computer simulations using the Custom Designer SE tool to understand effects on circuit power and performance. To simulate the effect of transistor breakdown, a ring oscillator circuit is utilized. This breakdown is modeled by resistors placed between the transistor terminals. The values of the resistors represent the severity of breakdown; large resistors represent fresh transistors, whereas low resistors represent a fully broken transistor. In addition to computer simulations, real ICs are studied by taking power measurements. This research aims to offer better insight into the impact of transistor breakdown and to improve IC design in Nano-scale.

**********

**Development and Use of and Construction Engineering Gaming Simulation in the Global Environment**

**Thomas M. Korman, Ph.D, P.E., M.ASCE, Hal A. Johnston, C.P.E.**
**California Polytechnic State University**
**San Luis Obispo, CA**

**Abstract**

Simulations and learning games use technology to create real-world experiences to provide the opportunity to engage, have fun, and truly learn. Many have been designed to meet specific learning goals, i.e. sharing case studies to demonstrating very complex situations. Gaming is not new to higher education but in the past was done in a very narrow vein and because of the complexity and development time required to produce them. Most have not been robust enough to engage students. Managing Construction involves being able to make decision to balance time, cost, quality, resources, and identifying and solving a variety of issues. As the millennium generation enters the higher education system many have spent many hours playing computer games as they have in the classroom during their lifetime; therefore, it is a natural transition that our learning environments begin to use techniques from the gaming world. The skills required of today's construction management personnel are a combination of management skills and technical knowledge. This paper describes the development of gaming system designed and developed at California Polytechnic State University, San Luis Obispo to educate civil and construction engineering students.

**********

**Integrating Earthquake Engineering into Community College Student Educational Experience through a Summer Internship**

**Cheng Chen, Qiming Zeng, Wenshen Pong, Hamid Shanasser**
**School of Engineering, San Francisco State University, San Francisco, CA**

**Max DeAndreis, Peter Moala, Agustin Robles, Jose Valdovinos, Amelito G. Enriquez,**
**Cañada College, Redwood City, CA**

**Abstract**

Young professional civil engineers are critical for preparing the San Francisco Bay Area for the next earthquake event. Many of these future engineers will come from community colleges, which serve as a gateway to higher education for large numbers of students, especially minority and low-income students. Preparing community college students for their future engineering career and engaging them in professional development is one of the major objectives of the NASA CIPAIR (Curriculum Improvements and Partnership Award for the Integration of Research)

program. In the San Francisco Bay Area, a collaborative NASA CIPAIR program between Cañada College, a federally designated Hispanic-serving community college, and San Francisco State University, a large urban university, has developed a summer internship program that provides freshmen and sophomore community college students an opportunity to participate in a ten-week study of earthquake engineering. For the summer 2012 internship program, students designed a three-story steel special moment resisting frame, and evaluated its performance under selected ground motions. The students optimized the structural design through iterative computer-based dynamic time history analysis. Structural analysis program SAP2000 was incorporated into the design process for students to examine story drift, and the capacity of the structural members. In addition to learning about fundamentals for earthquake engineering analysis and design, the interns also delivered an interactive presentation to local high school students to encourage them to pursue careers in math, science and engineering. The ten-week program was found to be successful in engaging community college students in the civil engineering career thereby helping train future American workforce for seismic hazard mitigation.

**********

**Engaging Undergraduate Students Into Advanced Earthquake Engineering Research**

**Cheng Chen, Jose Valdovinos, Frank Sanchez, Neli Avramova,**
**Hector Santillano, and Robert Hartsock**
**School of Engineering, San Francisco State University, San Francisco, CA**

**Abstract**

Preparing undergraduate students for advanced studies is critical to enhance engineering education to train future American workforce. This paper presents the engagement of undergraduate students into a two-year BRIGE project funded by National Science Foundation. The research project aims to establish a reliability assessment approach for real-time hybrid simulation with the presence of actuator delay throughout the experiments. Real-time hybrid simulation has been widely considered the most effective and efficient alternative for shake table test to accommodate rate-dependent behavior within large-scale civil engineering infrastructures. Research is urgently needed for reliability assessment of experimental results of real-time hybrid simulations. A total of five students were recruited with varying knowledge background in earthquake engineering. To involve these students into research activities, they were provided introductory lectures on structural dynamics and real-time hybrid simulation. Numerical model using Matlab and Simulink is created to emulate nonlinear structural behavior under ground motion. The students were instructed to conduct computational simulations of a nonlinear structure using recorded ground motions from PEER strong motion database and to interpret the simulation results to analyze the effect of actuator delay in real-time hybrid simulation. These engagement activities of undergraduate students have been demonstrated very effective preparing the undergraduate students for the further study to accomplish the project objectives.

**********

**Work In Progress: Stepping Back and Letting Students Take the Lead – Student-led Projects for a First-Year Introduction to Engineering Course**

**Matthew T. Siniawski, Adam R. Carberry, Nazmul Ula**
**Loyola Marymount University / Arizona State University**

**Abstract**

A first-year introduction to engineering course was redesigned to encourage active learning through a project-based pedagogy. A major goal of this approach was to improve students' engagement, learning, and interest in pursuing an engineering career. Student teams participated in four unique engineering projects throughout the course. Each project varied the degree to which the instructor defined the project goal, the specific project requirements, the schedule, the project deliverables, and the project-grading criterion. Some projects were completely defined by the instructor, while some projects gave freedom to the students in defining various project aspects. This paper will discuss student preferences toward the level of freedom given to them in defining various aspects of the projects.

**********

**A Project-based Approach for a Design and Manufacturing Laboratory Course**

**Matthew T. Siniawski, Adam R. Carberry, Rafiqul I. Noorani**
**Loyola Marymount University / Arizona State University**

**Abstract**

An upper-division design and manufacturing laboratory course for mechanical engineering students was redesigned to incorporate a semester-long project. The goal of the project was to provide students with an experience utilizing the design process to develop a simple product, a manual bottle opener. During the design process, students individually generated a conceptual design, created a 3D CAD model of their design incorporating appropriate design for manufacturing (DFM) guidelines, created a rapid prototype (RP) model of their design, and conducted relevant analyses to ensure reliability and functionality. The initial project design concluded with each student pitching his or her product idea to the entire class. The "winning" design was determined by a class vote. The entire class then worked to manufacture CNC milled prototypes of the winning design. This paper will discuss the details of the design

project and a qualitative assessment of the students' responses.

**********

**Engaging Underrepresented Community College Students in Engineering Research**

**Jose Carrillo, Alam Salguero, Ellaine Talle, Enrique Raygoza, Xenia Leon**
**and Amelito G. Enriquez**
**Ben Lariviere, Hamid Mahmoodi, Cheng Chen, Ozkan Celik, Hamid Shahnasser,**
**Wenshen Pong and Hao Jiang**
**Cañada College, Redwood City, CA**
**San Francisco State University, San Francisco, CA**

**Abstract**

One of the effective methods to engage and excel underrepresented minority students in the STEM field is to "replace standard laboratory courses with discovery-based research", as mentioned in the 2012 PCAST report. Funded by 2012 NASA CIPAIR (Curriculum Improvements and Partnership Award for the Integration of Research) award, five underrepresented minority (i.e., 4 Hispanic and 2 female) students from Cañada College participate in a ten-week research of designing a world smallest power harvesting apparatus for implantable medical devices (IMDs). Two of the five students engage in circuit simulation using LT-SPICE to predict the device's performance. Two students are involved in programming the micro-controller, which controls the operation of the power harvest apparatus, and characterizing its performance. Another student designs and winds spiral coils that is used to harvest time-varying magnetic field. After students are familiar with the system, they are asked to improve the existing device by re-designing the electronic circuitry using the printed circuit board (PCB) technology altogether. At the last week of the summer project, they have the opportunity to characterize the device that is designed and made by students. During the ten-week summer research, students from Cañada College have the opportunity to experience entire engineering development flow: idea > design > prototyping > validation. In addition to learning the electronics design using the state-of-art computer simulation tool, the students are exposed to the challenges in designing electronic systems for biological systems. The interdisciplinary thinking could benefit their future STEM careers. The feedbacks from the students show that the NASA CIPAIR is an effective method to engage underrepresented community college students in engineering research.

**********

**Development of International Mobility Program in Micro and Nanotechnology: Lessons Learned**

**Jesús Acosta-Iriqui, Eniko T. Enikov.**
**The University of Arizona**

**Abstract**

The Advanced International Studies in Mechanics of Micro- and Nano-systems program is a four-year student exchange program under the Atlantis Excellence in Mobility program supported by United States Department of Education and European Commission of Higher Education. The main goals of this project was to increase students' academic aspirations in science and engineering careers, increase students' professional aspirations in science and engineering, and increase students' awareness of science and engineering globally. With this presentation, we present some of the experiences that students from two universities in the United States – University of Arizona and University of New Mexico– gained while studying at the two European universities – Budapest University of Technology and Economics and Slovak Technical University – in Hungary and Slovak Republic. In addition, we address some of the challenges that prevented some students from traveling abroad. A successful student recruitment model based on utilization of the Senior Capstone Design course at the University of Arizona was developed and tested. The methods used to evaluate the program were interviews conducted through phone and Skype conference calls with participants. Most interviews were conducted during or after their semester abroad. A total of 24 U.S. students were recruited in a period of 4 years (2008-2012).

**********

**Work In Progress: Enhancing Students' Learning in Introductory Power Electronic Course Using an LED Driver Project**

**Taufik, Dale Dolan**
**Cal Poly State University, San Luis Obispo**

**Abstract**

This paper presents a new hardware project assignment introduced in the first course of power electronics at Cal Poly State University, San Luis Obispo. The new project is a culmination of series of experiments in the laboratory portion of the course. There are several objectives for assigning the project. First, the project is aimed to enhance students' learning by exposing students to practical issues in dc-dc converter designs. Secondly, the project will sharpen students' practical skills required by industry which are often not being taught to students as part of the curriculum. This, in turn, will help students in pursuing their career in the power electronics industry due to the skills learned from the project which match current demands from the power electronics industry. The project will also enforce students to learn beyond circuit design by incorporating one modern and widely used power electronic application as the final deliverable of the project. Consideration was taken such that the complexity

of the project should be appropriate for an undergraduate level course. Detailed description of the project along with preliminary results of student's assessment on the project will be presented in this paper. Challenges of conducting the project both for the instructor and students will also be discussed.

**********

**Easy Tracking System: a Valuable Outcome of a Student Capstone Project**

**Mohammed Alani, Alaa Ayoob, Jino Raj Xavier, Sameeullah Sharief, Mohammad Amin, Marcos Turquetti and Pradip Peter Dey**
**National University, San Diego, California**

**Abstract**

Easy tracking is a unique and an innovative tracking system that uses Bluetooth, Short Message Service (SMS), Global Position System (GPS), and Google Map technologies to develop a new mobile application. This system helps to keep monitoring of someone's personal belongings or loved ones (children or pet). The application utilizes the Java programming language and Android platform. It can be implemented on any mobile device including smart phone, laptop, iPad, etc. This system is capable of tracking missing luggage, car, child, and pet. It can also be applied to monitor elderly patients in a nursing home and children in a daycare. Easy Tracking system is an inexpensive and valuable tool that is capable of securing many things in our daily life. In this project, a prototype has been developed and tested for validating the proof of concepts by using two Bluetooth enabled mobile devices. The prototype was able to monitor a child's movement within 10 meters from the parents. Bluetooth technology was used to establish a short range wireless communication channel between two mobile devices. In this case, two smart phones were used (one for the parent and one for a child). The GPS technology was used for determining the exact locations and distance between these phones in real time and SMS technology was used for delivering this valuable information. Prototype was demonstrated and project findings were presented to a Faculty Judging Panel of three external and two internal judges. The overall quality of the project was found to be satisfactory and rated high.

**********

**Framework for Sustainability Practices in Construction Education Curriculum using BIM**

**Jin-lee Kim**
**Department of Civil Engineering & Construction Engineering Management, California State University Long Beach, 1250 Bellflower Blvd., Long Beach, CA**

**Abstract**

This paper presents a framework to develop a unique and innovative virtual approach in order to deliver sustainability practices using Building Information Modeling (BIM) technology for undergraduate students and implement it as a new hands-on laboratory- and project-based course in the construction education curriculum. The demand for specialists in these two emerging fields is increasing tremendously due to the fact that green buildings education, research, and practice issues are becoming driving forces in academia and industry. The BIM approach will provide students with building models containing integrated architectural information to implement sustainability that goes beyond both conventional 2D solutions using electronic drafting board and 3D modeling for purely visualization purposes. Therefore, it is expected that students enhance learning ability of sustainability via an innovative virtual approach using BIM. As an effort, this paper mainly focuses on the framework to bridge the gap between the current theoretical courses and hands-on experiences. Design and implementation methodologies for ten core modules and five advanced modules such as solar radiation analysis, day-lighting analysis, shading analysis, ventilation and air flow analysis and quantification and analysis of Greenhouse Gas (GHG) emissions due to the building materials and energy use of the buildings are discussed. The ultimate goal of this research project is to inspire undergraduate students with Green Buildings associated with BIM for the sustainable development of a built environment.

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**Professional Practice and the Engineering Curriculum**

**Paul M. Jones, J. Richard Phillips**
**Corporate and University Group/ Harvey Mudd College**

**Abstract**

There are elements of professional practice common to the engineering profession in all engineering fields. However, many, if not most, engineering academic curricula allow little or no room for professional practice other than minimal capstone projects. In those that do, the approach is widely scattered. The purpose of this paper is three-fold: (1) To briefly describe a professional practice program (featuring sponsored senior design projects) as adopted by California State University, Los Angeles (CSULA); (2) To discuss difficulties encountered in establishing such programs nationwide; and (3) To highlight the benefits and other facets of the Strategic Corporate Alliance Initiative at CSULA. We believe that first and foremost, a professional practice program will provide students with the experience of working on interdisciplinary team-based projects. (Virtually all engineering graduates entering the professional workplace will work in interdisciplinary teams.) It is vital that the projects be real-world projects suggested and funded by an outside sponsor. Moreover, the team project experience should extend beyond a one or two semester capstone course. Paul Jones and his colleagues at Corporate & University Relations Group have implemented custom Strategic Corporate Alliance Initiatives at CSULA,

Arizona State Polytechnic University, and U. C. Santa Cruz that feature adaptations of the Harvey Mudd (HMC) Clinic model. The goal of a professional practice program should be to prepare students for engineering practice in all its aspects: technical and social. Resistance to incorporating professional practice into an existing curriculum takes many forms. This includes a natural resistance to change and inadequate rewards to faculty for teaching and advising team-based projects, especially sponsored senior design (capstone) projects. For those institutions interested in a professional practice program, there are a number of other academic issues to be overcome. For example, there may be concerns about teaching credit for project advising, and course credit for students. Different departments at the same university can differ widely on these issues. Also, some departments will have a one-semester capstone course while for others it might be a one-year course. These complications may preclude carrying out sponsored interdisciplinary projects.

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**Practical Lecture, Research, and Projects Based Engineering Education**

**Jeffrey Ashworth, Ph.D.**
**Embry-Riddle Aeronautical University, Prescott Campus**

**Abstract**

A lecture, research, and projects based course has stimulated student interest in aircraft aerodynamics, performance, and static stability and overwhelmingly enhanced preparation for the practical aircraft conceptual/preliminary capstone design course. This unique elective course titled "Aircraft Flight Mechanics and Performance" uses learning methods reinforced by application techniques to analyze existing aircraft performance. Semester lectures cover three topics in nearly equal segments: practical aerodynamics, total aircraft performance, and static stability derivatives. These lectures contain references from many authors/texts for researching and understanding various techniques to analyze aircraft characteristics in the three areas. Students apply the various techniques in five assigned projects. The first project is an individual effort to plot published airfoil lift and drag curves for a selected aircraft. The four remaining projects utilize teams of two or three to promote team dynamics and analyze/plot data for their aircraft. The second project expands the airfoil data into wing data including high-lift-devices. The third project completes the aerodynamic phase by including the fuselage and empennage. The fourth project evaluates performance of the entire aircraft and plots total thrust and drag data. Project five is the final project and includes not only performance thrust, drag, excess power, and flight envelope plots but also calculates take-off, range, endurance, turning performance, and flight envelope data. Each project is documented in a written technical report and the final project includes a presentation of the overall results. When possible, the student data is then compared with existing aircraft data. This paper demonstrates how student learning through team efforts in applying research techniques to analyzing the performance and stability of actual aircraft will assist them in any aircraft design project. The described approach could easily be successful in any engineering discipline.

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**A Novel Approach to Expose Students to Global Issues in Civil Engineering and Construction Engineering Management**

**Antonella Sciortino, and Lisa Star**
**Department of Civil Engineering and Construction Engineering Management California State University, Long Beach**

**Abstract**

The availability of new technologies has resulted in great achievements in the civil engineering and construction engineering management fields worldwide. Young engineers should be equipped with the necessary knowledge to perform their jobs in any region of the world, and they should be able to understand the unique cultural and societal environment in which their designs are implemented. Engineering courses need to provide students with the global engineering perspective that will prove beneficial for their careers and this should be done at the early stages of the engineering curriculum. This study proposes a novel approach to expose civil engineering and construction engineering management students to current global issues in engineering and construction practices. An additional goal is the improvement of retention rates by increasing students' interest in the engineering field. The proposed approach consists of encouraging mentoring and collaboration between graduate students enrolled in a research course and freshmen/sophomore students enrolled in an introductory engineering course. The two groups work in teams to prepare a term paper and a presentation that focuses on a comparative assessment between two similar engineering projects, one in the United States and the other in a foreign country with an emphasis on engineering and construction practices and societal, economical and environmental issues. The challenges that we faced during the implementation of the plan and the proposed improvements to the courses are presented.

**********

**Incorporating Field Experiences into Environmental Engineering Lab Courses**

**Authors: Harmonie A. Hawley, Brian O'Dell**
**Department of Civil and Environmental Engineering, California State University, Fullerton, Fullerton, CA**

**Abstract**

Laboratories have long been considered a necessary part of engineering education to balance theory with practice.

Most introductory, undergraduate Environmental Engineering lab based courses focus on bench-top experiments. These experiments are important and provide the base work for subsequent lab courses. Another important, but often overlooked, lesson is to incorporate field sampling into environmental lab courses. Science majors, such as environmental science and geology, have field experience labs as part of the curriculum throughout the United States. This is a useful skill for Environmental Engineers going to the consulting or research industries.

Two field sampling experiments were incorporated into an environmental engineering class held in the Spring 2012 semester. The lecture material discussed different sampling techniques and the lab portion had the students learn "hands-on" proper sampling methods. The remainder of the lab time was spent learning field equipment for water and air quality analysis. A main learning objective in the class was for the student to be able to determine the most appropriate sampling technique for a specified situation. To assess student learning a practical exam was taken by all of the students which included scenarios that necessitated the choice of field equipment over bench-top equipment. Overall, the field labs were successful. Based on this outcome, further study is anticipated for the Spring 2013 semester.

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**Encouraging Women to Transfer into Engineering Programs from 2-Year to 4-Year Colleges**

**Authors: Lucia Riderer, Harmonie A. Hawley**
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**/Department of Civil and Environmental Engineering, California State University, Fullerton, Fullerton, CA**

**Abstract**

Women have long been an underrepresented group in the engineering community. Currently, research is being conducted throughout the United States on methods to retain women in engineering programs. Women in junior, or 2-year colleges, are often overlooked as potential members of the engineering community; however there are many women interested in engineering at junior colleges. The Encourage and Engage Women In Engineering (EEWIE) at Citrus College is a program intended to guide and keep women on track to transfer from a 2-year college to a 4-year college with a major in an engineering discipline. The program has successfully operated for one complete year (2012). Over the past year the women who joined EEWIE have worked with peers at 2-year and 4-year colleges, women faculty from 4-year colleges, and women engineers in the industry who provided honest opinions to the group about the fields of engineering.

Vital to the success of this program was linking the group with students and faculty at 4-year colleges. This collaboration allowed EEWIE members to interact with women engineers who were in college or graduated and were able to help them with the transition from general education courses to engineering courses. Meeting women who survived the engineering curriculum gave the students confidence that they could be engineers. Connecting the EEWIE women with female peers in engineering programs offered credible insights and encouragement for the women as they could relate to peers with similar problems. This is a model program from which many other colleges, universities, and students could benefit.

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**Teaching Bioinformatics in Concert: an Interdisciplinary Collaborative Project-based Experience**

**Alex Dekhtyar, Anya L. Goodman, Aldrin Montana**
**Department of Computer Science, Cal Poly San Luis Obispo, Department of Chemistry and Biochemistry. Cal Poly San Luis Obispo, Department of Computer Science, Cal Poly San Luis Obispo,**

**Abstract**

In the Spring of 2012 we piloted a novel approach to interdisciplinary instruction in the area of bioinformatics that enables undergraduate students in life sciences to work *"in concert"* with computer science students to solve biological problems. Our approach relies on well-defined **interdependent** roles for biology (BIO) and computer science (CS) students in a project-based laboratory.

We recognize distinct learning objectives for each major and implement them in two separate courses taught side-by-side: Bioinformatics Applications for BIO majors and Bioinformatics Algorithms for CS majors. We rely on separate lectures for each group of students, but in laboratory we form joint interdisciplinary teams to work on building software for solving specific biological problems. The teams rely on the biological expertise of BIO students and the software development skills of CS students to produce the software and to use it to obtain requested results. For each assignment, BIO students developed a set of software requirements for a computational biology question, provided it to the CS students on their team, and participated in design and testing of the software as it was being built.

In this paper we present the results of our pilot offering of the two courses to 24 BIO and 35 CS students. We collected and evaluated a variety of student artifacts and conducted extensive surveys in both courses. We discovered that both BIO and CS students indicate improvement in the quality of work of their partners over the course of the quarter. The majority of students reported increased confidence in their ability to collaborate with colleagues outside of their discipline. We discuss these and other findings and present our plans for improvement of our approach for the Spring 2013 offering.

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## Analysis of Aerospace Engineering Students Who Repeat Degree Requirements

**David Lanning Jr.**
**College of Engineering, Embry-Riddle Aeronautical University, Prescott, Arizona**

**Abstract**

This work investigates the enrollment statistics, semester-by-semester and cumulative grade-point averages (GPA), and overall success of a cohort of undergraduate aerospace engineering (AE) students who repeated required courses during their academic studies at Embry-Riddle Aeronautical University. Students retake courses that they do not pass, or sometimes retake courses to improve upon their prior grade to raise their cumulative GPA. It has been informally observed that there is a number of students who manage to persist in the degree program by retaking courses too many times, at least in the eyes of many of the engineering faculty. These students often manage to maintain an acceptable although often inadvisably low GPA, and harm their chances of success beyond graduation. The Department of Aerospace and Mechanical Engineering (AE/ME) is currently considering various alternatives to raise the bar on certain degree program requirements, such as limiting the number of attempts a student may make at completing a required course. For the purpose of tailoring any new degree program requirements to ensure student success both during their undergraduate engineering education and after graduation, this work focuses on identifying students who repeat courses, and obtain specific data on the number of courses repeated, improvements upon prior attempts, fluctuations in cumulative GPA, graduation rates, and the potential for success beyond graduation. These data and analyses are intended to be used as input to the AE/ME Department and especially the College of Engineering Curriculum Committee at the Prescott, Arizona campus of Embry-Riddle, to help during the deliberations of potential modifications to the course prerequisites and degree program requirements during the next several years.

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## Working in Progress: Teaching Introductory Digital Design Online

**Bridget Benson, Bryan Mealy**
**California Polytechnic State University San Luis Obispo**

**Abstract**

Partnerships with foreign engineering schools and universities are important to paving the way for global research and cooperation efforts with American institutions. The objective of this paper is to present how the University of Washington Tacoma (UWT) is working closely with Brazilian universities to receive undergraduate students under the Brazilian Science Without Borders program, as well as to enhance academic, cultural and research achievements through international cooperation.

The presence of Brazilian students helps improve student outcomes at UWT by aggregating the local students with the foreign ones in coursework that derives from fundamental and applied research being conducted by partnering institutions. These partnerships promote the development of UWT faculty and programs, and enhance the reputation and visibility of both the Institute of Technology and UW Tacoma, while also providing a global bridge for computer engineering studies.

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## Compact International Experiences: Two-year Reflections on Short-term Study-abroad Elective Engineering Courses

**Frank G. Jacobitz, Thomas F. Schubert**
**Engineering Programs, University of San Diego**

**Abstract**

In response to an effort by the home institution to internationalize the curriculum as well as strong student desire for engineering international studies, compact international experience (CIE) courses were developed. The efficacy of delivering such engineering electives as study-abroad, short-term courses is described through the experiences gained by repeat offerings in January 2013 of two distinct three-semester-unit courses in a three-week time frame in France and Australia. While each of these courses, Topics in Fluid Mechanics and Advanced Electronic Circuit Design, focused on its technical content, the desire for student understanding of the cultural environment and the impact of engineering solutions from a global and societal viewpoint were strong driving factors for each. The development of the two courses was undertaken with the hypothesis that CIE courses can successfully be taught in an intersession format while providing an international experience to the students. In the second offering of each course, increased interaction with local industry was a goal. Assessment of the program was carried out through typical course evaluations, student surveys, student reflection papers, and formalized instructor observations. Overall, these CIE courses have been found to be a valuable approach in the delivery of senior-level technical electives combined with an international experience.

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**The Middle East Initiative – Expanding Education in a Global Context**

**Liang Li Wu, Anis Hammoudeh and Gregory Washington**
**The Henry Samueli School of Engineering, University of California, Irvine**

**Abstract**

Strengthening education in a global context is the future in an increasingly interconnected world. Programs that can teach students valuable skills in an environment where they can also expand their language skills and worldview will be instrumental in creating the leaders of tomorrow. Research collaborations and international education programs were orchestrated as part of the Middle East Initiative at the Henry Samueli School of Engineering, University of California, Irvine (UCI) with Israeli and Saudi Arabia universities respectively. In this paper, we report our work in progress and results from implementing the Initiative.

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**Using Mastering Engineering Software-Based Homework System in Statics and Circuits Classes**

**Keith Level**
**Las Positas College, Livermore, CA**

**Abstract**

Mastering Engineering is a web-based, homework management system, created by Pearson Publishing Company. It is currently available in 4 engineering courses and 2 science courses. Engineering Courses currently covered by the Mastering Engineering software include (1) Statics, (2) Dynamics, (3) Mechanics of Materials, and (4) Electrical Circuits. This paper will examine the pros and cons of using this software, from a community college perspective, including opinions from both instructors and the students in their respective classes. There will also be some short discussion on possible future uses of software applications like Mastering Engineering.

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**Active Learning in Computer-Aided Engineering Courses (WIP)**

**Tammy Yut-Ling Chan, Gustavo Borel Menezes**
**Mechanical Engineering Department/Civil Engineering Department**
**California State University, Los Angeles (CalStateLA)**

**Abstract**

The field of numerical methods in engineering is broad with many established concepts, yet is still an area of active research. With the short 10 weeks in the quarter to teach this material to undergraduate students, the instructor is faced with issues such as the number of topics, depth of coverage, and how to effectively teach this large amount of material. Herein, the instructors used active learning and project-based approaches to teach students how to solve engineering problems with widely available computer software (MATLAB, Microsoft Excel) in undergraduate upper-division technical elective courses in the mechanical engineering and civil engineering departments. The instructors taught the most popular and useful numerical methods in depth by engaging and assessing students with course lecture, projects, presentations, programming, and report writing. In this pilot course, students worked in teams throughout the quarter to produce the final deliverables – a course manual and a final presentation highlighting the features of their manual (sales pitch). Every two weeks, students turned in work that formed the basis for a chapter and received instructor feedback to improve their work throughout the quarter.

Key features of the courses included: 1) Dedicated class time was dedicated for students and instructors to work together; 2) Teamwork enabled students, under time pressure, to analyze engineering problems, formulate solutions, program, write, and prepare presentations; 3) Engineering problems were solved with widely-available software; and 4) Teams competed to produce the best course manual for next year's course.

Preliminary results from surveys showed that students felt more confident and knowledgeable when presenting technical information, writing their reports, and using computer tools in their subsequent courses. They also used these skills later in their senior design projects. Compared to their peers who did not take this course, these students performed better in their senior design capstone oral presentations, according to surveys in which viewers rated how well students met ABET learning objectives. This work in progress (WIP) is currently collecting and analyzing more survey results to further demonstrate that active learning techniques improve student learning and retention of knowledge/skills.

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**PolyFS: An Extensible, Underspecified and Pedagogical File System and Disk Emulator**

**Foaad Khosmood and Phillip L. Nico**
**California Polytechnic State University**

**Abstract**

In recent years, teaching file systems at the undergraduate level has become increasingly challenging. File systems, while essential to most computer systems, are almost never offered as an exclusive required course for a computer science curriculum. The topic is usually taught as part of a course on operating systems (OS), along with other introductory topics such as process management, scheduling, concurrency, deadlocks, distributed processing and multiprocessing. Introductory OS courses are typically

required in computer science programs but the subject matter has grown tremendously in depth and case studies, making it difficult to spend any significant time on any individual topic. In this environment, professors can barely afford to cover the basics, let alone in-depth implementation of OS issues.

PolyFS is proposed as a solution to provide class assignments meant to exercise many of the established OS principles, while offering some level of design and implementation experience to students. Specifically, we stress three advantages for using PolyFS in an instructional setting: Variety, scalability and modularity.

We are developing PolyFS, a polymorphic file system assignment and corresponding storage device emulator compatible with a variety of operating systems. PolyFS specification includes a very basic block-device emulator making it easy to use regular Unix files, or even web-based services, as emulated disks. The file system itself is intentionally under-specified to allow instructors to focus on particular aspect of file systems in their assignments and students to actually design and implement important sub-systems using algorithms covered during lecture.

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**New Technology and Design Methodology for Micromouse: Challenges and Solutions**

**Ameneh Akbari, Karla Ananias, Jeffery Bouchard, Qian Wang, and George Law**

**Department of Electrical and Computer Engineering**
**California State University, Northridge, CA**

**Abstract**

The micromouse project has been integrated in many university curricula internationally. In the project, the students design and build an autonomous robot which explores and maps a fixed size maze, and races to the center of the maze in the shortest time. These mice will compete in IEEE or other engineering society sponsored competitions every year. Normally, the students will use a microcontroller or a microprocessor with external peripheral devices to control the micromouse. As the technology advances, the microcontrollers or microprocessors have been gradually replaced with field programmable gate array devices (FPGA). Using the latest technology and design methodology in the micromouse design, however, involves new challenges for the students and their supervising faculty. This paper describes the challenges in the system-on-chip (SOC) design where a field programmable gate array device (FPGA) is programmed to control the micromouse. The FPGA is also used to implement the various interfaces and memory. The paper also describes other related challenges involving the curriculum support, the software training, the algorithm coding, the simulator, and the design/software depository on the internet. More importantly, it describes how these challenges are met and how the next micromouse groups can be better prepared.

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**Retention Strategies for Engineering and Computer Science**
**Proven practices during first year in college**

**Raman Unnikrishnan and Victor Delgado**
**College of Engineering and Computer Science**

**Hye Sun Moon and Edward Sullivan**
**Office of Institutional Research & Analytical Studies**
**California State University Fullerton, Fullerton, CA 92831**

**Abstract**

The High Tech Education working group of the President's Council on Jobs and Competitiveness (Jobs Council) concluded that an increase in the number of U.S. engineering and computer science graduates is essential to maintain US competitiveness in the world. Accordingly, the National Science Foundation has embarked an initiative to increase the BS graduates in these disciplines by 10,000. However, engineering and computer science majors share the dubious honor of not retaining most of the students entering the programs as freshmen. The problem is much more severe among underrepresented students that make up an increasing fraction of entering freshmen at California State University Fullerton (CSUF). Studies such as the recent work by ASEE (2012) document over 60 strategies and practices to increase retention during the first two years of the undergraduate program. The strategies were divided into three categories: *student-focused strategies and practices; faculty-focused strategies and practices and department-focused strategies and practices.* The College of Engineering and Computer Science (ECS) at CSUF contributed its own practices and findings to the ASEE study, was acknowledged for its work and was recognized nationally by the Wal-Mart *Semillas* grant and *Excelencia's* Growing What Works initiative. This paper examines the causes of poor retention during the first year as well as the successful deployment of high impact practices to improve it. The approach taken by CSUF started with a careful and dispassionate review of student data with the help of the Office of Institutional Research and Analytical Studies. This data based inquiry naturally led to the identification of numerous problems and surprisingly several remedies also. ECS first-year retention has improved between 15 and 20% during the past five years. The approaches, analyses and results of the CSUF experience are expected to be useful to all, particularly for institutions with large populations of first-time college goers or underrepresented minorities.

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**Analysis Of An Android Based Student Project: Remote Medical Monitoring Station**

**Danyang Li, Qiao Zhen, Al Gordon, Bhaskar Raj Sinha, Marcos Turquetti and Mohammad N. Amin**
**National University, San Diego, California**

**Abstract**

**First responders provide urgent care to patients in medical emergency. Such care must be initiated as quickly as possible in order to maximize the survivability of the patient. Since first aid procedures are often needed, early information on the patient's overall condition is an asset to the responders. Advances in wireless communication data collection have occurred on several fronts. In the healthcare field, it is almost standard now to use sensors of many types to collect information and to send it to a patient's phone. Multiple instances of such data collection can occur via the Bluetooth standard, the Healthcare Device Profile (HDP), etc. This project utilizes some of these sensors, together with Bluetooth communication standards, to create a remote medical monitoring station. A new mobile app was developed using the Android platform to collect, display, and store biometric data on a mobile phone, and integrate it with WiFi and cellular networks. Relevant information is forwarded to a relational database developed for storage, or can also be directed to the first responders in case of emergency. Elderly patients, who are at home, or perhaps live far away from their physicians, are at risk when it comes to their health. This system will enable them and their physicians a daily look at their vital signs without having to leave their home or office. A prototype of this system was designed, developed, and tested by students under the guidance of faculty members. This project was analyzed on how it fulfilled the program objectives. Students made a formal presentation to the Faculty Judging Panel for official approval of this capstone project and the project was approved for the degree requirement.** The final report and the presentation were graded and it was ensured that they covered and reinforced the academic objectives and met the Program Learning Outcomes (PLOs).

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**Bringing Design and Construction into Elementary School Classrooms with Sandcastles**

**Pamalee Brady, Ph.D**
**James Guthrie, SE**
**California State Polytechnic University**

**Abstract**

The design and construction professions face a continuing need to attract talented and trained individuals. Essential skills include creativity and a strong understanding of math. Education in these areas cannot come too early, however often it is difficult for teachers to identify relevant motivating applications of math learning. A promising approach is to introduce these professions to students to motivate their learning and stimulate their creativity in elementary school classrooms. The Sandcastle Project is a collaborative effort that will bring students and faculty in the Cal Poly College of Architecture & Environmental Design (CAED) and the School of Education into local elementary school classrooms. The CAED includes departments in Architectural Engineering, Architecture, City & Regional Planning, Construction Management and Landscape Architecture and can provide students and faculty who are competent in all areas of building design and construction. Students, who have achieved the rank of Teacher Candidates in the School of Education, are the optimal means of introducing technical concepts and practices for the present and future education of elementary school students.

The goals of the Sandcastle Project are to stimulate elementary school students' creativity and an interest in building design, engineering and construction and to use real world examples of math and science to reinforce standard curricula. Teacher Candidates from the School of Education and students from CAED will join elementary school students initially in the classroom and later in an afterschool program. Exercises will give the elementary school students the experience of acting as the client, designer and contractor. The culmination of the project will be a sandcastle competition. Students will design and plan the construction of their sandcastles and will build them at a local beach on a Saturday morning.

The work in progress paper will describe the goals of the Sandcastle Project, the method of its implementation, assessment methods and future steps.

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**Creating Accelerated Educational Pathways for Underprepared STEM Students through an Intensive Math Placement Test Review Program**

**Amelito Enriquez, Denise Hum, and Christine Woo**
**Cañada College, Redwood City, CA**

**Abstract:**

A majority of California community college students enter college with low levels of preparation for college-level work, especially in math. For students interested in pursuing science or engineering degrees, this may mean up to four or five years of coursework before they are eligible to apply for transfer to a four-year institution. As a result, many of them drop out or change majors even before taking transfer-level STEM courses. To facilitate the entry of these underprepared students, Cañada College, a federally designated Hispanic-serving community college in the San Francisco Bay Area, developed the Summer Math Jam, which is a two-week intensive math placement test review program. Implementation of the program over the last four years shows success in improving student performance in the math placement test, in preparing students for success, and in creating a sense of community among program participants. An analysis of student academic performance in subsequent semesters shows

significantly higher success and retention rates among Math Jam participants compared to nonparticipants. The success of Math Jam has led to the development of the Mini-Math Jam – a shorter, one-week version of Math Jam that is offered a week prior to the beginning of the fall semester, and during the winter break. Since the initial implementation of Math Jam in summer 2009 the program has served over 1000 students, and enrollments in transfer-level STEM courses have increased significantly, with a higher rate of increase among minority students.

This paper describes the evolution of Cañada College's Math Jam Program, including challenges encountered and the strategies employed to overcome those challenges. The paper will also provide resources that have been developed at Cañada to assist other institutions in developing a similar program to improve the participation and success of underprepared students in STEM.

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**Ethics in Engineering:**
**Preparing Our Students to Meet Societal Obligations**

**Jim Helbling, Angela Beck**
**Embry-Riddle Aeronautical University, Prescott**

**Abstract**

This paper discusses a work in progress, reporting on how societal ethics are incorporated into a senior-level capstone course, AE 421: Aircraft Detail Design, taught at Embry-Riddle Aeronautical University, Prescott campus. Specifically, this presentation will focus on how the course instructors prepare these aerospace engineering students to perform as professional engineers as per ABET criteria 3f and 3h. By helping these students to become increasingly aware of their impact on society and by allowing them to practice ethical decision-making while in college, the instructors prepare students to engage in ethical behavior on the job.

Ethics is embedded in this detail design course in several ways, each of which is explained and exemplified in this paper. For example, students are required to design and fabricate wind tunnel models and structural test articles to strict material budgets. This effort requires the teams to understand the need to make economic decisions and balance design requirements relative to cost. The material selection process also requires an understanding of environmental concerns, the potential for recycling excess material, the proper disposal of waste products, and safe machine shop practices.

The most overt example of ethical instruction provided in the class involves an invitation to all graduating seniors to join the Order of the Engineer organization. This society requires all inductees to recite a pledge promising to always perform their jobs with integrity and with an understanding of the impact they have on society if they fail to do so. The invitation is directly applicable to the pressures the students feel as a part of the class, where they are required to perform testing to evaluate analytical predictions under tight schedules, thus learning to ethically report test results. The hope is that the students will assimilate these lessons as they transition from student to practicing engineer.

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**Enhancing Discovery Learning Techniques in Undergraduate Mechanical Design Classes**

**Nina Robson**
**California State University Fullerton, CA**

**Abstract**

The paper discusses two different challenges, presented in the form of two projects, as a part of the Introduction to Mechanical Design class at California State University, Fullerton, using inquiry and project based learning approaches, respectively. The students take the theoretical ideas of mechanical design and implement them with moderate guidance for the first project and limited faculty involvement in the second project. In order to asses the approach, we use techniques to uncover what the students are asking themselves as they try to solve each challenge. Based on these questions, the main project objectives such as critical thinking, responsibility for students' own learning and intellectual growth, are discussed.

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**The Decline of the Car Enthusiasts: Implications for Undergraduate Engineering Education**

**M. Cardenas**
**Harvey Mudd College, Claremont, California**

**Abstract**

Hands-on, project-based engineering education is alive and well. However, anecdotal evidence indicates that we are seeing fewer undergraduate engineering students who arrive on campus already knowing how to 'use their hands'—having familiarity with tools and mechanical devices, knowing how to connect things, savvy about avoiding leaks in fluid systems, wary of stripping a screw thread or shearing a bolt head—the kinds of things that an archetypal 'car guy' (or gal) would have learned in high school. For design-build-test project-based engineering educational experiences, having at least one 'car guy' has proven invaluable: more time can be spent on testing and re-designing, rather than getting bogged down in the initial selection of means to satisfy an engineering design function. 'Car-guy' skills also come in handy during the building process, rather than relying on inexperienced students who may be picking up tools for the first time. Why the (perceived?) decline in these do-it-yourself-ers? If it exists, was it influenced by the on-board diagnostic computer interfaces mandated (in the US) for new cars in 1996, thus making home car maintenance more difficult?

Is it because many gadgets, especially electronic devices such as mobile phones, PDAs, and gaming systems, are designed and manufactured in ways that make them difficult to open up and repair? I will explore these issues, especially their implications on current undergraduate engineering pedagogy, and suggest potential ways of improving beginning engineering students' hands-on skills.

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**Inquiry-Based Learning Activities in Dynamics**

**Jeffrey Georgette, Brian Self, James Widmann, Kathryn Bohn, Eric Wang***
**California Polytechnic State University, San Luis Obispo/*University of Nevada, Reno**

**Abstract**

The Inquiry-Based Learning Activity (IBLA) method was implemented in an undergraduate dynamics class to improve conceptual understanding. This was done through a rolling objects activity, in order to present students with the concepts of moment-of-inertia and work-energy. Students were evaluated with a Dynamics Concept Inventory (DCI), a quiz, a hands-on activity, and a final exam question. These activities were analyzed by the professor and teaching assistants to gain insight into student thinking and improve course outcomes and student learning success. Two implementations will be discussed: (a) a full IBLA where teams of 4-5 students manipulate the different objects, and (b) a demonstration mode in front of a class of 60 students.

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**Implementation of a Proactive and Effective Advising Program in a Large Civil Engineering Program In the Face of Budgetary and Organizational Constraints**

**Seema C. Shah-Fairbank, William Kitch and Kenneth Lamb**
**Civil Engineering Department, California State Polytechnic University, Pomona, CA**

**Abstract**

Assessment data from a senior exit survey in 2009 indicated significant dissatisfaction with the advising received at a large regional university. At the time the civil engineering program had over 1500 undergraduate students and only 16 full-time faculty members, resulting in a student to faculty ratio of 90:1. A review of the existing department advising program and retention data indicated the greatest short coming was in early advising of first year students. Training of advisors, focused on the specific needs of first year students proved unsuccessful in improving first year advising. An informal survey of faculty indicated a disinterest among the majority of faculty in learning the special issues freshmen and first year transfer students face. Both budgetary and work rule constraints inhibited the program from adopting techniques such as hiring a dedicated lower division advising staff. Cognizant of the existing structural constraints, a three phased approach was designed to address the advising needs of student throughout their academic careers. The first phase, implemented in winter of 2011 was to provide group advising sessions where consistent and vetted guidance could be provided to all students according to their academic standing. The second phase of implementation started in the fall of 2012 was to employ a dedicated group of advisor for entering freshmen and transfer students. This group of advisors was selected for the interest and willingness to advise first year students (freshman and transfer). They received special training in advising of these students. The third phase, yet to be implemented, is a dedicated advising group for at-risk students (overall GPA below 2.2). Preliminary assessment data from spring 2012 indicate a significant improvement in the advising, measured by student exit surveys. This paper presents the specific advising program implemented and how organizational and structural constraints were overcome.

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**An Innovative Approach to Educating Engineers in Entrepreneurship**

**S. Jimmy Gandhi & Mark Rajai**
**California State University, Northridge**

**Abstract**

Entrepreneurship is a key driver of our economy. This is because wealth and a large number of jobs are created by small startup businesses. As these small businesses continue to grow and prosper, they create even more jobs and thus contribute to the overall well-being of the local and national economy. One of the key ingredients of entrepreneurship is innovation and engineers as a profession come up with new ideas and thus are a hot bed for innovation. Engineering Schools are starting to realize the importance of entrepreneurship to engineers, which is why entrepreneurship is increasingly being taught as a part of engineering programs. However, the method of conveying the entrepreneurship education has been writing a traditional business plan. In this paper, the coauthors will discuss an innovative approach to educating engineers in entrepreneurship. This would include implementing in the curriculum new online tools for creating a business plan which have the mobility and convenience that today's generation of engineers have grown to know and expect. Furthermore, the authors will also discuss in this paper work being currently done at the Ernie Schaeffer Center for Innovation and Entrepreneurship at California State University, Northridge, which can be incorporated into the revised curriculum for educating engineers in entrepreneurship. This revision of the entrepreneurship curriculum would be particularly important for engineering managers to understand and would thus be a valued contribution for engineering management programs across the country.

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**Classical Test Theory Analysis of the Dynamics Concept Inventory**

**Natalie Jorion, Brian Self, Katie James, Lianne Schroeder, Lou DiBello, Jim Pellegrino**
**University of Illinois, Chicago/ California Polytechnic State University/ University of Illinois, Chicago/ University of Illinois, Chicago/ University of Illinois, Chicago**

**Abstract**

The Dynamics Concept Inventory (DCI) is an instrument designed to measure students' conceptual understanding of dynamics. Its primary intended use is to examine the effectiveness of teaching practices for helping students overcome misconceptions in the domain, based on evidence of student understanding. Given that many instructors are administrating this assessment in their classrooms, it is important to determine how well the instrument functions relative to the claims of its developers and relative to its intended uses. A further interest is to provide guidance for improving the instrument by identifying aspects of the instrument that may be modified or enhanced. Multiple analyses were conducted for data from two administrations of the instrument using classical test theory. These analyses provide insight into the DCI's conceptual content, measurement properties, and relative validity given its intended use. Overall, evidence shows that the instrument is well suited for low stakes formative assessment use but may have limitations for high stakes uses in its current form. Guidance is provided for the effective implementation and interpretation of the instrument for this purpose. Recommendations are also suggested for future iterations of the instrument and to provide evidence for the resultant changes in measurement properties.

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**CoursePedia for Engineering Courses**

**Kiran George**
**Computer Engineering Program**
**California State University, Fullerton**

**Abstract**

This work-in-progress (WIP) activity explores the potential of a supplementary student resource that involves setting up an online conglomeration of current and applicable topics for a course from the latest journals and publications to which students contribute, edit, and update as part of their class assignments and other course deliverables. The supplementary student resource described above was implemented in two engineering courses; the paper discusses: detailed implementation, pedagogical approach, and results of the measures taken to evaluate and assess the student benefits.

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**Summer Research Opportunity for University-Community College-High school Partnership: A Great Motivation for Engineering Education Pathways**

**Binod Tiwari, Ph.D.**
**Associate Professor, Civil and Environmental Engineering Department**
**California State University Fullerton**

**Abstract**

Although it has been identified as one of the high impact practices, involving undergraduate students in the faculty-student collaborative research has not been practiced with expected success. The situation is worse for community college and high school students. This paper includes an experience of the author in implementing a model that includes community college and high school students in summer research opportunities with students from master's degree granting institutions. The study shows that involving high school and community college students in the university level research motivates students to pursue engineering degree and exhibit high performance.

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**Engaging Engineering Students in Research from Early Stage of Their Student Career**

**Binod Tiwari, Ph.D.**
**Associate Professor, Civil and Environmental Engineering Department**
**California State University Fullerton**

**Abstract**

Engineering education in the USA has significantly been controlled by the accreditation agency. As a result, classroom education is paid much more attention compared to the hands-on or research activities. In this study, a select group of engineering students were involved in faculty-student collaborative research activities in different stages of their academic standings and their progresses were monitored. The study result shows that students can improve their academic performance significantly after being involved in faculty-student research activities. Moreover, students, involved in research, showed more leadership skill as well as advancement to graduate studies.

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**Evaluating the Impact of ECS Academic Catalyst for Excellence (ACE) Scholarship Program**

**Kiran George**
**Computer Engineering Program**
**California State University, Fullerton**

**Abstract**

Recent research strongly suggests that engineering education loses about % of undergraduate students of which roughly 40% switch to non-science fields. Similarly, the out migration fromthe College of Engineering and Computer Science (ECS) at California State University, Fullerton (CSUF) has been profound. In 2010 with funding availed from the NSF, ECS at CSUF established the ECS Academic Catalyst for Excellence (ACE) Scholarship Program designed to reverse its historical legacy of high student attrition. This program awards scholarships to ECS students over the 5-year period of the project and leverages a well-established network of ECS and University student services to support cohorts of ACE scholars (recipients of the ACE scholarship) majoring in ECS majors. The ECS ACE scholarship program provides tuition scholarships and a myriad of support services ranging from peer mentoring to priority registration. The paper presents detailed evaluation and assessment of the scholarship program using the following measures: a) Attitude and enthusiasm of students towards the ECS ACE scholarship program activities; b) Academic self-efficacy, and STEM interest and motivation based on the assessments of ACE scholars; c) Qualitative measure of program effectiveness based on: GPA of ACE scholars when compared to traditional students of similar background not supported by the ACE program, and correlation of GPAs to pre and post academic selfefficacy surveys; d) Impact of working hours (full time, part time, etc) along with the nature of work (technical vs. non-technical) on the ACE scholars' academic performance; e) Correlation between the scholarship amount and ACE scholars' academic performance; f) Impact of support services such as seminars, tutoring, and priority registration on ACE scholars' academic performance.

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**Identifying At-Risk Students: How Use of Optional Study Materials and Collection of Graded Work Correlate with Academic Performance**

**Vladimir I. Prodanov**
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**Abstract**

We report on a study designed to identify students at risk by monitoring certain academic behaviors. Two different approaches were implemented. The first one involves monitoring student access of optional homework problems. While this approach was successful in the early identification of students at-risk, optional homework (as opposed to mandatory one) degrades attainment of learning objectives. The second approach relies upon "counting" of uncollected work. Since no grades were posted, the only way for the students to keep track of their performance was to collect their work. Failure to collect graded work, we argue, is indicative of weak motivation, poor class attendance and poor attendance of office hours. In a class of 114 students, 29 students failed to collect at least one major graded work. Twenty-one of them had below-average class ranking and all students with final grades of F and D+ were part of the underperforming group of 21 students. We also studied the motivating impact of rank-performance plots. The impact of these plots was assessed using an anonymous survey. Total of 89 students participated and 78 of them state they have used the plots to determine their ranking. Total of 36 students (47% of 78) report increased efforts; for students ranking in the bottom 1/3 of the class this percentage was close to 60%. The disadvantage of using rank-performance plots as a motivation tool is an increased anxiety.

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**Increasing Lab Participation and Content Retention Through Supportive Laboratory Preparation Assignments**

**Tina Smilkstein.**
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**Abstract**

A study is done on an electrical engineering circuit lab course to assess the effect on participation, retention of course content and student satisfaction when prelab assignments were expanded to include a write up of the experiment background and goals. Reading that was created specifically for each lab covered background for the lab that the students should be bringing with them from previous courses but did not tell them how to do the lab. They were asked to summarize the reading on the background by the night before the lab in one or two paragraphs. The inspiration for the addition of this assignment was the observation that students that had trouble with previous quarter's subjects were falling behind even further behind and showed low participation, confidence and success. Retention was assessed using test and report scores as well as observations of students in later classes. Participation was assessed through observation and survey results. Satisfaction was assessed through survey results. Survey results showed that 1/3 of the weaker students increased their participation over other labs in the sections that had prelab statements whereas the section with no statements had zero students saying they participated more. Twice as many of the weaker students felt more prepared for lab than the lab without prelab statements. There was also a general upward trend in report grades and quality of organizational and reasoning sections of reports. Through observation, it appeared as if the weaker students were more confident and participating more also.

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**Protection Considerations for Telecommunications Network**

**Dr. Ibraheem Kateeb, Dr. Larry Burton, Michael S. Peluso**
**North Carolina A&T State University, Greensboro, NC, USA**

**Abstract**

For the majority of the last century single service fixed-line based networks were the primary means of communications. Over the past few decades we have seen tremendous change to the traditional fixed-line model including the introduction of wireless networks and a shift in focus from single-service to multi-service networks. These newer multi-service networks are designed to provide broadband via both fixed-line and wireless connections. All of this rapid change has resulted in very complex network management organizations and safety issues that are distinct to each network type. This paper will provide a survey and discussion of the safety issues that relate to both fixed-line and wireless networks. It will examine how the infrastructure service model is drastically different between traditional fixed-line service providers and wireless service providers. It will explore issues and regulations relating to buried telecommunications plant. Finally, it will also review safety issues that relate to optical cable and fiber optic networks.

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**The Fundamental Component of Telecommunications Cabling**

**Dr. Ibraheem A. Kateeb, Khaled F. AlOtaibi, Dr. Larry Burton, Michael S. Peluso, Dr. Evelyn R. Sowells**
**North Carolina A&T State University, Greensboro, NC, USA**

**Abstract**

The fundamental building block of last mile broadband connections for the telecommunications industry is the copper cabling systems that have traditionally underpinned the networks. Time has seen tremendous change in this core component of the network, with result being silica-based fiber optics are championed as the de facto replacement technology for traditional copper cabling in the last mile.

This paper will provide a survey and discussion of the current status of copper cabling in networks. It will examine the strengths of copper verses fiber optics. It will explore the effectiveness of recent technological advances made in delivering broadband over copper. It will also review the current economic models relating to cable deployments. Finally, an analysis will be presented that attempts to answers the question of phasing out copper.

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**Community Attitudes Related to Telecommunications Cables**

**Dr. Ibraheem A. Kateeb, Khaled F. AlOtaibi, Dr. Larry Burton, Michael S. Peluso, Dr. Evelyn R. Sowells**
**North Carolina A&T State University, Greensboro, NC, USA**

**Abstract**

One of the issues the Telecommunications industry faces is concern regarding aesthetic elements of the networks. These aesthetic considerations impact both network performance and community engagement with service providers. This paper will provide a survey and discussion of the aesthetic elements that relate to cable and outside plant infrastructure used in networks. This paper will examine historical community attitudes related to aesthetics and compare those attitudes with modern community attitudes. This paper will explore how aesthetic considerations such at outside plant cabinet color can impact network performance.

Keywords- Telecommunication cables, WAN, Community Attitudes, Aesthetics, fiber optics, telephone poles, outside plant, OSP cabinets.

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**A Community College Perspective of the Development of Engineering Transfer Model Curricula under the California Student Transfer Achievement Reform Act (SB 1440): An Update on Work in Progress**

**Kate Disney, Erik Dunmire, Michelle Millea, Larry Owens, Jo-Ann Panzardi, Liz Rozell**
**Mission College/College of Marin/Ventura College/ College of the Sequoias/Cabrillo College/Bakersfield College**

**Abstract**

California Senate Bill 1440, The Student Transfer Achievement Reform Act, requires California Community Colleges (CCCs) to develop associate degrees for transfer to the California State University (CSU) system. Engineering faculty representatives from both systems have worked together to develop preliminary transfer model curricula and associated course descriptors. Both the model curricula and the course descriptors are currently undergoing statewide vetting at the writing of this paper. The results of the vetting process and up-to-date documents will be presented.

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## A Data-Driven Approach to Categorizing the Spatial Organization of Homework Solutions

**Jim Herold, Dr. Thomas Stahovich**
**University of California, Riverside**

**Abstract**

It has been shown in prior work that both the temporal and spatial organization of a student's solution to a homework problem correlates with his or her performance on that solution. This result supports the intuition that the way in which a student organizes his or her work provides a view into the cognitive processes by which that student solved that problem.

In the present work, we seek to develop a taxonomy of the types of organization exhibited by students. The categories we identify serve as a basis for examining the cognitive processes employed by students as they solve homework problems. While we could use manual inspection of student work to identify typical organizational patterns, such an approach is prohibitively time-consuming. Also, the results could be inconsistent as they would rely on the inspector's judgment. Instead, we employ a data-driven approach to automatically discover patterns latent in the organization of the students' work.

This data-driven approach is enabled by our unique database of coursework. In the winter of 2012, undergraduate Mechanical Engineering students enrolled in a Statics course were given Livescribe digital pens. The students completed their homework assignments with these pens, creating a digital corpus of all their work in the form of time-stamped pen strokes.

To capture the spatial organization exhibited by the students, we represent each page of a solution as a low-resolution bitmap. We compute distances between bitmaps using the Hausdorff distance and cluster the bitmaps by that distance using the EM clustering algorithm. This algorithm identifies groupings of bitmaps that are similar with one another and distinct from bitmaps of other groups. Each of these groups represents a distinct spatial organization type. We then manually examine the pages which comprise each grouping, and describe the higher-level organizational habits present there. From these habits, we gain insights into the cognitive processes employed by students as they solve homework problems.

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## Using a Lexical and Temporal Analysis of a Student's Self-Explanations to Predict Understanding

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**Matthew A. Ung, Thomas F. Stahovich**
**Department of Mechanical Engineering, University of California Riverside**

Numerous studies have shown that self-explanation can lead to increased learning outcomes. Here we examine how the how the quality of self-explanation correlates with performance. More specifically, we examine how the words students use in their self-explanations correlate with performance on homework. We also examine how the sequencing of self-explanation within the solution process correlates with performance.

We conducted a study in which 30 students in an undergraduate Mechanical Engineering Statics course provided handwritten self-explanations of the major steps in each of their homework problems. The students completed the homework and self-explanations using LivescribeTM Smartpens. These devices record the work as time-stamped pen strokes, enabling us to see not only the final ink on the page, but also the order in which it was written.

Our analysis relies on data mining techniques—specifically Bayesian filters, Markovian filters, and clustering—to find patterns of language and timing that correlate with performance. For example, we train a Bayesian filter to identify which vocabulary choices indicate a strong understanding of the material and which choices indicate poor understanding. We also consider how the temporal properties of the self-explanation and problem solution relate to understanding. The temporal properties include the problem solving duration, the self-explanation duration, and the sequencing of the self-explanation within the problem solution. In this analysis, we measure student performance by the correctness of individual homework problems and the overall course grade. The results of this analysis provide valuable insights about the behaviors of successful and unsuccessful students. Additionally, these techniques form the basis of a novel automated assessment technique for evaluating student performance.

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## Simple Experiments and 3-D COMSOL Simulations to Enhance the Learning of Transient Heat Transfer

**Sergio Mendez and Lisa AungYong**
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**Abstract**

Engineers are at the cutting edge of implementing technologies to garner energy from sustainable sources or

to make processes more energy efficient. Therefore, it is imperative that we provide a solid education of heat since heat is often converted to mechanical power. To keep competitive on a global scale, it also becomes important to train students on the latest computational software. In the chemical engineering curriculum, students are first taught the principles of heat transport in a lecture course. Many students, however, struggle with the calculus-based math required to solve the heat transfer equations, and they do not fully make the connections between the concepts of conduction and convection and real world phenomenon. To further increase understanding, students are often given the opportunity to perform relevant experiments in a subsequent undergraduate lab course. We report on a combined experimental and computational module that can be incorporated into lecture or lab courses to enhance student learning about transient heat conduction/convection. The experimental set-up is low-cost and simple: first heat a cylindrical solid to an elevated temperature, then remove the solid from the heat source, and measure the temperature versus time cooling profile. There is heat conduction through the solid, and convective heat transfer to the ambient air. The students then compare the temperature profile with the results from a computer simulation. The two teaching aims are 1) for students to perform a hands-on activity that enables them to make the connection between textbook concepts and real-world observation, and 2) to give students the skills to employ the state-of-the-art, user-friendly, commercially available computer modeling software, COMSOL Multiphysics. The effectiveness of this teaching module was assessed with student opinion surveys, and their response to conceptual questions. Based on these results, we found that this module improved student understanding of heat transfer, and that their level of enthusiasm increased due to experiential, hands-on measurements and computer simulations.

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**Towards Gender Balance in Engineering for an Expanding Global Market Place**

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**Texas Tech University, Lubbock, Texas,**
**Ali Nejat**
**Texas Tech University, Lubbock, Texas**

**Abstract**

A global economy requires that engineers understand the importance of both cultural and gender diversity to be more efficient in solving problems in our connected, technological world. Nearly four decades ago, Unites States engineers led one of the greatest accomplishments of all time by successfully landing man on the moon and returning them safely to America. Four subsequent crews followed the first crew in equally successful triumphs. If we recall the picture of those engineers they were all white men in white shirts, most with plastic pocket protectors to hold rows of pens and pencils. This picture is slowly changing, as the field of engineering progresses and evolves. Recent studies showed that there are more women engineers joining the workforce every year, but still not enough to fulfill the gap. Engineering classrooms remains to be dominantly consisted of male students with the national ratio of six to one. The female ratio at the college of engineering in Texas Tech University is much lower than national statistics.

Influential factors of lower interest in women preceding engineering careers are known as "environmental" factors, such as isolation, exclusion from networks, and lack of role models. All of such are a major source of discouragement for girls and women in the field of science and engineering. If engineers are capable of solving complex problems of the world, then they surely can figure out how to improve enrollments of women into engineering-specific careers. This paper presents possible solutions for revamping the recruitment, retention, of female students in untraditional engineering careers.

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**From Step-Response to State-Space Controller-Observer Design in Twenty Minutes: A Hands-On Workshop on the Use of Matlab/Simulink to Control a Low-Cost Aerodynamic Pendulum**

**Eniko T. Enikov, Jesus Acosta Iriqui**
**Aerospace and Mechanical Engineering Department**
**University of Arizona**

**Abstract**

This workshop will present broad range of control systems design topics illustrated through the use of a low-cost aeropendulum. The project is based on a USB-powered kit operated by Matlab Simulink environment in real-time. Participants will follow the activities offered to senior-level undergraduate students from mechanical and aerospace engineering majors at the University of Arizona. The project illustrates the entire control systems design cycle from system identification, through analysis and design of dynamic compensators in classical (transfer function based) and modern (state space based) control theory. Advanced topics such as system identification tool box of Matlab, design and testing of an observer/controller pair is also illustrated in an intuitive way suitable for undergraduate students. A summary of the main learning gains is also presented.

The workshop will conclude with a question and answer session as well as individualized experimentation with the portable hardware.

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**Project-Based Innovation and Entrepreneurship Education in Engineering**

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**Abstract**

The project based innovation and entrepreneurship education activities developed and implemented at Mercer University School of Engineering (MUSE) are highlighted and how MUSE promotes entrepreneurial mindset among engineering students is presented and discussed in term of curriculum development, extracurricular activities, recruiting and involving students and faculty, assessment of entrepreneurship courses, implementation issues, and the lessons learned. The course sequence developed and implemented integrates elements of entrepreneurship with engineering; develops an entrepreneurial mindset in engineering students; fosters innovation and creativity in engineering disciplines; helps the students to develop business plans for the entrepreneurial design projects and compete in the annual business plan competition, and promotes new ventures creation. The program outcome is measured based on the number of students impacted, faculty involvement, number of students' participation in conferences, number of patents applied, number of commercial products developed, number of companies formed, and the feedback from graduating students. The expansion of this program will support educational interdisciplinary curricula and co-curricular activities directly benefiting students and provide multi- and cross-disciplinary teaching, learning, and research opportunities on innovation and entrepreneurship to faculty and students. Selected creative student design projects with business plans involving CAD/CAM, Robotics, and Rapid Prototyping are presented, analyzed, and discussed. The students learning outcomes and their professional competencies are assessed using appropriate assessment tools and the results are presented and discussed.

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**Can Students Build Production-Quality Software?**

**Gene Fisher**
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**Abstract**

The question posed in the title of this paper has been asked in many forms. There have been thoughtful scholarly publications on the subject, and less than scholarly opinion pieces. This paper asks the question in the context of a year-long capstone course in software engineering, taught at Cal Poly University San Luis Obispo. Specifically, if product development is the overriding goal for such a course, can a team of senior-level software engineering students deliver and deploy a genuinely production-quality software product? Unfortunately, the answer to this question in our case was "No". There are a number of reasons for the negative result, all of which will be carefully examined in the paper. The examination will begin with a working definition of "production quality". It will then describe the challenges in building this level of software, particularly for a team comprised of university students. The paper will also consider if it is reasonable to have product development as the primary focus of a university course, or if doing so sacrifices other important pedagogical goals.

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**Interactive Web Activities for Online STEM Learning Materials**

**Alex Edgcomb and Frank Vahid**
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**University of California, Riverside**

**Abstract**

We are developing a repository of parameterized interactive web activities to aid in learning STEM (Science, Technology, Engineering, and Math) concepts. Much web-based material today, including online textbooks, online tutorials, and MOOCs (massive open online courses), include quiz-like activities to support interaction with the user. Varied customizable interactive activities, such as drag-and-drop definition matching, or shooting or navigation games driven by quiz-like questions, are provided for free on various sites or for a fee by commercial firms. Quiz-like activities merely scratch the surface of the power of web-based learning. We have found that learning STEM concepts requires more-specific activities that allow for exploration and tinkering-with a concept to support bottom-up learning, such as a tool that allows tinkering with a binary-to-decimal converter or an equation plotter. Such tools can be developed for HTML5 via custom Javascript and CSS programs. Our goal is to create a repository of parameterized customizable activities that authors can use without requiring Javascript/CSS expertise. We have developed several activities, all in HTML5, originally for introductory programming concepts. We show how those activities can be generalized and thus be made applicable to a wider variety of STEM topics, such as math, physics, or chemistry. Our goal is to create a repository of approximately 100 STEM-focused activities that web-based material authors can instantiate to create powerful web-based learning materials.

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**Using Arduino Microcontroller Based Robot Projects to Teach Mechatronics in a Hands-On Mechanical Engineering Curriculum**

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**Dr. Kevin R. Anderson, P.E.**
**California State Polytechnic University at Pomona**
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**Mechatronics and Robotics Laboratory**
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**Abstract**

The use of ARDUINO microprocessors allows for a very top level approach to teaching Mechatronics. The focus on this paper is to motivate the use of ARDUINO microcontrollers to teach Mechatronics and Control Systems in Engineering Education. This is not a research paper per say, rather it is a detailed explanation of an example of "hands-on" pedagogy. The goal of this paper is to merely share the outcomes of an experiential learning environment with the academic community. This paper will present the results of using ARDUINO microcontroller based projects to teach a senior level Mechanical Engineering Mechatronics/Robotics course. The use of "hands-on" learning is documented in this paper via the teaching of Mechatronics through the capacity of having students design/fabricate/
engineer/program robot to navigate a maze autonomously. Use of Mechatronics, i.e. a synergy of control systems, data acquisition and sensors, kinematics of machinery, and programming is detailed in this paper using student projects as the learning/instructional vehicle. Rubrics for assessment of such a "hands-on" course will also be shared in this paper.

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**Computer Aided Teaching and Learning in an Undergraduate Electromagnetics Class**

**Milica Marković**
California State University Sacramento

**Abstract**

In this paper integration of commercial CAD programs in an introductory, undergraduate electromagnetics course at California State University Sacramento is presented. Matlab, Agilent's Advanced Design System (ADS) and Momentum are integrated in various activities throughout the semester. Students write Matlab code to visualize electromagnetic fields and waves and use Agilent ADS and Momentum to master transmission lines and design a microstrip patch antenna. The course requires students to integrate knowledge of advanced vector calculus, electromagnetic theory and computer programming to visualize fields and waves and to relate electromagnetics applications to engineering design. The intent of the class is to improve students cognitive and affective domains, by enabling them to use industry tools to experiment and develop their own understanding of concepts taught in an active learning environment.

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**Teaching Introductory Programming Concepts: A Comparison of Scratch and Arduino**

**Anne Beug, Phillip L. Nico**
**Department of Computer Science,**
**California Polytechnic State University, San Luis Obispo**

**Abstract**

In this paper we present our experiences developing and delivering two separate introductory computer programming units for high school students—one based on the Scratch visual programming environment and the other based on the Arduino embedded system prototyping platform. Scratch is a well-proven educational software development platform that teaches core programming concepts through a graphical programming interface, aimed at junior high and high school-aged students. The Arduino platform consists of both hardware and software: an open source microcontroller system programmed in a C-like language. We developed parallel curricula in Scratch and Arduino and compared the two in the setting of five high school classrooms. Each course consisted of five sessions (with a lecture and a lab), each covering a different topic, building on previous sessions. While the results of our quantitative study have not been conclusive, our experience suggests that the Arduino platform is not yet ready for teaching core programming concepts to computing novices. The combination of the C-like language and the hardware were too complex for novice programmers to use in learning programming concepts.

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**Professional Development of University Engineering Faculty through a Math-Science Partnership**

**Kurt McMullin, Thalia Anagnos, Jan Hustler and Nancy Thomas,**
**San Jose Staté University / Partnership for Student Success in Science**

**Abstract**

A six-year partnership of nine school districts, the engineering and education colleges of a local university, and two industry partners was formed in the San José region to provide professional development for K-8 science teachers and university engineering faculty members. Professional development for the K-8 teachers was delivered via Summer Institutes, academic year workshops, and development of site-based study groups.

This professional development work was led by trained K-8 professional developers in partnership with engineering faculty from the Institution of Higher Education partner. While working with the K-8 teachers, engineering faculty members also enhanced their pedagogical methods. Positive changes in teaching of engineering courses by the university faculty members were observed, including increased student-led inquiry, use of pre-assessment techniques, student-learning assessment, enhanced student probing, development of a university study-group to explore teaching of experimental design, and development of pedagogical content knowledge for basic engineering courses. Findings include identifying key elements of successful professional development programs, examples of the enhanced teaching practices of engineering faculty, development of a standard evaluation rubric for experimental design skills, development of educational standards for courses, and the development of preliminary concepts of pedagogical content knowledge related to engineering mechanics courses.

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**USING MODELS TO TEACH AND LEARN ENGINEERING**

**Slobodan Urdarevik**
**Western Michigan University**

**Abstract**

One of the biggest problems engineering students are facing is visualization. Without the ability to visualize engineering problems, students quickly find comprehending engineering topics to be very difficult. In order to help students to develop this skill and make teaching and learning more productive and interesting, I have developed a new teaching strategy based on using models. Experience in using models shows that:

1. Students are able to learn the topic in the most effective way.
2. Students are fully engaged in the learning process.
3. Students can gain the knowledge and obtain the skills developed in this "hands on" approach in learning that affects students' ability to absorb knowledge in subsequent courses where good visualization skills are required.
4. Using the models make students feel that engineering is an interesting field to study.

The benefits for teachers are:
1. Very little (or no) preparation time.
2. Less lecture time.
3. Easy to explain the topic.
4. Test results are much superior to those achieved by teaching from a textbook.