ASEE SOUTHEASTERN SECTION ANNUAL CONFERENCE

APRIL 1-3, 2007

"Advancing Scholarship in Engineering Education: Lessons Learned From a Year of Dialogue"

J.B. SPEED SCHOOL OF ENGINEERING
UNIVERSITY OF LOUISVILLE
LOUISVILLE, KENTUCKY

Proceedings Editor:	Barbara Bernal Thomas Southern Polytechnic State University
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Conference Program Chairs:	J.P. Mohsen & Michael Day University of Louisville

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UNIVERSITY of LOUISVILLE
dare to be great

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March 7, 2007

Dear Engineering and Engineering Technology Colleagues:

As host Dean for the 2007 annual meeting of the Southeast Section of ASEE, I am pleased to welcome you to Metro Louisville and the University of Louisville. This meeting is the second time in the past twenty years (last meeting in Louisville was in 1988) that our institution has hosted this regional meeting. I know that those of you who attended the last time around will be pleased to see the continuing progress of our university as we prepare engineering graduates for the future.

The theme of the conference, "Advancing Scholarship in Engineering Education: Lessons Learned from a Year of Dialog," continues the year long dialog that is taking place in various ASEE constituent groups nationwide. It is anticipated that this conference will address some of the significant engineering education scholarship issues which face our profession currently. Of course, the highlights of the meeting will be a presentation by our ASEE national President-Elect , Dr. Jim Melsa, Dean Emeritus, Iowa State University, and the keynote address by Dr. Jerry Jakubowski, President of Rose-Hulman Institute of Technology and Chair, Engineering Accreditation Commission of ABET, Inc.

I am proud of the participation and leadership of our faculty in ASEE and in their respective professional societies. I am equally proud of our engineering facilities at the University of Louisville, and I invite you to visit our campus during your visit to Louisville. I look forward to participating with you at the conference.

The conference committee and the representatives of the University stand ready to assist in any way that will make the conference more meaningful for you. I know that you will benefit from attending, as well as, enjoying the opportunity to meet both new and old friends.

Sincerely,

MR Wilhelm

Mickey R. Wilhelm, Dean
J. B. Speed School of Engineering

American Society for Engineering Education

Shelton Houston, President
Southeastern Section

Instruction ♦ Administration ♦ Research

Welcome to the 2007 ASEE Southeastern Section Meeting. This year's conference theme is centered on *Advancing Scholarship in Engineering Education: Lessons Learned From a Year of Dialogue*. The Keynote address by Gerald Jakubowski, ABET-EAC Chair, will set the tone for the conference. Workshops in Fostering Student Engagement in Technical Courses Using Tablet PCs and DyKnowSoftware and High Performance Learning Environment (Hi-PeLE) as well as a campus tour of theBelknap Research Center Clean Room will be of interest to everyone.

I want to express my thanks to the Site Committee at the University of Louisville for hosting this meeting. I especially want to welcome members from the Illinois/Indiana and North Central sections who are joining us this year. I also want to welcome our students who may be considering a future in engineering education.

I also want to thank all of the officers who have worked on the technical program, participated in the peer-review of manuscripts, coordinated workshops, organized the student poster session, prepared theconference CD-ROM, or will moderate a technical session. Without your efforts, this conference wo uldnot be possible. This meeting will offer something useful for anyone interested in engineering education.

Enjoy the conference and your time in Louisville. I look forward to meeting everyone as we come together to discuss current issues in engineering education.

Shelton Houston, Ph.D.
University of Southern Mississippi
ASEE SE President

Acknowledgements…

As conference site co-chairs we would like to thank everyone that had a hand in the organization and preparation for the 2007 ASEE Southeastern Section Conference. A special thanks to:

- the 141 registered conference attendees from 46 universities
- the 9 registered attendees from our fellow sections in Zone II: the Illinois-Indiana and North Central sections
- our workshop presenters: Dave Berque (DyKnow); Sharon Sauer, Adrienne Minerick, & Pedro Arce (Hi-PeLE); Kevin Walsh (UL tour)
- the 17 student teams in the poster competition
- the 110 presenters in the technical sessions
- Jerry Jakubowski (keynote speaker) and Jim Melsa (awards banquet address)
- Dean Mickey Wilhelm for his welcome address and financial support of Speed School faculty attendees
- our entertainment, comedian Rik Roberts, for being so accommodating
- Kathleen Doorman, Pam Hoeppner and Tara Thomas at the Brown Hotel
- Shelton Houston and the members of the Executive Board for their guidance in the planning
- UT-Chattanooga and the University of Alabama for allowing us to build upon their successes during our 2 years of planning and preparation (and best wishes to the University of Memphis for next year)
- Barbara Thomas for her work as Proceedings Editor
- Keith Plemmons for his work as Technical Chair
- Bob Mathews for organizing the Taste the Spirits of Kentucky reception and the sponsoring distilleries: Barton Brands, Brown Forman, Four Roses, Heaven Hill, and Maker's Mark
- John Jones, Ron Lile, Bernie Miles, and Randall Storey for their technical support at the conference
- Gale Crowe for her expertise and assistance in the hotel and conference arrangements
- Jackie Fryer for her help with site registration and assistance during the conference
- Kelly Fleenor for web development and online registration
- Meg Gladstone & Mike Harris for conference planning and preparations

If you need any help during the conference, go to the second floor hallway in the Crystal Ballroom foyer (conference registration desk) – Meg, Mike, Kelly, or Jackie should be around to answer your questions or provide assistance. Enjoy the conference and your time h ere in Louisville.

J. P. Mohsen
Conference Co-Chair

Mike Day
Conference Co-Chair

ASEE SE 2007 Conference Overview

Sunday, April 1, 2007

11:00am – 7:00pm	Conference Registration	Ballroom Foyer
1:00pm – 3:00pm	Workshop #1: DyKnow	Broadway A
1:00pm – 5:00pm	Workshop #3: Hi-PeLE	Broadway C
3:00pm – 5:00pm	Campus Tour	University of Louisville
3:00pm – 5:00pm	Executive Board Meeting	The Gallery Board Room
6:00pm – 8:00pm	Welcome Reception	The Jefferson Club, PNC Plaza

Monday, April 2, 2007

7:30am – 8:30am	Conference Registration	Ballroom Foyer
7:30am – 8:30am	Breakfast & Unit Meetings	The Gallery
8:45am – 10:00am	Welcome & Keynote Address	Crystal Ballroom
10:00am – 10:30am	Morning Break	South Alcove
10:00am – 12:00pm	Student Poster Session	Crystal Ballroom
10:30am – 12:00pm	Technical Session 1	Broadway, Louis XVI
12:00pm – 1:30pm	Lunch and Presentation	The Gallery
1:45pm – 3:15pm	Technical Session 2	Broadway, Louis XVI
3:15pm – 3:45pm	Afternoon Break	South Alcove
3:45pm – 5:30pm	Technical Session 3	Broadway, Louis XVI
3:45pm – 5:30pm	Campus Reps Meeting	J G Brown
6:00pm – 9:00pm	Reception and Award Banquet	Crystal Ballroom

Tuesday, April 3, 2007

7:30am – 8:30am	Breakfast & Division Meetings	The Gallery
8:45am – 10:15am	Technical Session 4	Broadway, Louis XVI, J G Brown
10:15am – 10:30am	Break	South Alcove
10:30am – 12:00pm	Technical Session 5	Broadway, Louis XVI, J G Brown
12:00pm – 1:30pm	Lunch & Business Meeting	The Gallery
1:30pm	Conference Adjourn	

Note: Map of Brown Hotel meeting rooms on page 1.9

ASEE SE 2007 Annual Conference Schedule

Sunday, April 1, 2007

<table>
<tr><td>11:00 – 7:00 pm</td><td colspan="3">Conference Registration
Brown Hotel, Ballroom Foyer (3rd Floor)
(Hotel Map on Page 1.9)</td></tr>
<tr><td rowspan="2">1:00 – 3:00 pm</td><td>Workshop #1
Broadway A
(3rd Floor)</td><td>Workshop #3
Broadway C
(3rd Floor)</td><td rowspan="2"></td></tr>
<tr><td>Fostering Student Engagement in Technical Courses Using Tablet PCs and DyKnow Software</td><td rowspan="2">High Performance Learning Environment (Hi-PeLE)</td></tr>
<tr><td rowspan="2">3:00 – 5:00 pm</td><td>Workshop #4
University of Louisville</td><td rowspan="2">Executive Board Meeting
The Gallery Board Room
(16th Floor)</td></tr>
<tr><td>Campus Tour :
Board van at 3:00 outside
1st floor hotel entrance</td></tr>
<tr><td>6:00 – 8:00 pm</td><td colspan="3">Welcome Reception
“Taste the Spirit of Kentucky” Bourbon Tasting
Jefferson Club, PNC Plaza 29th Floor
550 W. Jefferson Street
(Directions & Map on Page 1.10)</td></tr>
</table>

Note: Workshop #2 Canceled

ASEE SE 2007 Annual Conference Schedule

Monday, April 2, 2007

7:30 – 8:30 am	**Breakfast and Unit Meetings** **Brown Hotel, The Gallery (16th Floor)**				
8:45 – 10:00 am	**Moderator: Shelton Houston, President ASEE SE Section** **Welcome: Mickey Wilhelm, Dean, University of Louisville** **Keynote Address: Jerry Jakubowski, President, Rose-Hulman & ABET-EAC Chair** **Crystal Ballroom (3rd Floor)**				
10:00 – 10:30 am	**Morning Break** **South Alcove**				
10:30 – 12:00 am **Technical Session 1**	**T1-A** **Broadway A**	**T1-B** **Broadway B**	**T1-C** **Broadway C**	**T1-D** **Louis XVI**	**Crystal Ballroom**
	Instructional Division # 1 Distance Education and Online Instruction	**Mechanical Engineering # 1** Innovations in the Mechanical Engineering Classroom	**Professional Skills # 1** Insights into Professional Issues	**Administrative Division # 1** Changing Times for Administrators and Faculty	**Student Poster Session** **Closed Session Set up and Judging**
12:00 – 1:30 pm	**Conference Luncheon: Thomas Evans Outstanding Instructional Paper** **The Gallery (16th Floor)**				
1:45 – 3:30 pm **Technical Session 2**	**T2-A** **Broadway A**	**T2-B** **Broadway B**	**T2-C** **Broadway C**	**T2-D** **Louis XVI**	**Crystal Ballroom**
	Instructional Division # 2 Innovations in Pedagogy and STEM Education	**Civil Engineering # 1** Integrating and Assessing Learning Opportunities	**Administrative Division # 2** Assessment and ABET: Yesterday, Today, and Tomorrow	**Computer Engr & Technology #1** Learning for Tomorrow in Today's Classroom	**Student Poster Session** **Open Session to the Public**
3:30 – 3:45 pm	**Afternoon Break** **South Alcove**				
3:45 – 5:30 pm **Technical Session 3**	**T3-A** **Broadway A**	**T3-B** **Broadway B**	**T3-C** **Broadway C**	**T3-D** **Louis XVI**	**J Graham Brown**
	Instructional Division # 3 Innovations in Today's Classroom	**Mechanical Engineering # 2** First the Question, then the Learning	**Administrative Division # 3** Opportunities for Global, Regional, and Local Engagement	**Research** What are all the students doing?	**Campus Reps Meeting**
6:00 – 9:00 pm	**Reception (6:00) and Awards Banquet (6:30)** **Jim Melsa, Dean Emeritus, Iowa State & ASEE President-Elect** **Crystal Ballroom (3rd Floor)**				

ASEE SE 2007 Annual Conference Schedule

TUESDAY, April 3, 2007

7:30 – 8:30 am	**Breakfast and Division Meetings** **The Gallery (16th Floor)**				
8:45 – 10:00 am **Technical Session 4**	**T4-A** **Broadway A** **Instructional Division # 4** Applications of Technology and Pedagogy	**T4-B** **Broadway B** **Civil Engineering # 2** Improving our Courses Through Technology	**T4-C** **Broadway C** **Chemical Engr & Administr.** Innovative Classroom Practice	**T4-D** **Louis XVI** **Software Engineering** Using Software in Today's Classroom	**T4-E** **J Graham Brown** **Computer Engr & Technology #2** Creating Powerful Learning Experiences
10:00 – 10:15 am	**Morning Break** **South Alcove**				
10:15 – 12:00 pm **Technical Session 5**	**T5-A** **Broadway A** **Instructional Division # 5** Multidisciplinary Education Methods	**T5-B** **Broadway B** **Computer Engr & Technology #3** Technology Inside and Outside the Classroom	**T5-C** **Broadway C** **Professional Skills # 2** Teaching Ethics & Communications in Multidisciplinary Learning Environments	**T5-D** **Louis XVI** **Electrical Engr & Engr Tech** Mentoring and New Tools in Pedagogy	**T5-E** **J Graham Brown** **TBD**
12:00 – 1:30 pm	**Section Annual Business Luncheon** **The Gallery (16th Floor)**				
1:30 pm	**Conference Adjourn**				

Conference Parking and Transportation

The 2007 ASEE-SE Conference is being held at the Brown Hotel in downtown Louisville, Kentucky. The Sunday night reception will be held at the Jefferson Club in the PNC Plaza.

Parking at the Brown Hotel

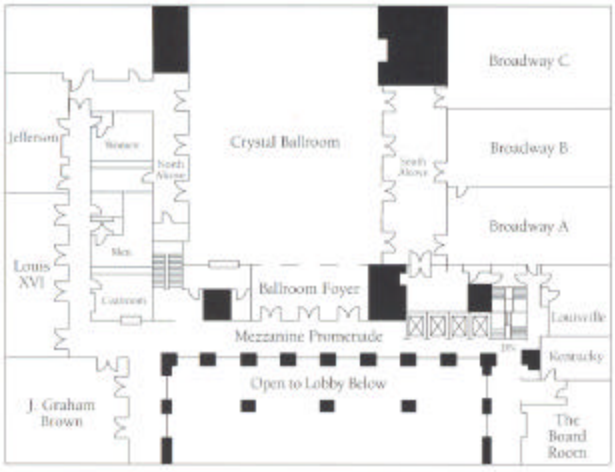
Self-parking in the Brown Hotel Garage is located just behind the hotel on 4th Street and is $6 per day. Valet parking is $18. Self-parking is at a reduced rate for the conference attendees. Please make sure your hotel bill reflects that rate.

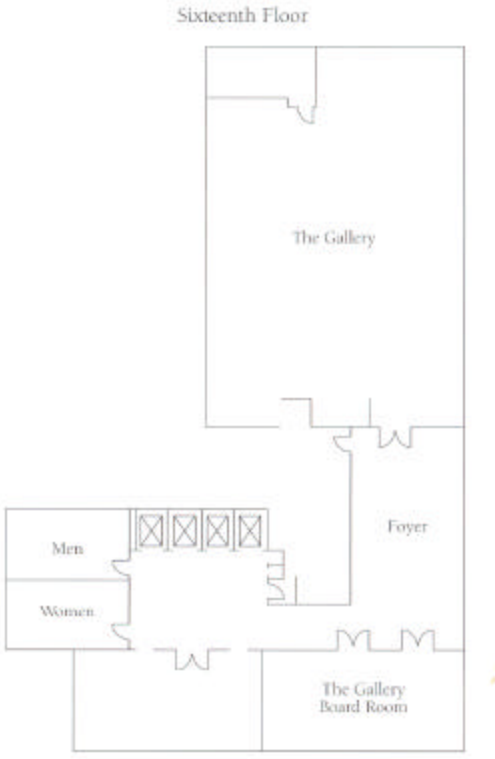
Transportation to U of L Campus for Sunday Tour

Transportation will be provided from the Brown Hotel to the University of Louisville for the Sunday afternoon tour from 3:00 – 5:00. Please meet at 3:00 outside the first floor hotel entrance.

Map of Brown Hotel Meeting Rooms

All meetings will take place on the 3rd floor of the Brown Hotel with the exception of breakfast and lunch, which will be on the 16th floor. (The Sunday night reception is being held elsewhere – see next page.)





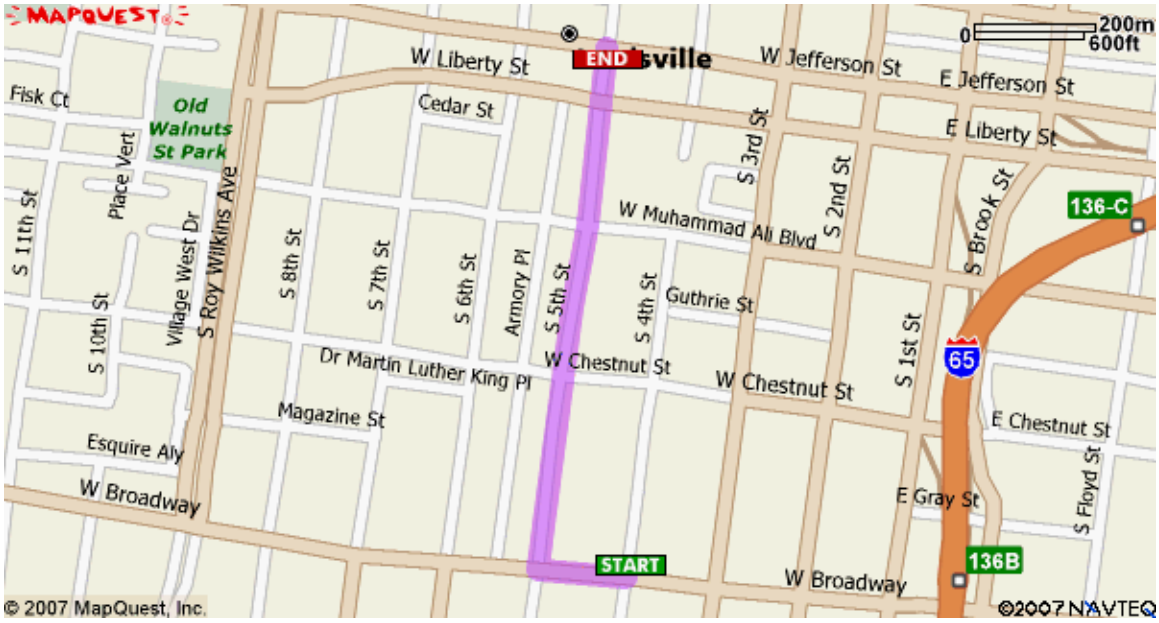
Map to Sunday Night Reception – Jefferson Club

The Sunday night reception (6:00 – 8:00 pm) will be held at the Jefferson Club, which is on the 29th floor of the PNC Plaza. This is located about 5 blocks away from the Brown Hotel.

Walking directions:
If the weather permits, we suggest you consider walking to the Jefferson Club – it's a nice 10-minute walk down 4th Street through "4th Street Live". Take a left on Liberty and then a right on 5th Street. PNC Plaza is on 5th between Liberty and Jefferson.

Van Pickup:
If the weather isn't cooperating or you do not feel like walking the 5 blocks, we'll shuttle people to the reception starting at 6:00 and we'll start returning around 8:00.

Driving directions:
Please, don't drink and drive! But if you wish to drive, take a right out of the Brown Hotel parking garage onto 3rd Street. Take an immediate right onto Broadway. Take a right onto 5th Street. The Jefferson Club is located in the PNC Plaza on 5th Street, between Liberty and Jefferson. Parking is available on the right, directly across from the PNC Plaza.



Conference Meals and Receptions

Welcome Reception : Sunday, April 1st 6:00pm – 8:00pm

The Jefferson Club, PNC Plaza

"Taste the Spirit of Kentucky" and sample Bourbon from five fine distilleries:

- Brown Forman Corporation
- Four Roses Distillery, LLC
- Heaven Hill Distilleries, INC
- Maker's Mark Distillery, INC
- Barton Brands, LTD

Unit Meetings Breakfast: Monday, April 2nd (7:30am – 8:30am)

The Gallery

A full breakfast buffet will be served starting at 7:30. Join the conference attendees for the Unit meetings breakfast. Sit down at one of the table clusters and meet colleagues with interests in the following ASEE-SE areas:

- Programs
- Publications and Promotions
- Awards and Recognition

There are many ways to be involved and contribute to ASEE SE!

Thomas Evans Award Luncheon: Monday, April 2nd (12:00 – 1:30pm)

The Gallery

The Thomas Evans Outstanding Instructional Paper will be presented at Monday's lunch.

Awards Banquet: Monday, April 2nd (6:00 – 9:00pm)

Crystal Ballroom

Come celebrate engineering education and the role of the ASEE-SE and its members. Many people will be congratulated on their outstanding contributions to the field of engineering education. Entertainment will be provided by comedian, Rik Roberts.

Division Meetings Breakfast: Tuesday, April 3rd (7:30 – 8:30am)

The Gallery

Grab your breakfast from the wonderful buffet and join the conference attendees for the Division meetings:

- Administrative
- Bioengineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering & Technology
- Electrical Engineering
- Engineering Design Graphics
- Engineering Technology
- Industrial Engineering
- Instructional
- Mechanical Engineering
- Professional Skills
- Research
- Software Engineering

Section Business Meeting Lunch: Tuesday, April 3rd (12:00 – 1:30pm)

The Gallery

Please come to the ASEE SE Business meeting to meet your present Section Officers and vote for your Section Officers for the upcoming year. We will also recap the events of the conference and officially announce the location for the 2008 Conference.

Conference Workshops

Workshop 1: Sunday, April 1, 1:00 – 3:00 PM

Fostering Student Engagement in Technical Courses Using Tablet PCs and DyKnow Software

Dave Berque
Professor & Chair of Computer Science at DePauw University, Consultant to DyKnow

DyKnow software is used to foster student engagement in classrooms at the K-12, college, and university levels (including the University of Louisville's J. B. Speed School of Engineering). The software supports collaborative note-taking; interactive activities such as sharing student solutions for in-class problems; out of class note review and replay; and computer monitoring. Although the system can be used in varied hardware environments, it is optimized for use with Tablet PCs and other pen-based systems. Tablet PCs will be provided to participants for use during this session. After a brief hands-on introduction to the Tablet PC the session will demonstrate the pedagogies associated with the use of DyKnow software and Tablet PCs by walking participants through real classroom examples. Additional pen-based hardware devices (including inexpensive $100 graphics tablets) will also be demonstrated with an eye toward considering how such devices can be used to support teaching and learning technical content.

Workshop 2: Sunday, April 1, 3:00 – 5:00 PM (Canceled)

Engineering Design Using K'Nex

Paul Palazolo, Stephanie Ivey, Charles Camp
Department of Civil Engineering, University of Memphis

At the University of Memphis, we have used K' NEX as a manipulative in a number of courses in civil engineering and in a number of outreach programs for middle and high school students. The ease of which they can be manipulated and the varieties of forms that can be developed have allowed a broad latitude of design principles to be illustrated. In this workshop, the participants will see examples of the way in which K' NEX have been used and will participate in different design competitions using the K' NEX as manipulatives. The format will be open and will allow for the sharing of ideas of how to use both K' NEX and other readily available "toys" in the support of teaching engineering design concepts. Participants should come ready to build and participate in active competitions with other participants.

Workshop 3: Sunday, April 1, 1:00 – 5:00 PM

High Performance Learning Environment (Hi-PeLE)
Sharon Sauer, Rose-Hulman Institute of Technology
Adrienne Minerick, Mississippi State University
Pedro E. Arce, Tennessee Tech University

This workshop focuses on design, implementation and assessment of learning environments of high retention and high student performance that enhance student learning within an active/collaborative approach. The methodology brings discovery and fun to the classroom and enhances hands-on and independent learning approaches in students. During the workshop, the basic ideas of Hi-PeLE will be introduced and illustrated as well as key aspects in the design, implementation and assessment with examples drawn from the conductor's experiences. Attendees will be encouraged to design their own Hi-PeLE and a critique will be offered for those that they like to have immediate input. This strategy has been highly successful in allowing instructors to modify their own instructional methodologies and quickly incorporate new aspects without significant activation energy.

Workshop 4: Sunday, April 1, 3:00 – 5:00 PM

Campus Tour
Michael Harris, Kevin Walsh

Get a ride to campus through the shuttle. Meet the shuttle outside the Brown Hotel 1st floor entrance. The trip from the Brown Hotel to the campus of the University of Louisville will include a view of Old Louisville, Papa John's Stadium, and Churchill Downs.

A riding tour of the campus will include a stop at the new Belknap Research Building. The 120,000 square foot research building combines complementary and coordinated interdisciplinary micro/nano/bio research efforts from both the School of Engineering and the College of Arts and Science. The showcase facility in the Belknap Research Building is the central 10,000 sq. ft. core cleanroom located on the 1st floor. A micromanufacturing facility houses a cadre of state-of-the-art processing equipment for prototyping next-generation micro- and nanodevices for applications such as microelectronics, homeland security, optoelectronics, biotechnology, sensing, MEMS and nanotechnology.

Keynote Speaker

JERRY JAKUBOWSKI
President, Rose-Hulman Institute of Technology
ABET-EAC Chair

Jakubowski came to Rose-Hulman from Arizona State University where he served as vice president and provost at the ASU Polytechnic campus. While there he was responsible for leading the transition of the former Arizona State University East campus in Mesa into a premier polytechnic institution. Among the 30 programs offered to the 5,000 students on the campus are bachelor's degrees in science and engineering along with master's degrees in computing studies and technology.

Prior to his appointment at Arizona State, he served 14 years as Dean of the College of Science and Engineering and professor of mechanical engineering at Loyola Marymount University (LMU), a private institution in Los Angeles, Calif. During his tenure at LMU, the academic quality and diversity of incoming freshmen increased. He was involved in university-wide, major capital fundraising campaigns that raised $19 million for a new science and engineering building, created funding for significant renovations to other facilities in the college and raised support to create endowed faculty chairs. Before becoming dean at Loyola Marymount, Jakubowski was interim dean of engineering, associate dean of engineering and professor of engineering in the Herff College of Engineering at Memphis State University. Prior to that position, he was assistant dean of engineering and associate professor of mechanical engineering at the University of Toledo. He also served as a faculty member at the University of South Alabama.

A native of Toledo, Ohio, Jakubowski earned the Ph.D. in engineering science and the master's and bachelor's degrees in mechanical engineering from the University of Toledo. His areas of engineering expertise include thermodynamics, fluid mechanics, heat transfer and energy. He is a registered professional engineer. Jakubowski has been involved in engineering education developments on a national basis. He currently is chair of policy for the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. ABET is the recognized accrediting agency for college and university programs in applied science, computing, engineering and technology in the United States.

In 2001, he served as national president of the American Society for Engineering Education after serving as vice president and a member of its Board of Directors. The organization consists of 12,000 members committed to developing policies and programs that enhance opportunities for faculty. It also strives to increase student interest in pursuing a degree in engineering. He has served in many leadership positions in the American Society of Mechanical Engineers and the Society of Automotive Engineers. Jakubowski has received numerous honors. He was elected as a Fellow in the Institute for the Advancement of Engineering, the American Society for Engineering Education, and the American Society of Mechanical Engineers in 1994, 1999 and 2001 respectively. He received the Excellence in Engineering Education Award from the Society of Automotive Engineers in 1998. He has served twice as a NASA Faculty Fellow, and received honors for his teaching from the Society of Automotive Engineers and the University of Toledo.

Banquet Address

JAMES L. MELSA
Dean Emeritus, College of Engineering
Iowa State University
ASEE President Elect

A distinguished scholar, an award-winning educator, and a visionary corporate leader, Dr. James L. Melsa has served as dean of the Iowa State University College of Engineering from 1995 to 2004. Previously, he spent 11 years at Tellabs Inc., Lisle, Ill., including appointments as vice president of strategic planning and advanced technology, vice president of research and development, and vice president of strategic quality and process management.

Melsa also was on the faculty at the University of Notre Dame for 11 years, serving as professor and chair of the electrical engineering department. He also has worked as a faculty member at Southern Methodist University, Dallas, and the University of Arizona, Tucson. During his years as an academic, Melsa conducted significant research on control and estimation theory, speech encoding, and digital signal processing; directed 20 masters theses and 16 Ph.D. dissertations; earned recognition as one of the nation's outstanding electrical engineering professors; and authored or co-authored 120 publications and 12 books.

He was named a fellow of the Institute of Electrical and Electronic Engineers in 1978 and received that group's Third Millennium Medal in 2000. He has previously served as President of the IEEE Control Systems Society and President of Eta Kappa Nu, the national electrical and computer engineering honorary. He was named a fellow of the American Society for Engineering Education in 2006 and is the 2006-2007 President-Elect of ASEE. He has an extensive record of service to national and international groups, including the Herbert Hoover Presidential Library Association, the Iowa Business Council, and the Malcolm Baldrige National Quality Award (past member of the Board of Examiners and the Board of Overseers).

Melsa received his B.S. degree in electrical engineering from Iowa State (1960) and his M.S. (1962), and Ph.D. (1965) degrees from the University of Arizona, Tucson.

ASEE Southeastern Section Officers

Members of Executive Board

President.....Shelton Houston
President-Elect.....Cecelia Wigal
Immediate Past President.....Laura Lackey
Vice-President (Programs Unit).....Michael Woo
Vice-President (Awards & Recognition Unit).....Joseph Owino
Vice-President (Publications & Promotions Unit).....Don Visco
Secretary/Treasurer.....Tulio Sulbaran

Other Officers

Newsletter Editor/Webmaster.....Ken Brannan
Proceedings Editor.....Barbara Bernal Thomas
Campus Representative Coordinator.....Thomas Dion

Unit and Division Officers

Unit	Chair	Vice-Chair	Secretary
Programs	Michael Woo	Keith Plemmons	Don Visco
Awards & Recognition	Joseph Owino	Claire McCullough	Alice Scales
Publications & Promotions	Don Visco	Brent Jenkins	Scott Schultz

Division	Chair	Vice-Chair	Secretary
Administrative	Ken Brannan	---	Richard Mines
Bioengineering	Mike Boyette	---	---
Chemical Engineering	Priscilla Hill	V. Subramanian	David Silverstein
Civil Engineering	Paul Palazolo	Shane Palmquist	John Murden
Computer Engr & Tech	Dan Kohn	Tyson Hall	Gary Johnsey
Electrical Engineering	Randy Buchanan	Salame Amr	Zhaoxian Zhou
Engr Design Graphics	Ted Branoff	Alice Scales	---
Engineering Technology	Peter Romine	Sandeep Ahuja	John Hannon
Industrial Engineering	Jessica Matson	Scott Schultz	---
Instructional	B. K. Hodge	Hodge Jenkins	Ted Branoff
Mechanical Engineering	Hodge Jenkins	Loren Sumner	M. Emplaincourt
Professional Skills	Peter Hoadley	Peter Romine	John Hannon
Research	Kevin Bower	Tim Mays	Sally Pardue
Software Engineering	M. Naghedolfeizi	Barbara Thomas	Juan C. Guzman

Technical Session Information

Session and Presentation Timing

Each technical session is scheduled for 4-6 presentations. The presentations will start in 18-minute increments. This allows a 1-minute introduction, 15-minute presentation, and a 2-minute question and answer period. If there is a no-show author in a session, a break will be called. **Papers will not be moved up or rearranged in sessions.** Therefore, we plan to keep the following schedule:

	Session 1	Session 2	Session 3	Session 4	Session 5
Presentation #1	10:30	1:45	3:45	8:45	10:15
Presentation #2	10:48	2:03	4:03	9:03	10:33
Presentation #3	11:06	2:21	4:21	9:21	10:51
Presentation #4	11:24	2:39	4:39	9:39	11:09
Presentation #5	11:42	2:57	4:57	---	11:27
Presentation #6	---	3:15	5:15	---	11:45

Technology Available to Presenters

Each presentation room is equipped with a projector, a tablet PC with USB port, and a wireless internet connection. Software common to each presentation room is the basic Microsoft Office package that includes Microsoft PowerPoint. Presenters may load a copy of their presentation on the tablets at registration. Broadway B will be available Sunday from 1:00-5:00 for presenters. If you must use your own laptop, let us know at registration and test it out with our projectors.

Instructions for Technical Session Moderator Chairs

Be prepared to moderate the session.

Arrive 10 minutes early to the room where the session you are moderating is being held. Meet the presenters as they enter the room and go over the pronunciation of their name. Make sure all presentations are loaded and ready to go before the session starts. Bring a watch.

Provide presentation guidelines at the beginning of the session.

Introduce yourself at the beginning of the session. Remind presenters of the time limitations (15 minutes for presentation, 2 minutes for questions) and that you will give a hand signal to warn that there are 5 minutes and then 2 minutes remaining.

Introduce each presenter or presenters prior to their presentation.

At the end of each presentation, the next speaker should come up and ready their slide show. Introduce the presenter when ready.

Maintain the presentation schedule.

One primary responsibility of the moderator is to ensure that the presenters begin and finish their presentations on time according to the technical program. Maintaining the presentation schedule within the session allocated time helps to have fair treatment for all presenters. In the event that a presenter, who is not last in the hour, is not present or has canceled, please wait to begin the next paper at the scheduled time, so that all who planned to attend the remaining paper(s) can. The moderator has the authority to stop a presentation that is about to run overtime. NEVER let a presentation and Q&A overrun the 17 minutes.

Student Poster Session Information

The Research Division is offering the 3rd annual Student Poster Competition, immediately after the Monday morning keynote address. The posters will be located in the Crystal Ballroom of the Brown Hotel. Students may set up their posters immediately following the keynote address with judging taking place shortly from 10:30-12:00. The poster exhibits will be open to the public from 1:45-3:30. Awards and certificates will be presented during the Monday evening awards banquet for the following categories:

- Freshman/Sophomore Engineering and/or Engineering Technology Design Teams
- Junior/Senior Engineering and/or Engineering Technology Design Teams
- Undergraduate Research

The Student Poster Competition gives undergraduate students the opportunity to (1) share their research/project work with students and faculty from other institutions and (2) practice their visual, written, and oral communication skills in a professional/conference environment. The goals of the competition are to (1) improve the visibility of student efforts, (2) recognize excellence in student projects, and (3) promote the sharing and exchange of ideas about team projects and undergraduate research among the members in the section.

Student Poster Competition Abstracts

The Southeastern Section of the American Society of Engineering Education (ASEE) has solicited extended abstracts from undergraduate students to present in a poster session at this year's conference.

Secttion 3 in this book contains the extended abstracts from this year's student participants. During a morning judging section, they will be evaluated on their abstract, poster, and communication skills. In the afternoon, the Research Division encourages all conference attendees to stop by and learn from students about the wonderful projects going on throughout the section.

Poster Specifications

Each poster shall be set on one 6-foot table. Posters shall be of standard presentation student presentation quality (typically made of corrugated cardboard), and shall stand on their own when opened. Participants may use tape, glue, or pushpins to make attachments to the poster. Special, professionally fabricated presentation displays will NOT be allowed. All supporting display material shall fit on the table with the poster in the space provided. Electrical power will not be supplied.

Monday, April 2, 2007 Technical Sessions

T1-A: Instructional Division #1 **Moderator: John Brocato**
10:30 - 12:00, Broadway A

Distance Education: Remote Labs Environment 2.1
Bassem Alhalabi, M. K. Hamza, Ali Abu-El Humos, Ashraf El-Houbi; Florida Atlantic, Lamar University, Jackson State University, Lamar University

Redefining "Distance" Education Increasing Diversity, Accessibility, and/or Classroom Participation in Engineering Courses on a Time, Financial, and Technology Shoestring 2.2
Tom Walker; Virginia Polytechnic Institute

Tools for Online Instruction 2.3
John W. Lipscomb; University of Southern Mississippi

What Effect? Studying Technological Changes (Specifically Distance Learning) in the Classroom 2.4
R. Craig Henderson, Jim Murchison; Tennessee Technological University, Columbia State Community College

Embracing the Middle Ground: Engaging On- and Off-campus Students within the Same "Classroom" 2.5
Leigh S. McCue, Glenda R. Scales; Virginia Tech

T1-B: Mechanical Engineering #1 **Moderator: Hodge Jenkins**
10:30 - 12:00, Broadway B

Capstan Speed Control in the Optical Fiber Drawing Process: A Case Study for Mechatronics 2.6
Hodge E. Jenkins; Mercer University

Using Mathcad to Enhance the Effectiveness of the Wind Energy Topic in an Alternate Energy Sources Course 2.7
B.K. Hodge; Mississippi State University

Using Design-Expert for Enhancing Engineering Experimentation Labs 2.8
Y. Charles Lu, William E. Murphy, and Vincent R. Capece; University of Kentucky

A TRIZ Tool for Engineering Education 2.9
Shih-Liang Wang; North Carolina A&T State University

A Structured Approach to Teaching Fluid Power Systems Using Spreadsheets 2.10
Aaron K. Ball, Robert Anderson, Chip W. Ferguson; Western Carolina University

T1-C: Professional Skills **Moderator: Don Visco**
10:30 - 12:00, Broadway C

Is the Postage Worth It? Lessons Learned from Grad Surveys 2.11
John H. Page; Virginia Military Institute

Advising the Advisor: Professional Development of Junior Faculty.....2.12
Dirk Schaefer; Georgia Institute of Technology-Savannah

Ethics Across Electrical and Computer Engineering Curriculum.....2.13
Roobik Gharabagi, Kyle Mitchell; Saint Louis University

Project Management Skills: A Study of Student's Prior Knowledge.....2.14
Meghan Gloyd, Marie C. Paretti, Christine Bala Burgoyne; Virginia Tech

Adult Learners and the Challenges Facing Educators.....2.15
Keith Plemmons; The Citadel***

T1-D: Administrative Division #1 **Moderator: Ken Brannan**
10:30 - 12:00, Louis XVI

A Model for Dual-Level Accreditation of Engineering Programs.....2.16
M.R. Wilhelm and J.P. Mohsen; University of Louisville

Increasing the Numbers of Science, Technology, Engineering and Math Students by Recruiting Students Into Graphic Communication System and Technology Studies.....2.17
Elinor Foster-Blackwell, Sonya Draper, Cynthia Gillispie-Johnson, and Alex Uzokwe; North Carolina Agricultural & Technical State University

Established Customs: Changing Roles in Departmental Culture and Impact on New Faculty.....2.18
Adrienne R. Minerick and Judy Schneider; Mississippi State University

A National Model for Engineering Mathematics Education 2.19
N. Klingbeil, R. Mercer, K. Rattan, M. Raymer, and D. Reynolds; Wright State University

The Development of Social Capital in Engineering Education to Improve Student Retention.....2.20
Shaundra Bryant Daily / Wanda Eugene / Anderson D. Prewitt; Massachusetts Institute of Technology / Auburn University / University of Florida

T2-A: Instructional Division #2 **Moderator: Mary Emplaincourt**
1:45 – 3:30, Broadway A

The First Year Engineering Program at the University of Southern Indiana.....2.21
Laura A. Ruhala, Richard J. Ruhala, Eric P. Sprouls; University of Southern Indiana

A Five-Year Engineering Program at the University of Southern Indiana.....2.22
Laura A. Ruhala, Richard J. Ruhala, Eric P. Sprouls; University of Southern Indiana

Engineering and Golf: A Professional Development Partnership between Mississippi State University's Center for Engineering Student Excellence and Professional Golf Management Program.....2.23
Tommy Stevenson, Alexis Power, Kelly Agee; Mississippi State University

Lessons Learned from a Single Gender Outreach Program.....2.24
Paul Palazolo, Stephanie Ivey; University of Memphis

An Initial Assessment of the Effectiveness of the Enhancing Assess and Fostering Science, Technology, Engineering and Math (STEM) NSF Summer Workshop Program.....2.25
Paul Lam, Julie Zhao, Dennis Doverspike, Jiang Zhe, Craig Menzemer; The University of Akron

Enhance "Book Learning" with Facebook.....2.26
Veronica Addison, Wally Peters; University of South Carolina

T2-B: Civil Engineering #1 **Moderator: Shane Palmquist**
1:45 – 3:30, Broadway B

Integrating Learning Outcomes Throughout the Civil Engineering Curriculum to Meet Site Engineering Prerequisite Needs.....2.27
Thomas R. Dion and Kevin C. Bower, The Citadel

Project-Based Learning: Developing Ductile Concrete.....2.28
Shane M. Palmquist, Western Kentucky University

An Analogy Tool to Visualize Bending-Moment Diagrams.....2.29
Gustavo O. Maldonado, Gustavo J. Molina; Georgia Southern University

Implementing a Problem Based Multidisciplinary Civil Engineering Design Capstone: Evolution, Assessment, and Lessons Learned with Industry Partners.....2.30
Scott A. Yost and Derek R. Lane; University of Kentucky

Adaptation of Groundwater Physical Models and Activities for Enhanced Student Learning.....2.31
Amy B. Chan-Hilton; Florida State University

Sequential Course Outcome Linkage: A New Look at the Structural Engineering Curriculum of a Civil Engineering Program.....2.32
Timothy W. Mays, Kevin C. Bower, and William J. Davis; The Citadel

T2-C: Administrative Division #2 **Moderator: Ed Hajduk**
1:45 – 3:30, Broadway C

Use of Indicator Courses in Program Outcomes Assessment 2.33
Timothy A. Wilson; Embry-Riddle Aeronautical University

ABET EC 2000: How Has it Changed? Has It Accomplished What Was Intended?.....2.34
Claire L. McCullough, University of Tennessee at Chattanooga

SACS, QEP, and Hindsight.....2.35
Shelton Houston; University of Southern Mississippi

The ABET Feedback Cycle Realized Through the Use of Cooperative Education in Curricular Reform 2.36
Bryan Dansberry, Kettil Cedercreutz, and Cheryl Cates ; University of Cincinnati ***

Incorporating Leadership into the Engineering Technology Classroom Through Cooperative Learning: Theories Used and Lessons Learned 2.37
William L. McDaniel, Chip W. Ferguson, and Aaron K. Ball; Western Carolina University

The Satellite Design Course AENG 468 at Tuskegee University as an Example to Implement ABET EC 2000.....2.38
A. K. Mazher; Tuskegee University

T2-D: Computer Engineering & Technology #1 **Moderator: Tyson Hall**
1:45 – 3:30, Louis XVI

On Line Assignment and Laboratory System for Digital Logic Timing Diagrams.....2.39
Daniel Kohn; North Carolina Agricultural and Technical State University

Answering the Calls to Improve Communication.....2.40
Nancy Bearden Howell; University of Southern Mississippi

Analysis of Student Performance in Programming Subjects of an In-house Exit Exam.....2.41
Masoud Naghedolfeizi, Singli Garcia-Otera, Nabil Yousif; Fort Valley State University

A Project Based Approach for Teaching System Analysis, Design, and Implementation Courses 2.42
Nabil A. Yousif, Masoud Naghedolfeizi; Fort Valley State University

Teaching Computer Architecture with FPGA Soft Processors.....2.43
Andrew Strelzoff; University of Southern Mississippi

Processor Performance Profiles for RFID Sensor Data Fusion.....2.44
Andrew Strelzoff; University of Southern Mississippi

T3-A: Instructional Division #3 **Moderator: Hodge Jenkins**
3:45 – 5:30, Broadway A

Enhancing the Teaching of the Fluid Mechanics Laboratory and Preparation for New and Continuing Teaching Assistants.....2.45
Rolando Bravo, Lizette R. Chevalier, Southern Illinois University

Investigations Concerning Pedagogical Strategies Promoting Engineering Students' Ability to Solve Open-ended Problems.....2.46
Christian Hipp, Veronica Addison; University of South Carolina

Technical Writing for Engineering Students: Using Tenets of the National Writing Project for Effective Writing Instruction.....2.47
Kelly Aggee; Mississippi State University

What Happened to This Course?.....2.48
Jerry Newman, Tom Banning; University of Memphis

The Impact of Engineering Design Projects on Student Understanding of Engineering's Societal Impact.....2.49
Cecelia Wigal; University of Tennessee at Chattanooga

An Innovative Student Engagement Project: Lessons Learned from a Log Cabin.....2.50
William L. McDaniel, George D. Ford; Western Carolina University

T3-B: Mechanical Engineering # 2 **Moderator: Aniruddha Mitra**
3:45 – 5:30, Broadway B

A Study on the Use of Knowledge Representation for Teaching Engineering Problem Solving.....2.51
Gustavo J. Molina; Georgia Southern University

Teaching Heat Transfer Concepts using Thermal Imaging Techniques.....2.52
Masoud Naghedolfeizi, Sanjeev Arora, Ugur Tanriver; Fort Valley State University ***

An Engineering Capstone Design Course Taught in a Collaborative University/High School Setting.....2.53
Mary Kasarda, Brenda Brand, and Eugene Brown; Virginia Tech

Animation Software for Vibrations Courses.....2.54
Glenn Kraige, Saurabh Bisht; Virginia Polytechnic Institute and State University

Introduction of Dynamics Laboratory in MET Program.....2.55
Aniruddha Mitra; Georgia Southern University

Evaluation of Bessel Functions Using a Computer Program.....2.56
P.S. Yeh; Jacksonville State University

T3-C: Administrative Division #3 **Moderator: Dennis Fallon**
3:45 – 5:30, Broadway C

Global Engineering Education Opportunities: A Survey of Selected ASEE SE Universities 2.57
Allen Greenwood, Mary C. Emplaincourt, and Tiffany Lampkin; Mississippi State University

International versus US Student Enrollment into Graduate Programs in Computer Science 2.58
Sravanthi Munagala, Sumanth Yenduri, Louise A. Perkins, and Franaz Zand; University of Southern Mississippi

Gateway into First-Year STEM Curricula: A Community College/University Collaboration Promoting Retention and Articulation 2.59
M. Wheatly, N. Klingbeil / B. Jang, G. Sehi, and R. Jones; Wright State University / Sinclair Community College ***

A Regression Model to Predict the Graduation Rates 2.60
Neslihan Alp and Ronald Bailey; University of Tennessee at Chattanooga ***

High School Engagement Activity: The Iron Egg Launch Design Competition 2.61
Jo Alice Pierce, Russell A. Aubrey, R.L. Alan Jordan. Dennis O. Owen, and David L. Riegle; Purdue University

University of Louisville Nanotechnology Fellows Symposium: Extending Engineering Excitement to High School Educators 2.62
Joseph H. Lake, Kevin Walsh, Bruce W. Alphenaar, Mark M. Crain, Robert S. Keynton, Robert W. Cohn, and Michael D. Martin; University of Louisville

T3-D: Research **Moderator: Sally Pardue**
3:45 – 5:30, Louis XVI

Graduate Student Mentors in REU Sites 2.63
Cesar D. Guerrero, Miguel A. Labrador, Rafael A. Perez; University of South Florida

Fostering Research in Aerospace and Mechanical Engineering Undergraduate Curricula 2.64
Viatcheslav Naoumov, Masood Parang; University of Tennessee

Assessing Outcomes in a Communication-Intensive Course 2.65
Nancy Bearden Howell; University of Southern Mississippi

Undergraduate Research: Challenges, Rewards and Lessons Learned 2.66
Robert J. Barsanti, The Citadel

Engineering and Computer Science in Robotic Development 2.67
Cameron Carper; Arkansas Technological University

Research in Nine Weeks – Can It Be Done? 2.68
S. Pardue, M. Abdelrahman; Tennessee Technological University ***

Tuesday, April 3, 2007 Technical Sessions

T4-A: Instructional Division #4 **Moderator: Ted Branoff**
8:45 - 10:00, Broadway A

Learning the Stiffness Method with FORTRAN, Excel and MathCAD.....2.69
Peter W. Hoadley; Virginia Military Institute

Using MathCAD Debugging Functions as a Teaching Tool.....2.70
Kenneth P. Brannan, John A. Murden, The Citadel

The Role of Computer Based Homework for Engineering Design Courses.....2.71
Steven M. Click; Tennessee Technological University

Engineering Economy: Getting Personal.....2.72
Scott R. Schultz; Mercer University

T4-B: Civil Engineering #2 **Moderator: Paul Palazolo**
8:45 - 10:00, Broadway B

Improving the Senior Level Hydraulic Engineering Design Course (CE 474) By Means of Computer Assisted Instruction.....2.73
Rolando Bravo; Southern Illinois University

Constructing and Teaching a New Asphalt Laboratory for the Engineering Department at the University of Tennessee at Martin.....2.74
Mohammad Obadat; The University of Tennessee at Martin

Implementing Field Work in Teaching Transportation Engineering Course.....2.75
Mohammad Obadat; The University of Tennessee at Martin

A Use of HEC-RAS as Instructional Tool.....2.76
Gregory H. Nail; The University of Tennessee at Martin

T4-C: Chemical Engineering & Administrative **Moderator: Adrienne Minerick**
8:45 - 10:00, Broadway C

Visualization and Computational Techniques for Teaching Polymer Chemistry to Engineering Undergraduates 2.77
C.L. Aronson, J.A. Charbonneau, D. Knack, R.L. Aiken, M.S. Parker, T.D. Rau, E.M. McDermott, D.P. Eddy, L.D. Aronson / M.T. Higgins, and J. Gurst; Kettering University / University of West Florida ***

An Online Community for Chemical Engineering Educators.....2.78
David L. Silverstein; University of Kentucky ***

A Micro-Macro Transportation Sequence for the ChE Curriculum: Role of Up - Scaling.....2.79
Pedro E. Arce, J.J. Biernacki, V. Subramanian and I. Carpen; Tennessee Tech University

Fuzzy Synthetic Evaluation of Engineering Institutions: A Consensus Driven Democratic Approach 2.80
Rajeev Kumar Upadhyay / S.K. Gaur / V.P. Agrawal / K.C. Arora; Anand Engineering College / Dayalbagh Educational Institute / B.I.T.S. Pilani Goa Campus / M.I.T.S

T4-D: Software Engineering **Moderator: Nabil Yousif**
8:45 - 10:00, Louis XVI

Online, Pre-Instructional Questioning Strategies: Do Formative Evaluations Correlate to End-of-Course Summative Evaluations in Engineering Graphics Courses? 2.81
Ted J. Branoff

Unifying the Code-base for a Client-Server E-Government Application.....2.82
Vinitha Muraleedharan, Andrew Strelzoff, Tim Rehner, Ray Seyfarth; University of Southern Mississippi

Model-Based Software Design Practice.....2.83
Barbara Bernal Thomas; Southern Polytechnic University

Understanding Open Source Software.....2.84
B. Wayne Walters; University of Southern Mississippi

T4-E: Computer Engineering & Technology #2 Moderator: Barbara Thomas
8:45 - 10:00, Louis XVI

First Year Experience as a New BEST Hub 2.85
John W. Pettit, Lipscomb University

Comparison of Upwind and Central Schemes for Optical Flow Velocity Estimation 2.86
Beddhu Murali, University of Southern Mississippi ***

Alternative Web-Programming Frameworks for the Classroom 2.87
Gary Johnsey, University of Southern Mississippi

Improving Student Preparation for Study of STEM Disciplines SPIN Information Night Programs 2.88
Thomas Brachman, Dale Elifrits; Northern Kentucky University ***

T5-A: Instructional Division #5 Moderator: Leigh McCue
10:15 - 12:00, Broadway A

Incorporating Technology into the Traditional Engineering Mechanics Lecture 2.89
Douglas R. Carroll, Hong Sheng; University of Missouri-Rolla

Interpreting Student-Constructed Study Guides 2.90
S. Swaminathan, D.P. Visco, H. Anthony, L. Zagumny; Tennessee Technological University ***

Development of Interdisciplinary Curricula and Labs in EET/MET/CET 2.91
Peter L. Romine, Julius Jow, and Kyle Rose; Alabama A&M University

Intelligent Web-Based Grading of Multi-Step Problems 2.92
Mel Maron; University of Louisville ***

Knowledge Assessment using Online Quizzes 2.93
Terry Weigel, University of Louisville ***

Virtual Reality Environments and Authoring Tool for Web Based Training and Education 2.94
Tulio Sulbaran, Justin Nosser; University of Southern Mississippi

T5-B: Computer Engineering & Technology #3 Moderator: Ellen Brehob
10:15 - 12:00, Broadway B

Using the Moodle Course Management System to Manage Accreditation Tasks.....2.95
Ray Seyfarth, University of Southern Mississippi

SWORD, an Information Server for Juvenile Justice.....2.96
Daniel Bond, Andrew Sterlzoff, Tim Rehner, Ray Seyfarth; University of Southern Mississippi

Networking Students Come to the Aid of Hurricane Victims 2.97
Wayne Walters; University of Southern Mississippi ***

Developing a Graphical User Interface to Improve Learning of Stochastic Theory in Hydrosciences in the Classroom.....2.98
Faisal Hossain, David Huddleston, Jonathan Schwenk; Tennessee Technological University

T5-C: Professional Skills #2 Moderator: Faye Sutton
10:15 - 12:00, Broadway C

Practical English: A Technical Communication Course Developed for Kyungpook National University Based on a Technical Writing Course in Mississippi State University's Bagley College of Engineering.....2.99
Alexis D. Powe, Mississippi State University***

Using the Challenger and Columbia Disasters to Discuss Technical Communication and Professional Ethics: A Multifaceted Approach 2.100
John Brocato; Mississippi State University

Implementing Technical Writing into the Undergraduate Steel Design Course 2.101
Ernie Heymsfield; University of Arkansas

Writing for Engineering: Benchmarks in the BS in Engineering Program at East Carolina University.....2.102
Rita Reaves; East Carolina University

Teaching Engineering Ethics Through a Nanoscale Case Study.....2.103
Christian Hipp; University of South Carolina-Columbia

Promoting Multidisciplinary Research in Environmental Engineering Among Undergraduates through REU Participation.....2.104
Davyda Hammond / Melinda Lalor; University of Michigan / University of Alabama

T5-D: Electrical Engineering & Engineering Tech Moderator: Zhaoxian Zhou
10:15 - 12:00, Louis XVI

A Microfabrication Laboratory Class Targeted to Freshmen.....2.105
Shamus McNamara, Kevin Walsh, James Graham, Kunal Pharas, and Mark Crain; University of Louisville

Teaching Electrical Engineering via Television.....2.106
Timothy Pratt, Virginia Tech

Developing Undergraduate Mentorship Skills Through BEST.....2.107
Greg Nordstrom, Anthony Andriano, and Nathan Turner; Lipscomb University

Design of Innovative Computer Networking Labs for Senior and Graduate Networking Courses and Supporting Research Projects.....2.108
Peter S. Lau; University of Memphis

Using a Two-Cycle Engine to Integrate Manufacturing Engineering Technology Curriculum.....2.109
Robert W. Hewitt; University of Memphis

Integration of Math and Physics into Electronic Engineering Technology Courses.....2.110
Zhaoxian Zhou; University of Southern Mississippi

*** Presentation Only

ASEE SE 2007 Conference Proceedings

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Tyler, Larry	University of Louisville
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Vernaza, Karinna	Gannon University
Visco, Donald	Tennessee Technological University
Walker, Thomas	Virginia Tech
Walters, Wayne	University of Southern Mississippi
Wang, Shih-Liang	North Carolina A&T State University
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Wilhelm, Mickey	University of Louisville
Willzerson, Tarrah	Tennessee Technological University
Wilson, Stephanie	University of Tennessee @ Chattanooga
Wilson, Timothy	Embry-Riddle Aeronautical University
Wolfe, Joanna	University of Louisville
Woo, Michael	The Citadel
Wu, Chih-Hao	Arkansas Tech University
Yost, Scott	University of Kentucky
Yousif, Nabil	Ft Valley State University
Zhou, Zhaoxian	University of Southern Mississippi

Technical Session Abstracts

Distance Education: Remote Labs Environment

Bassem Alhalabi, M. K. Hamza, Ali Abu-El Humos
Florida Atlantic University/Lamar University/Jackson State University

EXTENDED ABSTRACT

Since the invention of the Internet, many educational institutions and individual researchers have been searching for effectual virtual lab experiments; however, the very nature of real experimentation (real elements and real instrumentation) was not possible or missing. Yet, in the past few years, many scholarly articles and published research reports claimed the availability of virtual laboratories that mimics real laboratory experimentations. Nonetheless, within these virtual experiments' infrastructures, the elements of real experimentation- in comparison to conventional laboratories were far distant from constructing real experimentations online. Such a lack of real experimentation, over the internet, gave birth to an authentic leap beyond the limitations of antiquated virtual laboratories. The birth of Remote Labs Environment (RLE) at the Centre of Advanced Distance Education Technologies (CADET) brings with it a world of possibilities and innovative computing technologies. This paper conducts a survey on the students' perception of on-line labs, being real remote labs or software simulation. The results are analyzed. A brief description of some real remote labs is also furnished.

Redefining "Distance" Education Increasing Diversity, Accessibility, and/or Classroom Participation in Engineering Courses on a Time, Financial, and Technology Shoestring

Tom Walker, Associate Professor
Engineering Education Department
Virginia Polytechnic Institute and State University

EXTENDED ABSTRACT

This paper presents four semesters of methodology and results, some expected, some unexpected, from using Tablet PC technology and appropriate software tools to teach an introductory problem solving programming course for second-year engineering majors. The methods used provide both real and virtual seats in the same course with real student asynchronous world-wide participation at very minimal personal, personnel, technology, and time costs for both students and instructors. The results are overwhelmingly positive and the methods can be applied to all or parts of multiple courses and curricula. There is definite applicability to K-12 outreach programs as well as community/junior college collaborative programs. Issues addressed include learning styles, under-represented minority participation, student peer support and collaboration, student classroom participation, budgetary and personnel resources, computer grading, and course management systems. All of the methods and technology involved will be demonstrated during the presentation.

Tools for Online Instruction

Dr. John W. Lipscomb, Jr. PE
University of Southern Mississippi

EXTENDED ABSTRACT

Classroom instruction has traditionally used the blackboard and chalk. Online instruction uses a computer display as the blackboard with many types of "chalk" including text, still images, video, and sound. This article presents the author's development and use of hardware and software to capture lecture images with added audio for the online Construction Engineering Technology program at the University of Southern Mississippi. Developing online material can be very time consuming and efficiencies should be sought. A "webcam clipboard" was designed and fabricated to project images and capture images during classroom presentations or in the office. A compressed audio file describing the images was recorded later. The captured images and audio were then uploaded to the online software where they are available to enrolled students anytime. The result is an audio-visual online presentation that is an effective teaching tool and is dial-up Internet compatible.

What Effect? Studying Technological Changes (Specifically Distance Learning) in the Classroom

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EXTENDED ABSTRACT

Tennessee Technological University's (TTU) Department of Civil and Environmental Engineering is developing and testing a distance learning approach to Engineering Mechanics (statics). Camtasia Studio, PowerPoint, and a tablet PC have been used to develop the DVD or Web based course work. The concept is much like an engineering e-book where, students learn the theoretical principles of structural mechanics with step-by-step graphics, text and voice narration. However, learning is improved by use of the tablet PC to demonstrate the process of accurately working and checking statics problems by hand. The concept has been used progressively for two semesters in engineering mechanics classes at TTU. This paper describes the development approach for creating the distance learning class as well as qualitative findings based on student evaluations.

Embracing the Middle Ground: Engaging On- and Off-campus Students within the Same 'Classroom'

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EXTENDED ABSTRACT

There is little doubt that distance learning provides a host of opportunities for on- and off-campus students. For working professionals seeking a degree, often it is not an option to attend the University full-time. Distance learning programs provide the means to pursue an otherwise unattainable education. Likewise, on-campus students benefit from the virtual presence and expertise of off-campus students, who typically have more 'real-world' engineering experience than their on-campus peers. In this work, the authors' technological and philosophical approaches to distance education at the graduate level are presented.

This is an exciting time to be involved in distance learning. As hardware and software technologies present ever improving solutions to minimize physical distance, the distance learning instructor is left with a bevy of options for teaching on- and off-campus students in an engaging, interactive, and exciting environment. Virginia Tech students in programs offering courses/degrees via the University's distance learning program can be classified in three manners. On-campus, off-campus-live, and off-campus-asynchronous. It should be noted that most students will fall into two, if not all three of these categories within any given semester.

At the most fundamental level, as educators, we must engage our students, regardless of if they are on- or off-campus and attending live or asynchronous lectures. Institutions and departments may find it easy to inadvertently auto-differentiate on-campus students from off-campus students. While the same technical degree completion requirements are maintained, offering separate courses/sections for on- versus off- campus students results in simultaneously teaching the curriculum with two entirely unique styles, 'traditional' and 'online.' While this approach serves both student groups, it relinquishes the opportunity to capitalize on the numerous educational benefits available by simultaneously teaching both student groupings. For example, the diversification of technology required for teaching off-campus students can lend to improvements and innovations in delivery style of equal use to those on-campus. Additionally, teaching on- and off- campus students in the same virtual classroom provides a framework for students to learn from the experiences of their peers. These opportunities are most easily garnered by treating these two isolated student groupings as one and embracing the middle ground.

Capstan Speed Control in the Optical Fiber Drawing Process: A Case Study for Mechatronics

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EXTENDED ABSTRACT

Industrial case studies of successful implementations of combined mechanical and closed-loop control design provide students with meaningful examples of classroom theory. Such a case study on the development of a capstan drive with feedback control for use in optical fiber production is presented in this paper. Optical fiber is manufactured by the draw process, heating and pulling high purity glass cylinders to diameters smaller than human hair. Many process and product parameters are controlled during drawing of the fiber. Of critical concern is producing a constant diameter for the glass fiber and its light-guide core. Uniformity of fiber glass diameter within the necessary tolerances creates a product capable of high bandwidth optical data transmission as well as cost-effective production. The optical fiber draw capstan design has direct impact on the resulting fiber quality.

A systems approach to the design of mechanical and control aspects is demonstrated through mechanical/electrical parametric evaluations and modeling as well as in the simulation of the capstan drive. Disturbances in the draw process arise from several sources including the starting glass diameter variation and the draw tension control which affects the glass temperature and viscosity. Simulations reveal the achievable fiber diameter tolerance, with the completed design and control scheme in the presence of disturbances.

The fiber drawing process description, process model, and capstan design are presented as a case study suitable for undergraduate or graduate courses in system dynamics, control or mechatronics. The problem discussed is of a multi-disciplinary nature, typical of many manufacturing processes problems. The case study highlights the use of mechanical and electrical modeling, system identification, and control tools as means of product/process improvement.

The design of an optical fiber draw capstan pulley with motor and control has been successfully demonstrated for improved optical fiber diameter control. A stable, under-damped response of the capstan speed was achieved without current saturation. From the design and process relationships established, an effective system was synthesized and controlled. Students can gain a fundamental understanding of how to apply classroom theory to solve a real world problem through this example.

Using Mathcad to Enhance the Effectiveness of the Wind Energy Topic in an Alternate Energy Sources Course

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EXTENDED ABSTRACT

The escalating cost of energy is a dominant feature of the 21st Century and has resulted in increased interest in alternate energy sources topics in engineering education. At Mississippi State University, ME 4353 Alternate Energy Sources is taught as a technical elective/beginning graduate course in the Mechanical Engineering program. The course is a survey course that examines a number of alternate energy sources and alternate applications of existing energy sources. One of the topics considered is wind energy. Because of time constraints, less than two weeks of class time is available for most topics, including wind energy. The instructional goals of each alternate energy topic are to present the relevant harvesting principle, to survey the availability of the source, and to present a meaningful quantitative experience for the topic. This paper explores the use of Mathcad to enhance the classroom presentation and extend the level of a meaningful quantitative experience for wind energy. The wind energy topic in earlier offerings of the course examined the taxonomy of wind energy systems, the availability of wind energy resources, and the role of the power coefficient in wind energy and presented some examples of available wind energy systems and some fundamental computations involving wind turbines. However, the computations, the "quantitative" experience, did not extend beyond routine calculations for specified conditions. By introducing Mathcad and developing a worksheet centered about the Weibull distribution as particularized to wind energy metrics, the quantitative experience has been extended to the evaluation of system performance—a significant and useful enhancement. Discussion and examples of the use of Mathcad in wind energy engineering topics in the course are presented in the paper.

One of the reasons for the effectiveness of the use of Mathcad in providing a meaningful quantitative experience is that MSU mechanical engineering (ME) students are familiar with Mathcad and no time is spent introducing Mathcad. The MSU ME program uses Mathcad as the primary computational tool in all ME undergraduate courses. Mathcad in introduced in Thermodynamics I in the second semester of the sophomore year and forms the basis of the junior-year ME engineering analysis course. Thus, MSU ME students are familiar with all the Mathcad syntax used in the wind energy development. About 1.5 class periods (50 minutes per period) are required to go over the examples.

The use of Mathcad to enhance the quantitative coverage of wind energy systems is considered a great success. The students readily grasped that using a Mathcad-based assessment of performance metrics for a wind turbine systems was a vast improvement over just computing the power extracted for single wind speed. Moreover, the ability to pose and answer what if "questions" about wind turbine performance captured the attention of the class and permitted a homework assignment that was more focused on synthesis than analysis.

Using Design-Expert for Enhancing Engineering Experimentation Labs

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EXTENDED ABSTRACT

Design-Expert software has been integrated into an advanced engineering experimentation course that deals with design, execution and analysis of experiments known as DOE. The DOE is a scientific method for planning experiments and analyzing resulting data so that valid conclusions can be obtained. The design of experiments relies on principles of combinatorial mathematics such as combination, permutation, factorial, blocking, Latin square, etc. The analysis of experiments uses theories from statistics such as hypothesis, t-test and ANOVA. It is often hard for the students to manually design an experimental layout if they don't have sufficient combinatorial background. The theories of statistical analysis are generally easy for students to grasp, but the calculations are often tedious and consume a significant amount of class time. That could potentially shift the course focus away from experimentation and jeopardize the students' interests in this course.

The Design-Expert is a Windows-based DOE program. It has the tools for designing various experimental layouts such as single-factor experiment and factorial experiment. Once the experimental data are given, the program can perform various statistical analyses and display results graphically. The instructors have used Design-Expert extensively inside the classroom for presenting lectures. Students have also used the software for designing their experiments and analyzing the results. In this paper, an example lecture is discussed to demonstrate the use of this software. An example experiment conducted by students is also presented.

A TRIZ Design Tool for Engineering Education

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EXTENDED ABSTRACT

A TRIZ design tool is developed at North Carolina A&T State University to enhance student design projects and to strengthen the aerospace engineering program. The tool contains TRIZ contradiction table and inventive principles with extensive aerospace engineering examples.

The primary purpose of this TRIZ design tool is to enhance the quality of student design projects. Some of our senior capstone projects like ASME Student Design Competition and industrial sponsored projects, students often need to design from scratch. With the pressure of timeline to firm up their designs, they often commit to their designs that are not well thought out, leading to numerous modifications later on. As the design stage impacts the design projects significantly, a good design tool could enhance the quality of student designs by fostering innovation and creativities.

TRIZ is the acronym for the phrase "Theory of Inventive Problem Solving" in Russian. The premise of TRIZ is that there are universal principles of invention that advance technology, and they could be taught to people to make the process of invention more predictable. The inventive principles in available literatures are very general and abstract in order to fit in a wide variety of disciplines. The design tool developed contains many engineering examples to help users understand these principles and apply them effectively. The tool is developed with Visual Basic to interface with the contradiction table stored in an Excel file. The table resolves contradictions of 39 engineering parameters with solutions to suggest selective inventive principles. Each inventive principle in the tool developed is on a web page containing text, photos, and web links with examples collected from literatures, design books, and internet resources. In addition, many case studies have been established to walk through examples of using the table of contradiction and inventive principles.

The TRIZ design tool is intended as a supplement for all design courses. Once the tool is enhanced with feedback from senior students, it can also be disseminated to freshman classes. Since the inventive examples are primarily from aerospace innovation, the tool should attract student interests in this area. The Aerospace track within the Mechanical Engineering curriculum has been established for many years. However, the program remains small and is in need of a boost. This design tool is one of our multi-prone efforts to strengthen this program.

A Structured Approach to Teaching Fluid Power Systems Using Spreadsheets

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EXTENDED ABSTRACT

The use of spreadsheets such as Microsoft Excel® to supplement Engineering Technology has been implemented in many areas with demonstrated success including fluid power systems. Spreadsheet based commercial products such as Fluid Tools® are available for quickly performing calculations required for component sizing and circuit analysis. However, a different approach was taken at Western Carolina University to supplement instruction and enhance student learning in a Fluid Power course. Students were required to develop independent worksheets in a logical progression corresponding to topics covered in class. These worksheets were then used by students to check homework problems and perform laboratory calculations. Additionally, worksheets were combined and submitted as a final semester long project. This paper will describe how this approach was implemented into a Fluid Power course at Western Carolina University. Background objectives will be presented along with descriptions and examples of student developed worksheets. Instructional methods, student performance, and educational merit will be discussed.

EDUCATIONAL MERIT

The approach taken in using spreadsheets to supplement teaching and enhance learning provides a solid method for improving instruction in fluid power. Enhanced learning is evidenced through reinforcing computer skills and strengthening applications in verifying engineering design parameters related to fluid power systems. However, these skills are not always explicitly taught in engineering curriculums where the focus has been on content and analytical skills of specific engineering disciplines. Industry and the Accreditation Board for Engineering and Technology (ABET) nonetheless expect engineering graduates to have well developed computer skills.[8] The approach implemented at Western Carolina University provides a logical and systematic method for building on theory and developing essential computer skills. Through immediate feedback, students can gain a better understanding of variables in equations and the impact of changing design parameters in fluid power systems.

SUMMARY AND CONCLUSIONS

Student feedback and performance has been positive, and integrating spreadsheets has provided a vehicle for transferring theoretical knowledge to practical, systematic application. This practical approach has resulted in improved collaboration among classes and has provided more continuity within the Engineering Technology curriculum at Western Carolina University. Ongoing program assessment will continue to provide feedback on the effectiveness of using spreadsheets to enhance learning.

Is the Postage Worth It?
Lesson Learned From Grad Surveys

John H. Page
Virginia Military Institute

EXTENDED ABSTRACT

The Civil Engineering Department at the Virginia Military Institute has been conducting surveys of their recent graduates and their employers since 1990. This survey was started with the 1986 graduating class and has continued through the 2004 graduating class. This paper discusses the original objectives of the survey, the survey format, changes in the survey method, lessons learned, industry trends in entry level employment skills, curriculum changes and use of a longitudinal survey as an assessment tool. The results of the recent graduates' and employers' surveys and any trends and patterns, which evolved over the 20 graduating classes surveys, are identified and discussed. A review of curriculum changes and the effect on the recent graduates and their employers is included

Advising the Advisor: Professional Development of Junior Faculty

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EXTENDED ABSTRACT

Recently there has been much discussion regarding the capability of junior faculty to successfully advise graduate students with their dissertation projects. In particular, it has been argued that it is time to discard the notion that a first year Assistant Professor is automatically capable of supervising doctoral students.

Currently there is a growing demand for universities to create rigorous professional development programs aimed at helping their junior faculty rise to their full potential as academic educators and advisors. Such initiatives have to be anchored in the scholarship of education, but additionally need to address a variety of subject-specific issues.

The purpose of this paper is twofold. Firstly, it presents an approach to enhancing faculty development offered by an increasing number of universities in the UK where new faculty are required to successfully complete a program in "Learning and Teaching in Higher Education" as part of the criteria to be met for earning tenure. Key aspects, including rationale, objectives, learning outcomes and implementation of the above-mentioned program, are described and, based on further reflection, conclusions regarding the applicability of such a program to the US system are drawn. Secondly, the topic of professional faculty development is considered from a US perspective. Within that context associated activities, including mentoring and junior-senior faculty collaboration in general, are discussed.

Ethics Across Electrical and Computer Engineering Curriculum

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EXTENDED ABSTRACT

Ethics and Ethical aspects of engineering have been an integral part of the Electrical and Computer Engineering (ECE) curriculum at the Saint Louis University. The coverage of ethics begins at the freshman engineering course and continues throughout the four years. Case study approach is adopted to bring about a better understanding of ethical and professional responsibility. Many available resources on engineering ethics are employed to further aid the understanding of students' ethical and professional responsibilities. University community enjoys the resources of two centers of ethics. In addition, great many centers of engineering ethics at leading universities available on line are used as teaching resources. Accreditation Board for Engineering and Technology (ABET) requires engineering program to include "an understanding of professional and ethical responsibility" (ABET Outcome f) as one of program educational outcomes.

Students' knowledge of Ethics and Professional Responsibilities are assessed using direct and indirect tools. The direct assessment tools are based on a multiple choice questions and review of a case on ethics. A survey is also completed to provide an indirect assessment tool. The evaluation has shown our students have achieved more than acceptable levels stated in our departmental continuous assessment process.

Project Management Skills: A Study of Students' Prior Knowledge

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Virginia Tech

EXTENDED ABSTRACT

In launching the Year of Dialogue, the plenary speakers at the 2007 ASEE National Conference invited engineering educators and engineering education researchers to move from the scholarship of teaching to a more rigorous, research-based approach for examining the education of engineering students. This paper responds to that call by describing a case study in one particular learning arena: project management. In recent years, a number of scholars have called for increased attention to project management in design courses. But while we can teach students appropriate tools and principles, project management itself is a skill as well as body of knowledge. Students must "learn by doing" when it comes to defining and organizing open-ended team projects. As learning research suggests, however, students learn new things based on their prior knowledge, and effective education builds on that prior knowledge, adding to it and revising it as appropriate.

To begin to understand how to best mentor students through the process of honing their skills, this study seeks to identify the prior knowledge students bring to project management. Using surveys, interviews, and observations of students in capstone design courses, the study identifies key challenges students face when applying content knowledge of project management to open-ended problems in classroom environments. The data from this case study suggest that even without extensive formal instruction in project management, the engineering curricula examined do include opportunities for students to become familiar with the broad outlines of project management and recognize its importance. However, this general familiarity does not necessarily translate into the skill required to successfully plan and manage long-term, multi-individual projects. Students clearly struggle to move from general concepts to concrete practice, and as expected, their lack of project experience makes it challenging for them to accurately estimate time, cost, and critical paths to success. These findings can be used to develop appropriate teaching interventions to better support students as they move from textbook understanding to real-world practice.

Adults Learners and the Challenges Facing Educators

Keith Plemmons, PhD, PE, PMP
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EXTENDED ABSTRACT

Adult learners learn differently from pre-adult learners. Adults have motivations and distinguishing characteristics that make them different from a pedagogical perspective. Understanding these differences is important for educators who seek to provide appropriate learning experiences that respond to the needs of adults.

Some of these adults may or may not be engineering college graduates, but they are usually back in the classroom because they find themselves with a partial toolbox of knowledge, skills, and abilities. Others adult students are seeking to prepare themselves for future challenges, including professional and career development.

As educators, we find experienced adult students in the same classroom with recent engineering graduates, or possibly undergraduates. The result is a group of students with a spectrum of attitudes and learning skills. How recent graduates see themselves and how they see the activity of learning reflects on their preparedness for their chosen careers.

The results of a recent alumni survey will be presented to identify changes in their learning preferences across a ten-year timeframe as determined by Self-Directed Learning Readiness Scale (SDLRS) results. Self-directed learning, a mode of life long learning, will be explored in regards to its application within academia and the business world.

A Model for Dual-Level Accreditation of Engineering Programs

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EXTENDED ABSTRACT

The Engineering Accreditation Commission (EAC) of ABET does not currently allow Dual-Level Accreditation. Engineering programs are either accredited at the basic level or the advanced level.

The J. B. Speed School of Engineering at the University of Louisville currently has six Master of Engineering degree programs accredited by EAC of ABET at the advanced level. The requirements to earn the accredited Master of Engineering degree in discipline include five calendar years of study consisting of from 163 to 168 semester hours, with three required semesters of alternating cooperative internship assignments beginning in the sophomore year. The programs appear to be unique and have been in place since 1970. The structure of these degree programs appear to conform to the models of engineering education for the future proposed by the NAE Engineering 2020 study, by the ASCE Body of Knowledge proposal, and by the recently approved changes to the Model Law by NCEES.

In addition to the accredited M. Eng. programs, our students are awarded a B. S. in discipline after completing from 132 to 138 semester hours on the way to earning the M. Eng. By ABET Policy II.B. 8. a. of EAC, the B. S. degree programs would be accreditable by ABET if it were permitted by EAC because they are purposely designed to comply with this policy which says, in part, "Accreditation at the advanced level requires compliance with the general basic level criteria . . ."

The six departments that administer the accredited Master of Engineering programs also offer the Master of Science and Ph.D. degrees in those disciplines. Thus, students who earn undergraduate degrees from other University of Louisville programs, or from other institutions, may be accepted into these graduate programs in engineering in the Speed School. Even though, the M. S. and Ph.D. programs are not accredited by ABET, they conform to the regional accreditation criteria of the Southern Association of Colleges and Schools.

We contend that we have model programs that satisfy ABET EAC Policy II.B.8.a, and the only reason that we do not have both the baccalaureate and advanced level (M. Eng.) degrees accredited by the EAC is the dual-level prohibition imposed by this policy. This paper will outline the benefits that will be realized should the dual-accreditation prohibition be removed. A summary of the discussion conducted so far by various groups will also be included.

Increasing the Numbers of Science, Technology, Engineering and Math Students by Recruiting Students Into Graphic Communication System and Technological Studies

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EXTENDED ABSTRACT

Graphic Communication Systems and Technological Studies (GCSTS) is increasing the numbers of Science Engineering, Mathematics and Technology (STEM) graduates by providing young women and men with quality competency-based instruction which will prepare them to enter the fields of technology education and graphic communication systems. The GCSTS faculty assists majors in developing critical competencies in communications, mathematics and sciences which prepare these students to secure positions in education, industry and government. This department is committed to providing these students with the skills needed to be successful in all areas of life.

The two degrees which students pursue in the GCSTS are comprised of a number of concentrations. GCSTS has three concentrations: Printing and Publishing, Integrated Internet Technologies and Computer Aided Design and Drafting. Technology Education has concentrations in Industrial Training and Development, Trade and Industrial Education (Teaching), and Technology Education (Teaching). The department is comprised primarily of African American students. There are currently 318 undergraduate students enrolled in this department. The ratio of men to women is roughly two men for every one woman. African American males comprise roughly 60% of undergraduates in this department. African American females comprise roughly 35% of students pursuing undergraduate degrees in this department.

Recent population reports revealed that the numbers of student pursuing degrees in this department have declined. In an effort to stem the tide of students turning away from this technological degree the department chair has instituted a recruiting committee. This committee is an action based group of faculty, who consistently devise and implement plans to attract interest and new students to this department. A few of the strategies this committee is involved in to help draw new students to this department include participation in outreach and recruitment efforts which are conducted both on campus and in the community.

Established Customs: Changing Roles in Departmental Culture and Impact on New Faculty

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EXTENDED ABSTRACT

As a new faculty member begins to teach courses in a department, the process is an adjustment for the faculty member, the students, and the department. The success of the faculty member in the classroom is dependent on a number of factors including their technical proficiency, organization, and interpersonal rapport with the students. Establishing interpersonal rapport with a student body is a daunting and challenging task, not wholly under the influence of the new faculty member. Established departments inherently have developed customs regarding timing and structure of: homework, exams, projects, student feedback, and one-on-one interactions. Based on these inherent customs, student expectations may differ greatly from the new engineering educator's class management procedures. As a result, interpersonal rapport may suffer and the new faculty member may experience negative feedback simply because of change. It is important for other faculty in the department to be cognizant of this potential for mismatched expectations and actively and publicly provide information and support for the new faculty member. The reasoning for this is two-fold. First, the new faculty member was probably hired to positively influence the growth of the department. This growth is hindered if the new faculty member is persuaded to adhere to existing customs. Secondly, exposure to a variety of learning environments is beneficial to the professional development of students.

This contribution will discuss examples of established customs that the authors encountered followed by a discussion of strategies and advice on maintaining interpersonal rapport while preserving credibility and learning standards. In addition, this paper strives to be a resource for established faculty to assess positive and negative impacts of engrained customs on not only the students, but also on new faculty. A discussion of topics will be presented that have a significant impact on a new faculty member's first teaching experience at a new institution. Unfortunately these are not frequently addressed in teaching workshops. The goal of this manuscript is to open a dialogue on unspoken practices in engineering departments and to make the process of gaining familiarity and / or influencing these practices smoother.

A National Model for Engineering Mathematics Education

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EXTENDED ABSTRACT

The traditional approach to engineering mathematics education begins with one year of freshman calculus as a prerequisite to subsequent core engineering courses. However, the inability of incoming students to successfully advance through the traditional freshman calculus sequence is a primary cause of attrition in engineering programs across the country. As a result, this presentation will describe an NSF funded initiative at Wright State University to redefine the way in which engineering mathematics is taught, with the goal of increasing student retention, motivation and success in engineering.

The WSU approach begins with the development of a novel freshman-level engineering mathematics course, EGR 101 "Introductory Mathematics for Engineering Applications." Taught by engineering faculty, the course includes lecture, laboratory and recitation components. Using an application-oriented, hands-on approach, the course addresses only the salient math topics actually used in core engineering courses. These include the traditional physics, engineering mechanics, electric circuits and computer programming sequences. The EGR 101 course replaces traditional math prerequisite requirements for the above core courses, so that students can advance in the engineering curriculum without having completed a traditional freshman calculus sequence. This has enabled a significant restructuring of the engineering curriculum, including the placement of formerly sophomore-level engineering courses within the freshman year. The WSU model concludes with the development of a revised engineering math sequence taught by the math department later in the curriculum, in concert with College and ABET requirements. The result has shifted the traditional emphasis on math prerequisite requirements to an emphasis on engineering motivation for math, with a "just-in-time" structuring of the new math sequence.

This paper will provide an overview of the WSU model for engineering mathematics education, followed by an assessment of student performance, perception and retention through its initial implementation. It will also summarize the scope of a recent NSF CCLI Phase 2 Expansion award, which involves a multiyear assessment at WSU, pilot adoption and assessment at two collaborating institutions, and a widespread dissemination of results.

The Development of Social Capital in Engineering Education to Improve Student Retention

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EXTENDED ABSTRACT

The challenge of retaining African American college students in engineering fields is evident from the collegiate enrollment numbers. In 2001, African Americans represented 4.8% of the engineering degrees awarded in the US and only 41.8% of African Americans entering engineering actually graduated [Brown, Morning, Watkins]. The individualistic and weed out culture of engineering, ethnic isolation, and the lack of interaction with faculty and broader university community can leave these students feeling isolated. Consequently, students may become at risk for leaving the field or not excelling in it, thereby making the goal of retaining a diverse cohort difficult to achieve. Ways must be explored to ensure the retention of minority students. Many researchers have shown how social capital can lead to academic success; therefore, the purpose of this paper is to present a framework for understanding how social capital generated through involvement in student-run engineering organizations can help to improve retention rates of African American students in engineering and positively affect their overall success.

To investigate the strength of student-run organizations, the National Society of Black Engineers (NSBE) – the largest student-run organization in the world – was chosen. Through interview data that reflect the experiences of students involved in the National Society of Black Engineers, it can be demonstrated that student-run organizations can help develop social capital for positive outcomes. More specifically, it can be shown that NSBE provides the collaboration, trust, and sharing of power characterized by genuineness mutual respect and informality that serves as a building block for generating social capital [Gutierrez]. A consistent focus on leadership development in NSBE creates an environment that allows its members to develop a positive orientation toward achievement and to navigate the world outside of NSBE. The result is that members are able to create the bonding and bridging capital necessary for both retention and future success in the field of engineering. This bridging social capital is in addition to the access to resources that NSBE exposes its members to, provided by industry and university partners. This paper introduces these ideas and other data relevant to the efficacy of student-run organizations in creating social capital.

The First Year Program at the University of Southern Indiana

Laura A. Ruhala, Richard J. Ruhala, and Eric P. Sprouls
University of Southern Indiana

EXTENDED ABSTRACT

The University of Southern Indiana (USI) has administered a successful, accredited program in Engineering Technology since 1975. By the start of the 21st century, however, the need for a regional, public engineering program strongly emerged; so in 2002, the University of Southern Indiana started a new engineering program leading to a Bachelor of Science degree in Engineering. Designing this new curriculum gave faculty and administrators very unique opportunities. This paper focuses on the changes made to the first year of the program.

USI offers a Bachelors of Science degree in Engineering with three possible emphases: civil, electrical and mechanical. Two programs are offered in the engineering curriculum, depending upon the student's entry math level. The 'four-year engineering program' is designed for students who enter the program ready to take differential calculus, MATH 230. Students that are at the pre-calculus level, enrolled in college-level algebra and trigonometry, enter the 'five-year engineering program'.

Since some students arrive ready for calculus while others arrive pre-calculus, five introductory engineering courses were developed. The first one, ENGR 101, is a seminar class where freshmen are able to learn about various engineering fields and become involved with the professional clubs and their design projects. Incoming students take ENGR 101 regardless their math level.

Pre-calculus students spend their first year taking ENGR 103 & 104: Principles of Problem Solving and Applied Problem Solving, respectfully. These courses are explored further in a paper by R. Ruhala.

Engineering students who are co-registered in differential calculus are qualified to sequentially take ENGR 107 & 108, Introduction to Engineering and Design, respectively. ENGR 107 teaches rigorous problem solving techniques. Students practice their techniques on problems that preview upcoming classes including statics and dc circuits. Later in the semester students learn to solve the problems using MS EXCEL, MS VBA Visual Basic and Matlab.

In ENGR 108 students learn AutoCAD while concurrently working on and disseminating hands-on civil, mechanical and electrical design projects.

A Five-Year Engineering Program at the University of Southern Indiana

Richard J. Ruhala, Laura A. Ruhala, and Eric P. Sprouls
University of Southern Indiana

EXTENDED ABSTRACT

The University of Southern Indiana (USI) has administered successful, accredited programs in Engineering Technology since 1979. By the start of the 21st century, however, the need for a regional, public engineering program strongly emerged; so in 2002, USI started a new engineering program leading to a Bachelor of Science degree in Engineering. Designing this curriculum provided the faculty and administers a unique opportunity to develop a new engineering program.

From experience with the Engineering Technology programs, a population was identified of students who are interested in engineering, show potential for success in engineering, but are not ready for Calculus I their first semester. To accommodate these students, a 5-year program was implemented in addition to a 4-year program. Historically, many students ultimately add a fifth year to the end of their program, but this 5-year program added the fifth year to the beginning of a student's collegiate experience. Hence students can start with college algebra and trigonometry their first semester, and then take their first calculus course starting either their second or third semester. Two engineering courses were designed specifically for this program so that these students will still be able to have immediate contact with the engineering program and faculty.

The courses developed, Principles of Problem Solving and Applied Problem Solving, are offered during the students' first and second semesters, respectively. Principles of Problem Solving focuses on fundamental mathematical tools, such as error analysis, unit conversions, statistics, and graphical analysis. The students are also exposed to engineering laboratory methodologies, technical writing and design. In Applied Problem Solving the principles of the previous class are applied to select engineering topics. Computer applications for problem solving and graphical analyses are also emphasized, including MS EXCEL, VISUAL BASIC and TK SOLVER.

This 5-year plan of study also provides the added benefits of a reduced credit load per semester, and having an academic advisor who is also an engineering professor (just like the rest of the engineering students) from their first semester.

Assessments of direct and indirect measures show that the key learning objectives for these courses are being met by most of the students who complete these courses. One retention investigation shows that of the 28 students who started ENGR 103 -Principle of Problem Solving in fall 2004, five were enrolled in Statics by the fall of 2006. Another study shows that the three-year retention rate for engineering students starting in the 5-year program is 30%, compared with 43% for engineering students starting in the 4-year program.

Engineering and Golf: A Professional Development Partnership between Mississippi State University's Center for Engineering Student Excellence and Professional Golf Management Program

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EXTENDED ABSTRACT

This paper describes a partnership between the Bagley College of Engineering's Center for Engineering Student Excellence (CESE) and the College of Business and Industry's Professional Golf Management (PGM) program at Mississippi State University. CESE seeks to produce well-rounded engineering graduates who interact and collaborate with others easily in both business and social arenas; and to foster relationships between female and minority engineering majors and the university's mostly Caucasian male engineering student body. With these goals, CESE and the PGM program offer Engineering and Golf (EG), a free program in which engineering students of different backgrounds and genders gain a working knowledge of the game while developing the social and team-working skills to make them more attractive to potential employers. A secondary goal of the program is to allow students to seize potential business opportunities more readily, as recent studies and initiatives show that much of today's business is done in a social setting like a golf course.

EG is the impetus many students need to communicate with those outside of their particular fields of engineering and with often-underrepresented women and minorities within their fields. It includes four components: an introduction to the program and overview of the game of golf; classroom instruction in the basics of golf, such as course etiquette and club choice; practice outings where students train together and learn basic golfing skills (under the supervision of trained golf professionals, PGM students, and various faculty volunteers from the two colleges); and a culminating tournament, in which assigned teams compete for prizes. Participating students network with faculty/staff from various fields; hone social skills; engage in peer-to-peer instruction; and work with students with whom they might not otherwise interact (since classroom teams are often formed by the students themselves). Topics include the rationale behind the program, the CESE program and its aims, EG implementation and costs, and quantitative and qualitative assessments of the program from engineering student participants and PGM student instructors.

Lessons Learned From a Single Gender Outreach Program

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EXTENDED ABSTRACT

The Herff College of Engineering at the University of Memphis hosts a summer outreach program for young women to give them an overview of the engineering profession and career opportunities available to them and to help them better understand engineering concepts through hands-on experience. Now in its fourth year, this program is funded by the Women's Foundation for a Greater Memphis.. It was modeled after similar co-ed programs offered at the Herff College over the past 10 years. This paper details the lessons learned from migrating from a co-educational program to one exclusively for young women, and it outlines why we believe that a single gender program for young women, an underrepresented group in the field of engineering, is superior to co-educational models.

Success keys for this type of program are dedicated faculty, interesting program elements, community support, and positive mentoring. Details on how we approached each of these elements are presented in the paper as well as the lessons we had to learn to understand the importance of each of the keys.

An Initial Assessment of the Effectiveness of the Enhancing Access and Fostering Science, Technology, Engineering and Math (STEM) NSF Summer Workshop Program

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EXTENDED ABSTRACT

The Enhancing Access and Fostering Science, Technology, Engineering and Math (STEM) Program for specific learning disabilities students is a National Science Foundation Research in Disabilities Education Focused Research Initiative (RDE-FRI) funded program at The University of Akron. The three major objectives of this pilot project are: 1) encourage Special Learning Disabilities (SLD) and typical students to explore STEM as a future career choice by building their confidence and efficacy in STEM, 2) develop empathy and better appreciation of diversity amongst students who would traditionally enter engineering programs and 3) develop understanding, better appreciation of diversity, and an elaborated sense of teaching and learning amongst the participants. Exciting hands-on activities based on the Society of Automotive Engineers' "A World in Motion", smart balloon, civil materials, and Information and Communication Technology (ICT) are designed to spark and capture the interests of participants in the STEM fields. The materials presented at the workshops will illustrate aspects of inclusive technology and engineering classroom education that will help the students succeed. The purpose of this paper is to describe, summarize the findings and assess the first year summer STEM workshop for SLD and typical middle school students. Data obtained from the participants and their parents via various surveys were used in the analysis.

Enhance "Book Learning" with Facebook

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EXTENDED ABSTRACT

Facebook is an online networking website available at 80% of colleges and universities. It is estimated that 85% of students on these campuses have a *Facebook* account and check it up to 6 times a day. There are 27,805 registered *Facebook* users in the University of South Carolina network.

Some universities have discouraged the use of *Facebook* for fear of security and encouraging cheating. Some professors caution students against its use by warnings in syllabi. Administrators use it to look for student conduct violations. We don't see *Facebook* as a distraction or danger; rather we see it as an opportunity.

This paper will discuss how we are using *Facebook* in an introductory freshman course, UNIV101-Engineering Honors, to do what Blackboard, WebCT and other course management software is intended to do: Keep students up to date with communication and posting of assignments. We are encouraging students to connect with us and other students via *Facebook*. We also discuss how students in our UNIV101 course and throughout the University are using *Facebook* as an online meeting/sharing space; this facilitates file-sharing, frequent communication, and enhances their overall educational experience.

The utility of *Facebook* for the student is that it allows them to function in their chosen "online"space. Each user has a profile which they are able to expand to include a personal blog, interests, activities, and course schedules which can be monitored by the professor and used to incorporate meaningful examples and projects into the course.

We use Daniel Pink's book A Whole New Mind to introduce students to the six essential abilities that will be necessary for survival on our "new flat earth": Design, Story, Symphony, Empathy, Play and Meaning. Our use of *Facebook* serves as practical and familiar illustration of several of these senses.

Integrating Learning Outcomes Throughout the Civil Engineering Curriculum to Meet Site Engineering Prerequisite Needs

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EXTENDED ABSTRACT

The Accreditation Board for Engineering and Technology (ABET) has promulgated criteria for accrediting engineering programs in the United States under the heading ***ABET Engineering Criteria 2000***. Criterion 3 sets forth outcomes that every accredited engineering program must demonstrate that their graduates meet, using a process of assessment. These program objectives are commonly referred to as "a" through "k" outcomes.

The American Society of Civil Engineers (ASCE) has published ***Civil Engineering Body of Knowledge for the 21st Century—Preparing the Civil Engineer for the Future***. This publication, which supports ***ABET's Engineering Criteria 2000***, has been referred to as the "Body of Knowledge" (BOK) by ASCE's Committee on Academic Prerequisites for Professional Practice. It describes what should be taught and learned, and incorporates the eleven "a" through "k" ABET outcomes while adding four additional ones addressing technical specialization, project management, construction, asset management, business and public policy and administration, and leadership. The BOK further delineates what level of competence a student is expected to achieve for each of the fifteen outcomes from either a Bachelor's Degree program plus a Master's Degree (or 30 hours plus experience) (**B+M/30**), additional experience, or additional post-licensure education and experience.

This paper examines what constitutes the practice of site engineering, the associated subject matter that provides a knowledge and skill base that will serve as a foundation required for this practice after graduation, the sequencing of material relating to site engineering as to when it should be presented to students, and at the level of achievement expected from the students in order to meet the intended ABET and BOK outcomes. One undergraduate institution's individual course goals are examined for subject matter pertaining to site engineering. Those particular courses that are involved are then further evaluated to see if, across the curriculum, the necessary subject matter is included. In addition, the continuity and sequencing of material between the freshman and senior level courses is checked. This paper also examines the role that "threads of knowledge" established by individual course goals play in creating/meeting pre-requisite requirements necessary to establish continuity of learning throughout the curriculum.

Finally, this paper provides a summary of findings and recommendations for improving a student's educational experience in the site engineering area of practice that could be used to better integrate courses within the curriculum.

Project-Based Learning: Developing Ductile Concrete

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EXTENDED ABSTRACT

Concrete is a brittle material, while steel is a ductile material. For design purposes, the tensile strength of concrete is assumed to be negligible since concrete is weak in tension. Reinforcing steel is added to concrete for this purpose. In recent years, materials like Engineered Cementitious Composites (ECC) have been in development. ECC is a material designed to be ductile and is often referred to as bendable concrete. The components of ECC are very similar to normal concrete except no coarse aggregates are used and air entrainment is not necessary. Like concrete, ECC is designed to be cost effective and has numerous potential applications, including use as a material in buildings and bridge decks, and for projects involving repair or rehabilitation work.

The focus of this paper is to present the results and work performed by the students in a junior level construction materials course to develop a type of ductile concrete. Students were required to work together in teams to perform a literature search, build beam molds, develop potential mix designs, cast beam specimens, test the specimens, and write a report. This project offered students the opportunity to develop a product that has potential use in the community, and the students really appreciated this aspect.

An Analogy Tool to Visualize Bending-Moment Diagrams

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EXTENDED ABSTRACT

This article presents the use of an analogy that assists in the generation of bending-moment diagrams for simple beams. These diagrams are first presented to students in courses on Statics or on Introduction to Structures. The analogy is referred to as the Chain Analogy and is intended to help those students in visualizing the shape of bending-moment diagrams. This is not a new tool. However, since most of the popular textbooks used in courses on Statics do not include it, the authors understand that it is not widely used in educational institutions.

The analogy is based on two similar differential equations describing two different equilibrium problems in Statics. One of them is related to the internal equilibrium of beams and relates bending moments with the external loads distributed on the beam. The other problem involves the equilibrium of a weightless, inextensible chain, subjected to the same loadings that affect the beam. Solutions of the second problem are easily visualized and can be used to assist in attaining solutions for the first one. In order to properly visualize the shape of the bendingmoment diagram, for a particular beam, with a particular loading, it is necessary to use certain details on the corresponding chain. For example, a concentrated moment on the beam requires the presence of a long rigid link in the chain. A connecting hinge in a compound beam requires the chain to pass through a fixed hoop at the location of the hinge.

Several examples are presented to illustrate the proper use of the analogy. Also, it is shown that the profiles of chains with proper lengths are exactly the same as the moment diagrams of the corresponding beams. Chains with that appropriate length have the horizontal component of their tensional forces equal to a unit force. The variety of cases presented indicates that the analogy is not restricted to certain support or loading conditions. Five examples show how to properly use it in simply-supported beams, cantilevered beams, and in beams with overhangs.

They included distributed loads and concentrated moments and loads.
The authors have used the analogy in their classes for several years now, and students who used it indicated that it is a useful tool.

Implementing a Problem-Based Multi-Disciplinary Civil Engineering Design Capstone: Evolution, Assessment and Lessons Learned with Industry Partners

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EXTENDED ABSTRACT

In response to the ABET2000 criteria and the industry feedback concerning program needs and outcomes, many Civil Engineering Programs have made fundamental changes in their curriculum. Most notable are the attempts to create capstone design experiences that provide rewarding experiences for seniors as they participate as members of multidisciplinary teams. This manuscript details the evolution of a civil engineering design capstone experience at a research extensive university that attempts to meet ABET requirements, discusses measures to assess communication competence, and presents lessons learned while working with industry partners. We provide a candid discussion of lessons learned about industry involvement, the use of actual clients, student and instructor workload management and realistic project management.

With the capstone design class focusing on the design process, the administration of the class centers on a single comprehensive design project. These projects have real clients, real engineering issues, and real impacts on the local communities. Having outside engineering firms involved with the class has been a real benefit to the student. The student teams started with the actual RFP from the client (provided by the consulting engineer) and responded to the RFP with a statement of qualifications (SOQ). The students proceeded with conceptual design (Phase 2 report), environmental impact assessment (Phase 3 report), cost estimating and scheduling (Phase 4 report), then ended the semester with the detailed design and specifications (Final report). The student teams present their detailed design to the client and consulting engineers at the end of the semester.

Even with the rewards of including real projects, real engineers, and real clients, there are numerous benefits and costs associated with collaboration. It should be obvious that the benefits include a real engineering project, gaining insight into the workings and management of a project, having access to senior and professional engineers, learning how to interact with clients, and seeing the how the design process fits together with the various stakeholders. We have been fortunate to have willing participants from industry to fill this role. In consideration of the student's perspective, the biggest challenge for the faculty and consultant is limiting the scope of the project to be manageable and

Adaptation of Groundwater Physical Models and Activities for Enhanced Student Learning

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EXTENDED ABSTRACT

Studies have shown that using a variety of teaching techniques to address the spectrum of learning styles enhances student learning. The goal of this project is to improve student interest and learning of groundwater topics relevant to environmental engineering. Specifically, the objectives are to: 1) adapt physical models and classroom demonstrations and real-world activities to provide students hands-on learning of groundwater concepts; and 2) incorporate and implement these physical models and activities in the Introduction to Environmental Engineering and Laboratory courses. The target audience of this project is sophomore- and junior-level undergraduate students enrolled in Introduction to Environmental Engineering and Laboratory, which both are required courses. The FAMU-FSU College of Engineering serves two universities: Florida Agriculture and Mechanical University, a Historically Black College and University (HBCU), and Florida State University, a Doctoral/Research University-Extensive institution. Minorities and women comprise approximately 50% of the students in the Civil and Environmental Engineering department. Thus students from underrepresented groups will be directly affected and involved in all aspects of this project.

This paper presents a summary of the physical models and real-world activities developed and implemented in the courses. The models and activities are adapted from material produced by Project WET and EPA, while the implementation into courses is based on the ASCE ExCEEd teaching model. The focus of this project are enhancing student learning of groundwater topics, including basic groundwater definitions, groundwater flow and Darcy's law, well hydraulics, and contaminant fate and transport. Overall students achieved the learning objectives and students gave positive evaluation scores for the models and activities developed in this work. In particular, students liked the hands-on, real-world, and visualization opportunities that the models and activities provided them.

Sequential Course Outcome Linkage: A New Look at the Structural Engineering Curriculum of a Civil Engineering Program

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EXTENDED ABSTRACT

In Fall of 2004, the faculty of the Department of Civil and Environmental Engineering at The Citadel adopted an expanded set of fifteen program outcomes identified in the American Society of Civil Engineers Body of Knowledge and completed the development of common course goals with appropriate levels of cognitive achievement based on Bloom's taxonomy.

In addition, the department has adopted a holistic process for investigating and analyzing the linkage of individual course goals in various discipline-specific areas of concentration within the curriculum. Sequential course outcome maps or "threads" have now been developed for each of the department's major discipline tracts (structural, environmental, site development, and transportation engineering). Through the process of developing sequenced course threads, a major objective was to identify the effectiveness of how course goals are linked within the undergraduate curriculum. This paper expands the work presented by Bower et al. [1] describing the impact of identifying threads for the environmental engineering tract by presenting both similar conclusions and some new findings that appear to be relevant only to the structural engineering tract. In addition, the process and corresponding tabulations used to quantify the analysis procedure for assessment documentation of the structural engineering tract are provided.

This work sets the stage for a department wide analysis of cognitive development assessment along specific subject matter threads.

Use of Indicator Courses in Program Outcomes Assessment

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EXTENDED ABSTRACT

The outcomes assessment process for each of the computer engineering and software engineering programs at the Daytona Beach Campus of Embry-Riddle Aeronautical University employs indicator courses: Selected subjects in the curriculum that provide information regarding the degree to which a number of program outcomes are met. Indicator courses are chosen such that they meet one or more of the following criteria: They reflect broad curricular areas; they depend on prerequisite courses; they are prerequisite for multiple courses; they are the capstone of a curricular sequence. Each indicator course should assess multiple program outcomes, and each program outcome should be assessed by multiple indicator courses. The collection of indicator courses has to achieve total coverage of the program outcomes.

Achievement of program outcomes in each indicator course is reflected in a qualitative but numerical score on course assessment forms completed by the instructor in each indicator course. Artifacts collected by the instructor to support the assessment are noted and referenced on the form. The confidence of each assessment is indicated numerically on the same form, reflecting whether the instructor has collected artifacts that support the assessment or is making a judgment based on experience and intuition.

At an annual programs assessment meeting, faculty discuss the achievement of program outcomes specific to each indicator course, then the degree to which each outcome was achieved in the whole for the program. Data for the latter includes a survey of graduating students. The approach not only requires rather limited data collection, leading to a sustainable outcomes assessment process, but also provides for a robust and valuable discussion regarding course content, delivery, and student performance among program faculty at the annual assessment meeting. The assessment meeting discussion develops faculty trust in the assessment process.

ABET EC2000: How Has It Changed? Has It Accomplished What Was Intended?

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EXTENDED ABSTRACT

Now that ABET EC2000 has been in place for several years, and most (though not all) engineering schools accredited by ABET have now gone through at least one cycle of accreditation under those criteria, schools are becoming more comfortable with the assessments and continuous program improvement which the criteria require. However, it is a fallacy (unstated and unconsidered by many) that EC2000 criteria are the same now as they were when they were first established. Each year, small changes have been incorporated into the criteria by the Engineering Accreditation Commission (EAC) of ABET. These have ranged from relatively minor, such as softening the list of requirements on constraints to be included in the capstone design project, to more major changes, such as the proposed addition of an additional criterion on Assessment and Evaluation to the current list [1], which, if approved, would become effective in the 2007-2008 cycle of accreditation visits. Even more than the wording of the criteria themselves, the guidance provided by the EAC to accreditation visitors has changed considerably over the period since EC2000 were first put into place, especially in terms of what assessment methods would be considered "sufficient" to demonstrate student fulfillment of outcomes and objectives. This paper uses on the author's years of ABET accreditation experience and the ABET documentation to discuss the changes in EC2000 and give a clear picture of the criteria as stated, and as assessed, today. The paper also draws on the recent wave of papers in the literature to discuss whether EC2000 has met its stated goals of ensuring "program improvement and quality assurance" in higher education" [2].

References

[1] Criteria for Accrediting Engineering Programs, ABET Inc., Baltimore, MD, 2006.

[2] 2003 Annual Report, ABET Inc., Baltimore, MD, 2003.

SACS, QEP, and Hindsight

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EXTENDED ABSTRACT

As institutions in the Southeastern section prepare for reaffirmation of accreditation by the Southern Association of Colleges and Schools (SACS), fundamental changes have been implemented that have a significant impact on the institution and academic programs. One of the major additions is SACS core requirement 2.12 that requires an institution to prepare a Quality Enhancement Plan (QEP). The QEP should be focused on improving some aspect of the educational component process that enhances the quality of student learning. Beyond this broad statement, the institution must develop a plan, implement the plan, assess the plan, and demonstrate to SACS with measurable results the impact of the QEP on student learning, as defined in the plan. This paper describes the QEP process as it developed at the author's home institution. The author presents perspectives as a member of the QEP leadership team and as a faculty member dealing with the QEP.

The ABET Feedback Cycle Realized through the Use of Cooperative Education in Curricular Reform

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EXTENDED ABSTRACT

The University of Cincinnati is embarking on the second century of cooperative education by creating a vibrant new partnership with faculty interested in curricular reform. Using over 200,000 data points produced annually through co-op employer evaluations we are able to create a feedback loop that shows the impact of teaching through student co-op performance. This information is being used in curricular reform projects around campus to both illuminate areas for reform and to measure the impact of changes on co-op student performance. The University of Cincinnati has been awarded a $1 million US Department of Education Fund for the Improvement of Postsecondary Education [FIPSE] grant to be used for the Development of a Corporate Feedback System for Use in Curricular Reform. Using aggregated data from employer assessments of cooperative education student work performance to measure curricular effectiveness forms a cornerstone of outcomes based assessment at the University of Cincinnati. One problem is that results may get buried in both measurement and statistical uncertainty. Enrollment numbers of a single work term may be too small to provide high measurement certainty. University of Cincinnati research shows that the situation can be alleviated by applying Six Sigma Process Stability Analysis (PSA) to data covering multiple academic years of pedagogically stable programs. Stable programs are in this context defined as mature offerings, having relatively small annual fluctuations in curricular offerings. The stability of a process allows the aggregation of statistically relevant data over a sustained period of time to look at student skill development as a function of the curriculum.

This presentation focuses on demonstrating the effectiveness of a methodology relying on comparing means and standard deviations of student work term performance indicators. The results are communicated through Mean Standard Deviation Matrixes (MSDM's) or Delta Mean Standard Deviation Matrixes (?MSDM's). Examples will be given for the Civil Engineering curricular reform project which has completed an initial feedback cycle as well as in curricular reform projects which are ongoing.

Incorporating Leadership into the Engineering Technology Classroom Though Cooperative Learning: Theories Used and Lessons Learned

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EXTENDED ABSTRACT

Leadership can be defined by many people with no consensus on the dynamics of the ever-important trait. Likewise, the integration of leadership skills into the classroom has become a mainstream goal of many educational professionals. Research suggests ways in which teachers can facilitate the leadership process in their classes, along with sound pedagogical ideas behind helping students realize their leadership potential. The ineffectiveness of "chalk and talk" activities has been widely discussed with substantial research supporting new methods of facilitating student learning. One of the most successful strategies for instilling leadership skills in future engineering professionals is cooperative learning. Small group cooperative learning environments provide an opportunity for students to work in groups, as well as create a stage for situational leadership to arise.

This paper will address basic leadership theories and their utilization in facilitating learning activities in the engineering technology classroom so that teachers may provide appropriate opportunities for students to develop leadership skills through cooperative learning activities. Cooperative learning provides critical skills such as positive interdependency, individual accountability, face-to-face promotive interaction, interpersonal skills, and group processing, which are all essential proficiencies for business and industry to cultivate company leaders for tomorrow.

Cooperative team structures have been utilized in several engineering technology classes at Western Carolina University. Among these are rapid prototyping, parametric modeling and design, and engineering materials. In this paper, some of these experiences will be described, analyzed, evaluated, and the results will be presented. While the integration of leadership into the classroom is still a work in progress, much progress has been made, and future development will reflect lessons learned.

The Satellite Design Course AENG 468 at Tuskegee University as an Example to Implement ABET EC 2000

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EXTENDED ABSTRACT

This paper shows that a satellite design course AENG 486, developed by the author during the last four years and offered to aerospace engineering students at Tuskegee University, as a technical elective, can be considered as an excellent model to implement the new ABET criteria. ABET EC 2000 is composed of eight criteria that emphasize quality and professional preparation for engineering students. The course is developed to implement criterion 3 of ABET EC 2000. Also, the instruction techniques and the assessment procedures developed by the author to evaluate the outcomes of criterion 3 for this course are presented. The new ABET EC 2000 requires a collective and coordinated work from the faculty of all engineering departments to review the course development procedure. Instruction techniques, e-learning, virtual environment, audiovisual aids, and evaluation procedure should be modified to produce students that can achieve the 11 requirements of criterion 3 of ABET 2000. Without a fundamental changes and collective agreeable plans to write the course objectives, to teach the courses in class and labs, and to evaluate the learning of the students it will be difficult to implement AEBT 2000 successfully. In an effort to give a model for faculty members, I have developed the satellite course at aerospace engineering science department, Tuskegee University, as an example for comprehensive effort to implement Criterion 3 of ABET 2000.

Organization of the Paper

The paper will cover the following topics in the given sequence:

1. Satellite design course development plan
2. Course syllabus
3. Course description and contents
4. Course activities
5. Grading
6. Instruction Techniques
7. Evaluation
8. Correlation to EC criteria 3

On Line Assignment and Laboratory System for Digital Logic Timing Diagrams

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EXTENDED ABSTRACT

With more and more universities turning toward online courses to increase enrollment and revenue, educators are turning to open source scripts to create interactive, random assignments and labs for their students.

When it comes to digital logic courses that use flip-flops and latches, the automatic generation of interactive assignments becomes a problem. How do you generate random timing diagrams for the inputs to these devices? How do you make it so a student submits the resulting timing diagram and have it accepted by an HTML form? Furthermore, how do you check the student's answer via a script so you can provide instant feedback?

This paper describes one such effort to create an assignment/lab script that allows an instructor to create interactive assignments and/or laboratories appropriate for these topics. The script will also allow the instructor to create and embed interactive simulations into the web based system, generate appropriate random inputs for students (so each assignment is unique) and then grade and record the results so the student receives prompt feedback and so that the instructor can review the results and give students further feedback.

The system is based on HTML and PHP and uses the Hamburg Design System (HADES) Framework for embedded interactive Java simulations of logic circuits.

Answering the Calls to Improve Communication

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EXTENDED ABSTRACT

Calls to improve written and oral communication skills come from both academia and industry. Other calls encourage communication across the curriculum and recommend communication-specific courses within the disciplines. This paper describes strategies implemented, in response to these calls, in a three-hour junior-level course at a four-year university. The theme Finding Your Voice weaves through both the written and oral communication components in order to increase awareness of the differences between voices used for personal communications with peers and friends and professional communications with colleagues and clients. Writing as Revision encourages a step-by-step approach to the writing process. Speaking to Learn enables the incorporation of oral communication without sacrificing course content. General requirements for writing assignments and oral presentations are explored in this paper, as well as specific topic assignments. Self assessment and peer assessment procedures are also discussed.

Analysis of Student Performance in Programming Subjects of an In-house Exit Exam

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EXTENDED ABSTRACT

This paper analyzes the performance of students in Computer Science (CS) and Computer Information Systems (CIS) in the programming subjects (Principles of Programming I & II and Data Structure) of an in-house exit exam given in years 2003-2006. The student performance was measured in seventeen different categories of computer programming. The data for each category was colleted based on student responses to questions related to that particular category. The data was analyzed with respect to whether a student was majoring in CS or CIS, and with respect to whether a student was a male or female.

The analysis of data indicates that in simple programming data types and structures, students majoring in CS performed above satisfactory level while CIS majors did not. It also shows that students of both majors did not have a satisfactory performance in complex data structures and object-oriented programming topics. Further, the analysis shows that students majoring in CS generally performed better than CIS students in most categories of computer programming. Additionally, both male and female students performed approximately at the same level.

The results of the analysis will be used to identify the problem areas and make necessary adjustments to both curriculum and teaching strategies in order to improve and enhance the long-term knowledge retention of students in computer programming subjects.

A Project Based Approach for Teaching System Analysis, Design, and Implementation Courses

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EXTENDED ABSTRACT

The department of Mathematics and Computer Science at Fort Valley State University (FVSU) offers a major in Computer Information Systems (CIS) in addition to Computer Science and Mathematics. As part of CIS curricula, students are required to complete a sequence of two courses in System Analysis, Design, and Implementation. These courses are upper level classes that are taught in consecutive semesters.

In the first semester students learn about the system planning, system analysis, and system design. A comprehensive overview of the system development life cycles is presented with emphasis on planning, analysis and design. After students demonstrate sufficient depth of the subject matter, they are divided into groups of three or four in order to carry out their information system project. Each group will select a project related to a real world business information system that will be designed and implemented during the two semesters. Some examples of projects include payroll, registration, inventory, air line reservation, and hotel reservation systems. Students are required to perform project planning, analysis, inputs/outputs design, and collaboration with an industry related to their project in the first semester course.

In the second semester students review and revise their design and start the implementation phase. Students will have the freedom of selecting a software system to be used to implement their project. For instance, some students use Microsoft Access with integration of Visual basic. Others may use Java or C++. After completion of the implementation phase students complete the support and documentation phase. In the support and documentation phase students will document their information system project and prepare a user manual that will guide any non-technical person to operate the system project. Then, students are required to present their projects for their peers and invited faculty members. Finally, students submit hardcopies and electronic files for grading.

This method of instruction teaches students how to implement the course concepts from the classroom to real-world applications. In addition, students gain a thorough practical knowledge of the system development life cycle (SDLC). Moreover, they learn how to work collaboratively and resolve conflicts in the interest of completing their project tasks.

Teaching Computer Architecture with FPGA Soft Processors

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EXTENDED ABSTRACT

Computer Architecture has traditionally been taught to Computer Science students using simulation. Students develop and test small scale processors using a hardware description language [HDL]. Building a processor in simulation can be interesting and instructive. However, the HDL experience is generally not useful for other Computer Science classes or senior projects. Complex circuits built entirely in simulation usually do not function properly if translated to real hardware. A great deal of additional effort and a much deeper understanding of transistor level and gate level hardware are required to develop a functioning integrated circuit purely from simulation. Simulated processors also lack high level language compilers, loaders or linkers. Testing is usually done with hand-written assembly code. This is reasonable for Computer Architecture but makes the simulated processor unsuitable as an embedded processor. The ideal situation would be a way that students could study Computer Architecture with processors which would actually be useful for future projects.

Field Programmable Gate Arrays [FPGA] are integrated circuits which are imprinted with arrays of logic units connected with switches. By programming the switches a logical circuit is formed. FPGA were originally developed to prototype other types of printed circuits, but in recent years these devices have developed very rapidly in capabilities and capacity. Prices for FPGA mounted on supporting boards have fallen dramatically. In addition, a wide variety of open source soft processors have become available.

A soft processor is a HDL description of a processor which may be implemented on a variety of different FPGA. For students this offers the opportunity to use real functioning computer hardware with processors that range from simple micro-controllers to complex multi-threaded superscalar machines. Compilers are available which translate various high level languages to the assembly languages of each processor. In addition, a wide variety of peripheral cores such as interface protocols and common arithmetic tasks are available and may be easily integrated into a student's design. Students using FPGA rather than simulation enjoy using actual computer hardware and they gain a valuable skill which is applicable to wide variety of other student projects.

This article discusses the use of FPGA with soft processors to teach Computer Architecture. The use of FPGA in the classroom, the various methods for programming the FPGA, and the development of a workbook and curriculum which features the Altium LiveDesign FPGA kit and the TSK family of soft processors are discussed.

Processor Performance Profiles for RFID Sensor Data Fusion

Andrew Strelzof
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EXTENDED ABSTRACT

Software defined radio is an exciting new area of research in which the basic functionality of a radio device is defined in an embedded processor. This provides tremendous flexibility in programming a variety of Radio related algorithms. Field Programmable Gate Arrays (FPGA) offers the opportunity to not only to change the code running on an embedded processor but also change the processor itself. Radio Frequency Identification (RFID) presents numerous practical problems which may be solved through the use of software defined FPGA implemented radio technology. One of the most challenging of these problems is the accurately positioning of thousands of RFID-tagged objects using multi-lateration techniques. One of the first steps in developing a robust embedded FPGA based system which can triangulate thousands of moving objects is to select a soft processor or processors on which the algorithms will run. It is expected that additional application specific hardware will need to be developed but the initial selection of a size-efficient processor is extremely important.

This paper presents initial profiling and performance metrics for Radio Frequency Identification [RFID] Positional Sensor Data Fusion using two soft processor architectures. Implementation size, code size and running time are compared for the TSK51 microcontroller and the TSK 165 RISC processor. The RISC architecture achieved faster run time performance but was less size efficient on a triangulation per logic unit used basis. This mixed result has motivated further study of the issue and the continued effort with more advanced NIOS II and TSK3000 processors. This effort and the first steps towards application specific architecture for RFID sensor fusion are discussed.

Enhancing the Teaching of the Fluid Mechanics Laboratory and Preparation for New and Continuing Teaching Assistants

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EXTENDED ABSTRACT

As with many other programs in engineering, the laboratories of junior level courses are instructional tools for the theoretical aspects of the lecture. The experiments have a fixed laboratory set-up, which educators often view as "canned experiments". As teachers, we recognize the need to integrate laboratory experiments that challenge students to design experiments, both independently as well as group projects. By adding this type of experiment, the student has the opportunity to design an experiment, to predict the outcome of a test based on prior analysis or to correlate the results of a less conventional experiment in terms of a reasonable analytical model. One of the challenges of implementing this approach is recognizing that graduate student training is limited.

The main objective of this project was to develop the methodology to enhance the training of the laboratory teaching assistants for an introductory course in fluid mechanics. We specifically want to establish a graduate training that emphasized the use of mathematical tools such as calculus and statistics, creative writing for presenting the reports, assessment of the experiment conducted and the ability to guide the students to design experiments.

The Student Participation Experiments focused on the student's experience in performing a controlled test with a number of variables. In this type of experiment questions of instrumentation, accuracy and reproduction assume a major role.

In the Student Project Experiments, the student are required to perform an initial analysis, to design the complete experiment, to calibrate the equipment, to perform the test, and to improve the equipment as needed, and to reach suitable engineering conclusions.

The introduction of the new experiments requires special training for the TA assigned to teach the Laboratory. The fact is that there is no potential graduate student with the background or experience in this type of teaching enhancement. Additionally, the introduction of these type experiments is a novel idea that limits the chances of getting potential Graduate Students with knowledge about this type of experiments.

The training outline summarizes the following points:

- Methodology to demonstrate the basic principles of applied engineering to the trainee.
- Provide training in the technique of measurement and use of equipment,
- Provide training and experience in collecting and interpreting experimental data,
- Provide training to design and conduct experiments, as well as to analyze and interpret data,
- Provide training to design a process to perform an experiment,
- Provide training to lead the students to function in a team.

Investigations Concerning Pedagogical Strategies Promoting Engineering Students' Ability to Solve Open-ended Problems

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EXTENDED ABSTRACT

This paper describes an on-going, NSF funded, exploratory research project in the Course, Curriculum, and Laboratory Improvement Program (CCLI). Though the project currently is still collecting and analyzing data, this paper seeks to relate the project's justification, goals, and methods. The research objective is to determine the best ways to introduce computing into early undergraduate mechanical engineering curriculum, focusing particularly on numerical methods and analysis. Given the importance of computing in professional engineering practice, this project seeks to improve students' facility with computers while moving away from 'cookbook' approaches which emphasize software-specific skills at the expense of more fundamental mathematical and conceptual knowledge.

When students first learn to use computers in the engineering classroom, they often learn to use the computer in a stepwise manner. However, this approach may hinder their abilities to think about the kinds of open-ended problems they will face as professional engineers. Students expecting such a 'plug-and-chug' approach are lost in the workplace – they do not solve problems well because they do not know how to start. This research focuses on finding ways to efficiently develop skills that will enable students to solve more complex problems as well as get students to think more creatively about computer-aided approaches while seeing the problems with 'cookbook' approaches for themselves.

To this end, this project's investigations are structured by four central research questions: (1) What computer experiences (STEM – Science, Technology, Engineering, and Mathematics -- or otherwise) do students have when they enter college-level engineering class? (2) In what ways does varying the timing of the introduction of computer techniques affect students' expectations and creative use of these methods? (3) In what kinds of problems does the computer specifically enhance understanding? In what kinds of problems does the computer act as an obstacle to understanding? (4) How can we emphasize the importance of setting up problems for computer-aided solutions instead of emphasizing the results of the process? These questions are investigated through a sophomore course in numerical analysis. All four areas are the source of several experiments using different teaching strategies and methods.

Technical Writing for Engineering Students: Using Tenets of the National Writing Project for Effective Writing Instruction

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EXTENDED ABSTRACT

The professional world demands people who can think critically and creatively, but those who can express their ideas effectively are in even greater demand. Too often engineering students question their need to both write well and write for a combined audience, one comprised of both experts and lay readers. Therefore, the need for future engineering professionals to develop stronger technical writing skills has become crucial. In particular, this article presents writing instruction techniques that address the growing demand for engineers to communicate in a clear, concise manner. The Accreditation Board for Engineering and Technology, Inc. (ABET) recognizes the importance of successful communication practices, listing "an ability to communicate effectively" as one of its 2005-2006 Program Outcomes and Assessment criteria for accrediting collegiate engineering programs.

Tenets of the National Writing Project (NWP) initiative encourage sensible writing instruction that aims toward helping students adopt effective writing practices, which include developing logically arranged documents that adhere to conventions of grammar, punctuation, and spelling. This article discusses incorporating experience from the West Tennessee Writing Project, an official site of the NWP, into a collegiate-level technical writing course for junior- and senior-level students from a variety of engineering disciplines. Topics covered include the importance of emphasizing the analysis of audience and purpose in technical writing; of spending time teaching writing skills and strategies rather than focusing solely upon corrective measures; of providing sample templates for writing assignments; of analyzing exemplary and non-effective student writing with students; and of using the iterative writing process and multi-disciplinary peer reviewing to inform student revising and editing practices.

What Happened To This Course?

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EXTENDED ABSTRACT

This paper addresses the concerns professors have regarding the currently accepted first year curriculum, specifically textbooks, for Electronic Engineering Technology students. For many years, technology textbooks have retained essentially the same content, with few, if any, changes. While certain scientific principles have not changed over the years, the students in these classes and the technology around which the courses are built, most decidedly have changed. The textbooks should adapt to meet the needs of current students and the needs of the industry.

The revised freshman level course adopted that new textbook which utilizes a building block approach, allowing students exposure to the 'building blocks'. Additionally, the lab experiments have been modified to mirror the book. Students don't have to 'wait' until the next semester to get the picture of why the coursework is being presented. The department has experienced a drop in both the withdrawal and failure rates and the students' response has been an increased interest in course material in their critical freshman year in school.

For engineering technology to recruit, retain and successfully graduate talented, educated individuals, we must develop a new textbook with a corresponding syllabus, and a new curriculum that meet the needs of today's students. By redesigning the accepted textbook layout and format, and by designing lab coursework to coincide with the information in that textbook, we should experience a drop in both withdrawal and failure rates of students. Increasing student interest and satisfaction in their critical freshman year in school would be a bonus as well.

The Impact of Engineering Design Projects on Student Understanding of Engineering's Societal Impact

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EXTENDED ABSTRACT

ABET, as part of its expected program outcomes, states that programs must demonstrate that their students have the education to "understand the impact of engineering solutions in a global, economic, environmental, and societal context." Many engineering programs address this outcome through various design courses and capstone projects. The engineering programs at the University of Tennessee at Chattanooga (UTC) are no exception. These courses embed economic, environment, and global contexts in either the specific projects or through class discussions or invited presenters. However, more difficult to address and to ensure student understanding of is the impact of engineering solutions in societal and global contexts.

The Engineering program at the University of Tennessee at Chattanooga (UTC) is composed of Civil, Chemical, Environmental, Electrical, Mechanical, and Industrial emphases, and offers both a freshman and a combined junior/senior interdisciplinary design experience. Both experiences require students to participate in customer sponsored projects. However, the customers and the ultimate goals of the projects vary. Some projects are supported by a grant from the Tennessee Department of Education that focuses on providing or improving assistive technology for young children. Other projects support local industry sponsored projects. Still other projects are sponsored by the college or faculty in the college and provide either specific products for faculty or large products for regional and national competitions or support faculty research. These projects have the usual expected outcomes for design projects. One of the expected outcomes is that students be introduced to and experience the impact of societal concerns and global issues on engineering decision making. But, due to the variation of project types, this is not necessarily an outcome that is easy to measure. What is being questioned is whether all students are being provided opportunities to address this outcome.

This paper addresses the above question by first defining what is meant by "societal" and "global" context as they apply to engineering applications; second, by providing an introduction of how these issues are presently being addressed by the engineering education community; and third, by describing how students of four types of UTC student projects – industry supported, foundation supported , contest based and research based – are introduced to and experience societal and global context applications. The findings are based on UTC Freshman and Junior/Senior interdisciplinary design sequence projects during the 2005 and 2006 academic years.

An Innovative Student Engagement Project: Lessons Learned from a Log Cabin

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EXTENDED ABSTRACT

As an element of its fundamental mission of teaching and learning, Western Carolina University aids businesses, industries, and individuals in western North Carolina through the expertise of its faculty, staff, and students. "Engagement" is a valuable commodity among professors who seek to provide appropriate experiences for their students, as well as assisting emerging business and industry in the region. Innovative professors supplement classroom instruction and lectures with student engagement projects that provide real life, hands-on experience for their students. These projects will provide an important approach to university students today who demand to know "why." This paper will describe how one particular project was integrated into Engineering Technology classes at WCU.

During the fall semester 2005, students in the Engineering Materials and Processes class was asked to perform an air conditioning load survey for the owners of a local, historic restaurant. The class calculated the required amount of air conditioning for the building and provided a technical report for presentation to the owners. The report would be used to provide a contractor with sufficient information to purchase and install the recommended equipment.

Design considerations for the structure were:

- Inside design temperature of 76 degrees F.
- 20 CFM of ventilation air needed per person per ASHRAE 62-2001 [1].
- Outside design temperature of 85 degrees F.
- No humidity control would be considered for afternoon and evening operations.

The project challenged the students with a real world design problem involving several different areas of study including ethics, design methodology, architectural design and financial analysis.

Students were also exposed to concepts of heat conduction and insulation properties of various building materials, report writing, presentation, and public relations. In addition, the project captured the interest of students and provided a means for professors to present material in a unique format. The project was used in conjunction with lectures and labs to address ABET learning outcomes in an innovative learning environment. Additional emphasis was placed on collaboration strategies and teaming approaches as applied to project management. In this paper, student experiences are evaluated, feedback from the business is provided, lessons learned are described, and results of the study are presented.

A Study on the Use of Knowledge Representation for Teaching Engineering Problem Solving

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EXTENDED ABSTRACT

The author introduced in a sophomore design class the Fuller-Polya Diagram (FPD) for problem solving, a simple structured method for knowledge representation of deterministic engineering algorithms. The FPD proposes a formal language and graphics approach when the equations or procedures are known to exist, but they may be unknown (e.g. yet to be determined) or non-mathematical (e.g., meta-operations). A study is presented on the students experience when solving problems with and without the help of the FPD methodology; this work indicates the feasibility of introducing the FPD at the sophomore level. A standard questionnaire is used to evaluate the method and to survey students' opinions on the usefulness and helpfulness of the learning experience. Remarks for teaching the FPD and for further study are discussed.

Teaching Heat Transfer Concepts using Thermal Imaging Techniques

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EXTENDED ABSTRACT

This work explores the educational applications of thermography in teaching heat transfer concepts to undergraduate students. Thermography helps students effectively visualize heat transfer phenomena particularly in two and three dimensions.

Experiments were designed to demonstrate one-dimensional heat transfer in metal rods, two dimensional heat transfer in a metal plate using various boundary conditions, and convective heat transfer in fluid. The data obtained through these experiments, including thermal imaging video clips, was made available to students enrolled in instrumentation and physics courses. Using these thermographic data, students could physically observe heat transfer phenomena that otherwise would have been difficult to visualize. For instance, in the metal rod experiments, students promptly grasped the concept of one-dimensional heat transfer affected by the boundary conditions and the rod's ratio of length to radius. In the plate experiments, students could easily observe the diffusion patterns of heat transfer from a heat source at the center of plate throughout the entire plate. Similar observations were made in other experiments.

In addition, students compared the data with the predictions based on existing theoretical models to learn the effects of environmental factors on measured data, error sources, and modeling approximations.

An Engineering Capstone Design Course Taught in a Collaborative University/High School Setting

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Virginia Tech

EXTENDED ABSTRACT

Senior mechanical engineering students at Virginia Tech are required to take a two-semester engineering capstone design course. Students have many choices including working on industry-sponsored projects, design projects in the context of research problems, national design/build competitions such as SAE Formula and Mini Baja, and a recently established educationally-focused project. This educationally-focused project requires students to design and build one or more educational tools (such as a testing device or a piece of hands-on educational equipment) that will help high school teachers who are working with FIRST Robotics teams communicate to their students the essential elements of the engineering design process while creating an environment to facilitate more interest in technical fields by students. The yearly FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition is a national program for high-school students who are given six weeks and a "kit of parts" to design and build a robot which performs a prescribed set of tasks.

This paper will describe how senior mechanical engineering students were placed in a mentoring role and completed their own design and build project related to this activity. The project is novel in that unlike other design projects, engineering students receive significant formal leadership training to facilitate their effectiveness as mentors that will translate directly into their future professional and outreach activities.

Animation Software for Vibrations Courses

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EXTENDED ABSTRACT

Three software modules for upper-undergraduate/first-graduate-level vibrations courses are presented. In all modules, the ability to quickly view the animated motion for user-specified conditions is paramount. All modules use the Visual Basic platform.

The first module treats single-degree-of-freedom spring-mass-damper systems. In addition to simple animation for specified conditions, this module also has the novel feature that any one condition can be continuously varied while holding all other conditions constant, and the corresponding displacement, magnification ratio, and phase lag plots all correspondingly change. The second module treats vibrating systems of up to three degrees of freedom. The user can specify all of the masses, spring constants, dampers, external forces, and initial conditions, and then watch the system in action, with corresponding plots of the displacements being simultaneously generated. The third module treats the transverse vibration of uniform beams. Any classical end conditions, along with attached particles and rigid bodies, can be specified. The natural frequencies are calculated and displayed, and any one of the first few modes of vibration is then animated.

A demonstration of the software will be the main feature of the oral presentation. In addition, student feedback will be presented.

Introduction of Dynamics Laboratory in MET Program

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EXTENDED ABSTRACT

Dynamics is scheduled as a sophomore level second semester class in the Mechanical Engineering Technology curriculum at Georgia Southern University. It is currently a four credit hour course out of which one credit is separately assigned for a two hour lab session. However, these lab hours were primarily used as interactive problem solving sessions.

In the present work, the author introduced three separate physical laboratory experiments in the course while retaining most of the hours for problem solving sessions. The challenge was to introduce a "hands on" component in the course in compliance with the philosophy of a technology program without the requirement of a high level of report-writing skill. The first experiment was the motion analysis of a toy cart where the data was collected and analyzed using National Instruments' hardware and LabView software. The second experiment was the determination of the mass moment of inertia of cylindrical object using the torsional pendulum principle. These two experiments were severed from the current lab-based Mechatronics course and a senior level elective Vibration course to free up their lab hours for more advanced topics. The last experiment was the determination of coefficient of restitution. This is experiment is still in the developing stage. A Newton's pendulum was modified to build the experimental set up. Students were asked for their suggestions to improve the accuracy and method of this experiment. The optimum method will be adopted for future use. A detailed survey was conducted which shows a positive opinion of the students about the introduction physical lab experiments in the Dynamics course. This work brings the undergraduate student research component into the course.

Evaluation of Bessel Functions Using a Computer Program

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EXTENDED ABSTRACT

In cylindrical coordinate, there are two types of Bessel functions. These functions are the Bessel function and the modified Bessel function. Both functions are expressed mathematically by infinite power series, and each one consists of different orders, beginning with the zero-order, and then the first order, the second order, and so on. The Bessel function is the solution of the Bessel differential equation, which is a linear, second-order ordinary differential equation. Similarly, the modified Bessel function is the solution of modified Bessel differential equation. The difference between these two differential equations is the signs of the non-differential terms.

The applications of Bessel functions are in the scientific areas of elasticity, electrical field theory, aerodynamic flutter analysis, fluid flow, and heat transfer by conduction.

Based on two previous research projects conducted by the present author, which have been published in two ASEE Southeast Section Conference Proceedings (2004 and 2005), an executable computer program has been developed in this study for the computation of the Bessel functions and the modified Bessel functions. For a large range of the independent variable, that is, R=0 to 13.0 with an increment of 0.10, the functions are presented in the form of numerical tables from zero-order to the third order. The program can also be executed interactively for a series of input values of the independent variable R. In conjunction with the use of a desktop or a laptop computer, this interactive execution of the program provides immediate feedback of numerical values of Bessel and modified Bessel functions. The executable computer program is named BESSEL.EXE. A free copy can be obtained from the author by contacting him through his e-mail address.

Global Engineering Education Opportunities: A Survey of Selected ASEE SE Universities

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EXTENDED ABSTRACT

In today's integrated global economy, engineering collaborations span the globe. In fact many companies are looking for students who are willing to operate in a dynamic, global market. Thus, a key part to engineering education is to prepare students to be effective engineers in the international arena.

Opportunities need to be provided for students to travel, study, and work abroad for the purpose of deepening their understanding of other cultures and other ways of doing business. These opportunities will enhance their experiences from an educational, cultural and professional standpoint.

Offering a range of study abroad opportunities will provide options to the students that would best fit their educational goals, as well as, meeting their time and financial considerations. This paper will present a survey of study abroad programs from selected universities in the ASEE SE region that provide global engineering education opportunities for engineering students. The documentation and characterization of existing programs provides a foundation for forums to discuss topics of mutual interest, better understanding the problems/risks and rewards associated with the programs, comparing alternative study/work abroad models, and developing collaboration among programs. The paper also outlines the study abroad programs at Mississippi State University and the strategic plan for increasing participation of engineering students in international programs.

The efforts to survey study abroad programs at the universities in the ASEE SE region via the universities' websites did not provide very much information. To say that study abroad program opportunities do not exist at these universities is not true. The difficulty in finding the information may lie in the fact that it is well hidden with in the website and using the search engine of the website does not reveal any information. This problem still plagues Mississippi State University. Recent efforts have been made to make this type of information easier to locate at the MSU Bagley College of Engineering website and even though improvements have been made the conclusion is that more improvement is needed.

International versus US student enrollment into Graduate Programs in Computer Science

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EXTENDED ABSTRACT

In the US, graduate education has become a successful enterprise, serving the important needs of sustaining US leadership in various fields. It is an approximate $13 billion dollar industry. Many Science and Engineering (S&E) programs in the US rely greatly on foreign students and skilled workers. Enrollment of international students has waxed and waned in the past decade. The 2004 Council of Graduate Schools *(CGS) International Graduate Admissions* survey found sharp declines in both the number of applications and enrollment of international students in US universities. The 2006 CGS survey suggests that US universities are beginning to see improvements in international admission and enrollment. Though the growth in 2006 may seem little, it is a notable improvement over 2005. India, China, and Korea are the top three countries for providing international students in the US. This encourages focusing on these three countries which are hugely responsible for changes in international student enrollment over the years. Though students from countries in the Middle East were included, their numbers were significantly low to influence total international enrollment. About 73% of international graduate students enrolled at the institutions that participated in the survey were in fields of business, engineering, social sciences, physical sciences, and life sciences. Engineering and business gained in total number of international graduate students in 2006 while other fields declined.

Many universities are recruiting more students since 2004. This may be a prospect for the US software industry as more and more employers are relying on foreign born students and workers. Though the numbers from the past two years suggest improvement in the international student enrollment, there are chances that these improvements may not follow through in the coming years. Many countries are now realizing the potential of these foreign born students and employees who bring enormous knowledge and strength along with them, and are creating immigrant-friendly polices and the infrastructure in order to attract them. The current job market obviously encourages many students to opt computer science because of the high median annual salary when compared to many other science and engineering programs. Universities need to exercise new marketing programs overseas in order to recruit these students and the government has to support by making necessary amendments to immigration polices.

This paper discusses the variations in the international student enrollment in graduate programs in the recent years in universities in the United States. The focus is on the variations of enrollments in graduate programs in the fields of Science and Engineering with an emphasis on Computer Science. This paper discusses the survey data of CGS and Taulbee surveys with respect to variations in international graduate student enrollment, particularly in Computer Science (CS). It points out the changes that international graduate enrollment has undergone in the past decade. It also notes briefly the changes undergone in the undergraduate enrollment using the CRA Taulbee surveys. The paper also discusses the enrollments of US students in comparison with that of international students in graduate programs. It tries to find the possible reasons for recent changes in international graduate enrollment.

Gateway into First-Year STEM Curricula: A Community College/University Collaboration Promoting Retention and Articulation

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EXTENDED ABSTRACT

This presentation will summarize an NSF STEP collaboration between Wright State University (WSU) and Sinclair Community College (SCC) to develop a common first-year STEM experience, which aims to increase first-to-second year retention at both SCC and WSU, as well as articulation of STEM majors from SCC to WSU. The approach is intended to be readily transferable to other community college/university dyads in urban settings with comparable open admission policies.

STEM attrition is a problem throughout the 4-6 years of college study; however, the first-year experience (FYE) is most critical to retention of students in STEM disciplines. Thus, a focus on promoting success in the first year will help to ensure that students remain in STEM disciplines, as opposed to switching majors or dropping out. The primary barrier to success in Engineering/Technology is the mathematics "gateway" calculus sequence; the barrier to success in Science/Mathematics is general innumeracy and scientific illiteracy. Prior NSF support of WSU's National Model for Engineering Mathematics Education has shown that the introduction of EGR 101 "Introductory Mathematics for Engineering Applications," coupled with a significant restructuring of the early engineering curriculum, has resulted in a significant increase in first-to-second year retention, as well as increased student motivation and confidence in math and engineering. Based on this prior success, the current NSF STEP initiative will: 1) Implement EGR 101 and the associated engineering curriculum reforms at SCC. 2) Develop a companion lab-based class for science majors (Scientific Thought and Method), SM 101/ASE 101, for instruction at both WSU and SCC. 3) Provide professional development opportunities for faculty at both institutions. 4) Train STEM seniors/graduate students to serve as lab/recitation assistants and peer tutors for any introductory STEM classes. 5) Disseminate the curriculum and associated first-year experience.

The above educational treatments will make the curriculum substantially more accessible to all incoming students, and particularly to those who have been historically underrepresented in STEM disciplines. This model is therefore highly appropriate for other metropolitan university/community college dyads with similarly diverse enrollments. While this NSF STEP initiative has only just begun, this presentation will provide an overview of the motivation, goals and development to date of the program.

A Regression Model to Predict the Graduation Rates

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EXTENDED ABSTRACT

Higher education is accepted as a key factor in upward social mobility and an emerging requirement for membership in the American middle class. Therefore, the baccalaureate degree serves as an institution's de facto certification of an individual's knowledge and success. However, despite the value of the baccalaureate, the National Center for Educational Statistics estimates that 16% of first-time undergraduates in public 4-year institutions leave in their first year of enrollment, and of these students 36% never return to postsecondary education. Furthermore, of baccalaureate graduates who attend 4-year public institutions, only 27% graduate in four years and approximately 12% take more than ten years to complete their degree (NCES, 2001). In addition, universities with engineering programs usually attract more highly qualified students, but the actual graduation rates in universities with large engineering programs are often below the predicted graduation rates.

Retention and graduation rates for undergraduates have received considerable attention in higher education and public discourse. Naturally, colleges and universities have been forced to focus more attention on graduation and retention rates, because average time-to-degree is a contributing factor to the rising cost of an undergraduate education. Furthermore, the extended time required to graduate further exacerbated the growing recognition that the United States needs to increase the production of engineers in order to remain competitive in a global economy.

Recently, the President of the University of Tennessee has revealed a new strategic plan. The key elements of this plan are the student access and success, research and economic development, outreach and globalization. In order to improve student access and success, a clear understanding is required of the variables and attributes that control predicted and actual graduation rates.
This paper will present a regression model used to calculate predicted graduation rates and compare them to the actual graduation rates for the College of Engineering and Computer Science at the University of Tennessee at Chattanooga. Some of the variables that are considered in this model are the high school grade point averages, ACT scores, math placement test scored, age, the proportion of undergraduate students that are enrolled part-time, etc. Attributes to be examined will include gender and ethnicity.

High School Engagement Activity: The Iron Egg Launch Design Competition

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EXTENDED ABSTRACT

This paper describes a university engagement activity designed to develop interest and excitement in science and technology through a non-athletic competition.

Background

This activity began with the design and implementation of an Iron Egg Launch Design Competition for teams of high school students in a two county area of the state. Since the execution of this contest in 2004, the event has opened up to high school teams in thirteen counties in the state, has garnered financial support from local businesses, and has the potential to expand to ten locations throughout the state with a final grand champion competition to take place on the main campus of the university.

Benefits

This university engagement activity provides many benefits and opportunities to those involved as it allows for the participation of students already interested in science and technology to have hands on experience; makes for an environment to entice new students to the areas of science and technology through competition; builds a partnership between the high schools and the university; strengthens relationships between classroom teachers and university faculty and staff; and provides an avenue into the classroom for university faculty to continue to build interest for careers in the field of science and technology.

University of Louisville Nanotechnology Fellows Symposium: Extending Engineering Excitement to High School Educators

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EXTENDED ABSTRACT

This paper reports on the first annual University of Louisville (UofL) Nanotechnology Fellow Symposium (NTFS) held on July 27, 2006 at the Belknap Research Building at UofL. Educators interested in generating enthusiasm for engineering in secondary schools should find this paper to be of particular interest. This initial offering of the NTFS was open to all secondary school educators in the disciplines of math and the various branches of science within Jefferson County Kentucky in both the public and private school systems. Eleven teachers attended the event representing six public and three private schools.

The event was divided into four basic components: presentations on Nanotechnology and the research being conducted at UofL, a short tour and explanation of the cleanroom facilities at the university and the associated equipment, presentation of a microfabrication experiment suitable for high school students and an open forum between the hosts and attendees on outcomes of the day and areas for suture improvement.

A very high level of interest was displayed regarding the nanotechnology presentations and the possible implications of the field to current high school students. This paper will present some of the concerns raised regarding student interest in the fields of engineering and engineering research along with other lessons learned from this first offering of the Nanotechnology Fellows Program. Details of the microfabrication lab presented will also be given, as this will be used as a blueprint for future examples and classes. Given the success of this first event, plans are currently under way to not only host this event annually, but to expand the model to include a larger group of secondary educators through out Kentucky and the region and a similar offering to be open to freshman engineering students at UofL to help them see the answer to the eternal question of "when will I ever use this?"

Graduate Student Mentors in REU Sites

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EXTENDED ABSTRACT

The Research Experiences for Undergraduates (REU) program supported by the National Science Foundation is designed to provide academic experiences for undergraduate students through participation in research. This program has been implemented in the Department of Computer Science and Engineering at the University of South Florida (USF) for the last two years. During the 10-week summer research program, students work on independent projects under the supervision of a faculty mentor and attend several educational and social activities.

Summer REU Sites are very resource demanding, before, during and after the program. Faculty mentors need to define the research projects and the minimum requirements before the program is started so projects can be advertised for interested participants. They also participate in the selection of the students, prepare lab infrastructure and work space, spend time mentoring the students during the entire program, and several other activities. As a result, faculty mentors have frequently utilized graduate students to help them in several of these activities.

In this paper, we focus our attention on the role of graduate students as undergraduate mentors, and its impact on the students, faculty and the objectives of the REU program. Moreover, we provide some guidelines and suggestions to make this role a powerful opportunity for each of the parties involved in the program. Based on our experience, and on information collected from students and mentors through surveys and interviews, we show that graduate mentors contribute to achieve the REU program's goals, and that the mentoring experience is beneficial to both, graduate students and faculty.

For the REU program goals, it is shown that graduate mentors provide to undergraduate students a permanent and qualified guidance to succeed in their research project, facilitate collaboration and independent work, and give them a broader and real perspective of what research and graduate programs are all about. For the graduate mentors, this experience enhances their mentoring skills and contributes to their research progress. For faculty, this strategy gives them the opportunity to have low time demanding REU students contributing to their graduate students research and publications. Finally, REU students develop an academic friendly relationship that facilitates their progress and commitment with the program goals.

In order to further improve the experience and better achieve the goals of the REU program, it is recommended to give graduate students a formal workshop on mentoring skills, teach them how to become role models and influence REU students, and allow them to participate in the design and planning of the research project. REU programs, at the same time, are well established training sites where graduate student mentors can improve these skills.

Fostering Research in Aerospace and Mechanical Engineering Undergraduate Curricula

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EXTENDED ABSTRACT

One way to foster undergraduate research is implementation of a research component at senior-level undergraduate courses. Typically, mechanical and aerospace curricula are very structured with major portions devoted to mathematics, physics, material science, thermal science, mechanical system, and courses in other areas. This leaves little time to implement a research component. One opportunity to facilitate undergraduate research and involve students' skills in solving non-traditional scientific and engineering problems is in senior design projects. Over last five years University of Tennessee Mechanical, Aerospace, and Biomedical Engineering Department has offered undergraduate students "microgravity" senior capstone design projects as part of NASA Reduced Gravity Student Flight Opportunities Program. In comparison with traditional design projects these projects have a well-developed research portion, which includes research experiments onboard NASA "Vomit Comet", data analysis, and scientific reporting. The main features of this approach to implement a research component in undergraduate curriculum are: involvement of students in cutting edge areas of science and technology; fostering student interest in science; providing the opportunity to use basic knowledge in real scientific research; and recruiting talented students for MS and PhD programs. Starting in 2002-2003 academic year three microgravity research projects were performed with a focus to investigate two-phase fluid flows and mass transfer in microgravity conditions. "Making a Mixing Measurement of Two-Phase Flow" project simulated film boiling using air injected in a vertical pipe liquid flow. "Heat Exchange Research and Condensation Evaluation by Utilizing a Liquid/Fog Experimental Setup" investigated peculiarities of forced - flow condensation using saturated air-water mixture flow. "Simulation for Confirmation of the Onset Correlation of Liquid Potassium Entrainment" simulated liquid droplet entrainment in vapor flow and investigated entrainment interaction between air and water in annular - flow regime. The overall experience included scientific research, hands-on experimental design, test operations, and educational/public outreach activities. While projects mainly focused on research, they involved a great deal of design activity preceding the research portion of the projects. Five years of participation in NASA Reduced Gravity Student Flight Opportunities program has demonstrated amply that these programs are not only very suitable as capstone design projects, but that they also provide senior students unique opportunities to apply their knowledge to real scientific problems and improve their analytical abilities. A large percentage of students that participated in microgravity teams as undergraduates applied and successfully enrolled in graduate programs. At the same time interesting scientific results were collected from the flight tests and presented at annual AIAA Aerospace Sciences Meetings and Exhibits in Reno in 2004, 2005 and 2007.

Assessing Outcomes in a Communication-Intensive Course

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EXTENDED ABSTRACT

Educators from various disciplines endorse and support the assessment process. Though outcomes assessment processes are often informal, such as via the comment from one professor to another "My students are better engineers/programmers/writers/speakers because they were in your class", the process needs to be formalized. Stakeholders expect accountability. Accreditation agencies require programs to assess outcomes at the course level and at the program level in order to demonstrate effectiveness in meeting stated objectives. This paper describes methods implemented in a discipline-specific content-oriented three-hour junior-level course at a four-year university to assess the outcomes of written and oral communication components. Levels of assessment implemented at various stages in the writing process include self assessment, peer assessment, assessment via consultation with a writing tutor, and self-assessment of the overall process. Sample Self Assessment and Peer Assessment forms and procedures are examined. Assessing outcomes of the oral component is determined in part by analyzing the pre and post data provided by students on a Personal Report of Communication Apprehension survey form.

Undergraduate Research: Challenges, Rewards and Lessons Learned

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EXTENDED ABSTRACT

Undergraduate research has both challenges and rewards. This paper describes both through the authors experience with two undergraduate research projects conducted in the recent past and present. The paper includes descriptions of the projects, the methodology employed by the faculty advisor, and the lessons learned from each experience.

The challenges of conducting undergraduate research are well documented in the literature, they include; lack of student in-depth topical knowledge, minimal student understanding of research procedures and methodology, and poor student time management skills. The rewards include student enlightenment, student maturity, and student appreciation for the role of research in the engineering community.

Two electrical engineering research projects conducted at The Citadel are discussed. Both projects were composed of multiple students and completed work in less than one year. The first project was composed of three students conducting signal processing research using software simulation of non-linear filtering techniques. This project resulted in a peer reviewed paper and presentation at a sectional IEEE conference. The second project is ongoing (but nearing completion), and is composed of a two student group studying the application of wavelet analysis to digital communication signal demodulation.

Although many lessons were learned, this paper discusses project selection; the importance of topical tutoring, the advantages of using small groups of students, how less gifted students can contribute, setting goals and how to measure progress.

Engineering and Computer Science in Robotic Development

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EXTENDED ABSTRACT

Purpose

The purpose of this paper is to act as a parallel to undergraduate research, performed by the author, aimed at developing a robot platform capable of cooperating with other entities of a multi-agent robotic system using stereoscopic vision. The project outlines design decisions and their rationale. This approach allows a reader not only to follow the design process of the author, but also to understand the principles that make the design possible. The project is also designed to be entirely modular, providing libraries and reconfigurable systems which allow future researchers to incorporate existing work into new projects.

Methods

The methods used to implement each module of the project are greatly varied, but are all built upon the principles of modularity, portability, and abstraction. By constant adherence to these design principles, the final product can be disassembled, rearranged, and modified by researchers in order to apply the present work for new purposes.

The hardware of the robotic platform is separated into the chassis, motor and encoder, and motion controller circuitry. Each area, though dependent on others for functionality, is self contained and may be interchanged with minimal effort.

The software is divided into the following sections:

1. Operating System – The operating environment for the robot control software.
2. Controller Interface – A software module providing a layer of abstraction between the low-level interface of the motion controller and the high-level logic module.
3. Camera Interface – A software module to provide a simple, high-level interface to other software modules.
4. Image Processing – A software module to extract the necessary information from images provided by the camera interface.
5. Logic Module – A software module to determine the correct path and distance to objects based on information provided by the image processor.

Conclusion

The hardware platform has recently been completed and a working software prototype is expected by January, 2007. At that time, the full prototype will be tested, improved, documented thoroughly, and the software released for use by other researchers.

Research in Nine Weeks – Can It Be Done?

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EXTENDED ABSTRACT

Preparing to work with undergraduates in a research endeavor can be an intimidating task if the goal is produce students who can do independent research at the end of nine weeks. Add to the challenge that the projects are multidisciplinary within engineering - mechanical, electrical, chemical, and technology - existing in a field that many undergraduates have limited educational experience with, lost foam metal casting, guarantees an exciting summer. Making good use of existing models, Tennessee Technological University hosted a National Science Foundation sponsored Research Experiences for Undergraduates (REU) site: Industrial application of Sensing, Modeling, and Control during Summer 2006. Highlights from the programmatic design of the REU site will be presented. Special emphasis will be given to a unique aspect of the program, a sponsored one-day workshop called Mentoring the Mentors for faculty interested in guiding research with undergraduates. Lessons learned from the preparation and delivery of the workshop as well as informal assessment of the level of independence achieved by the ten REU students from Summer 2006 will be shared.

Learning the Stiffness Method with FORTRAN, Excel and MathCAD

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EXTENDED ABSTRACT

The stiffness method for structural analysis has been taught at the undergraduate level for several years. FORTRAN, MathCAD and Microsoft Excel have all been used in the civil engineering department at VMI when teaching the method. Recently, a comparison was made between these three software tools to determine which was the best for learning the method.

The stiffness method begins by isolating members and writing the member end forces in terms of loads and deformations. Joint equilibrium equations are written in terms of these member end forces resulting in a linear set of equations with deformations as the unknowns. This set of equations is modified for support conditions and then solved yielding values for deformations. These known deformations are substituted into the original equations for member end forces. Deformations and member end forces serve as output.

At VMI during the 1980's and early 1990's, FORTRAN was taught in a dedicated course during the sophomore year and used as the primary software tool for teaching the stiffness method. There are three basic problems learning the stiffness method when using FORTRAN – input/output, syntax and conceptual understanding.

MathCAD© is a powerful equation solving software tool ideally suited for engineering problems. One advantage MathCAD has over FORTRAN is that it is far more visual yet syntax can still be a hindrance to learning.

Using Excel to learn the stiffness method has definite advantages over MathCAD and FORTRAN. Like MathCAD it is more visual than a formal programming language but its syntax is much easier. Excel seems to be the best tool for learning the stiffness method.

Using Mathcad Debugging Functions as a Teaching Tool

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EXTENDED ABSTRACT

Based on experience gained from a combined forty-plus years of teaching programming in several languages, it appears that one of the critical points at which students encounter difficulty is when loops are introduced. The difficulty escalates when subscripted variables (arrays) are used in the loops. To teach these features in Mathcad, the authors have employed several techniques, including explanations of example programs, flowcharts, pseudocode, hands-on electronic workbook, and frequent tests and assignments. No single technique has eliminated the barriers to learning, particularly for weaker students.

When Mathcad was selected a decade ago as the programming language, a technique was lost that had been available in languages used previously – the ability to demonstrate during the early stages of instruction what happens to loop and non-subscripted variables during line-by-line execution of a loop. With earlier versions of Mathcad, only after arrays were introduced could students see actual output associated with a function, and by then many weaker students were struggling to catch up. With Mathcad 13, several new debugging functions have been added that allow the user to see annotated line-by-line output as the loop is executed. In addition, the debugger allows execution to be suspended to examine output at a given point in the loop, and the user may step through the loop interactively, observing the output during each pass through the loop. The purpose of this paper is to describe how this new feature has been incorporated into an introductory programming class and assess whether the feature has improved the teaching and learning of loops and subscripted variables.

Survey results from students taking the computer applications class indicate that loops and subscripted variables are difficult topics. In addition, student responses showed that the new debugging tools helped to improve understanding of loops and subscripted variables. While the new features were perceived by over two-thirds of the students to be helpful in the teaching and learning of loops and subscripted variables, other teaching methods such as doing weekly assignments, preparing for weekly tests, "playing computer," and working with on-line electronic workbook files were found to be more valuable aids for learning. Students identified the most difficult topic to be nested loops, which is currently being taught as the last topic in the programming sequence. However, three of the relatively difficult topics were taught in the first two weeks, which may contribute to the difficulty experienced by students when they first encounter loops.

The Role of Computer Based Homework for Engineering Design Courses

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EXTENDED ABSTRACT

Evaluation of students in engineering design courses remains a key challenge to educators. While the evaluation techniques presented by computer based homework may not seem applicable to design courses, a basic understanding of the ASCE Body of Knowledge, Bloom's Taxonomy, and its use as a measure of achievement within the Body of Knowledge allows for the development of meaningful assignments. The key to success is to clearly understand the role of such assignments, and then design questions to meet that stated intent. Well designed homework assignments can then take their place among other evaluations, such as tests or projects, to provide a comprehensive evaluation of student levels of achievement in an engineering design course.

This paper begins with three brief descriptions. First, a description of the ASCE Body of Knowledge, a collection of 15 educational outcomes desired of engineers both before and after licensure. Following is a description of Bloom's Taxonomy, a learning taxonomy which divides the cognitive domain into six levels, and which was used by ASCE to draft Levels of Achievement Applicable to the Body of Knowledge. The final brief description is of the draft Levels of Achievement, especially considering the Body of Knowledge Outcome Rubric, and how it can be used both as a tool in developing courses and in designing student assessments.

The remainder of the paper is devoted to investigation into the relative ability of computer based homework to evaluate different achievement levels, including the differing amount of intervention required (or the amount of automation available) for typical question types. The paper uses as an example a highway design course, including information from a typical course syllabus, intent of that course's computer based homework, role of the homework in the overall student evaluation, and sample problems addressing different levels of achievement.

Engineering Economy: Getting Personal

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EXTENDED ABSTRACT

To some, sitting through an Engineering Economy lecture can be as interesting as watching paint dry. However, throw in a few personal examples, and Engineering Economy can become a life changing course. In this paper I describe an active learning approach to Engineering Economy where numerous hands-on labs accompany a standard lecture style course. More importantly, these labs apply fundamental Engineering Economy concepts to everyday life events, events in which students will become involved with numerous times throughout their personal and professional lives.

Improving the Senior Level Hydraulic Engineering Design Course (CE 474) by Means of Computer Assisted Instruction

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EXTENDED ABSTRACT

This paper reports on the development, over the last two years, of spreadsheets in engineering hydraulics at Southern Illinois University Carbondale. The objective of this project was to provide a user-friendly format for studying applications of the design theory presented in hydraulics lectures.

A survey about the need of developing these practical spreadsheets was conducted in the Hydraulic Engineering Design course (CE 474) at the end of the spring 2004 semester, and all twenty-one students enrolled in the class responded. The survey was constructed with eight questions, all related to the objectives of this proposal, and its results more than encouraged our continuing the work presented in this paper.

Most of the design problems assigned in CE 474 involve tedious and time-consuming calculations. Some require numerous trial-and-error procedures. Additionally, just a small change in the configuration of the problem to be analyzed requires repetition of the entire procedure. For these reasons a computer-assisted method can be so advantageous in enabling students to simulate a variety of realistic problems. Enhancement of the understanding of real life problems is not, most of the time, a priority of textbooks. Currently, there is no textbook in the market which includes this type of teaching-enhancement tool. Moreover, homework and projects assigned in this course are currently limited to relatively simple systems due to the fact that more complicated systems will involve extremely time-consuming numerical operations.

Therefore, with the use of appropriate software, the course content can be significantly improved in the area of real-world application. Additionally, computer-aided design is used in all practical areas of engineering. Exposure of the students to this current technology will increase their ability to handle complicated, real problems, give them motivation for continuing the development of similar applications in other areas, and definitely increase their job opportunities.

Another quite important issue is the fact that even though there is commercial software available for some of the topics that will be covered in this project, the only way of testing is having a parallel solution developed independently.

This paper presents the modules developed for the design of pipes, pipe systems, pipe networks, uniform flow in open channels, critical flow in open channels, and gradually-varied flow in open channels. Each module has relevant course material such as examples, projects, handouts, and notes, key factors in the implementation of a computer-assisted method of instruction in the classroom.

Constructing and Teaching a New Asphalt Laboratory for the Engineering department at the University of Tennessee at Martin

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EXTENDED ABSTRACT

Building and constructing a new civil engineering laboratory is a challenging task and requires a lot of work. At the same time, exposing undergraduate civil engineering students in a general engineering program to the hands-on pavement design experience is of great importance.

Pavement design and analysis is a newly developed civil engineering upper division undergraduate course offered at the department of engineering at the University of Tennessee at Martin. This course is a four- credit hour consisting of a three-hour lecture and a three-hour laboratory. The primary objective of the laboratory work is to introduce different methods required to design hot mix asphalt pavements to the civil engineering students.

Superpave and Marshall Mix designs are the two main methods used for the asphalt-based design of pavements. The two mix design procedures are implemented in the developed laboratory which requires a set of experiments on the aggregate, the binder "asphalt", and the mix. The goal is to achieve an optimum proportioning of the materials and desired characteristics for the asphalt mix.

Challenges for building a new laboratory are numerous such as allocating funding for equipping the laboratory and finding a proper space within the building. The intent of this paper is to share the experience of developing and teaching an asphalt laboratory including layout of the laboratory section of the course, the process of equipping the lab, the procedure and students work for the laboratory experiments, and a final assessment for the laboratory. A questionnaire was developed for the students to evaluate the teaching process, laboratory procedure handouts, the laboratory equipment usage, and group work. A summary and analysis of the questionnaire is presented. The developed asphalt laboratory in conjunction with the pavement design and analysis course aimed to expose the students to the theory, laboratory, and field work of the pavement design and construction. The development of the asphalt laboratory was successful, and it exposed the students to hands-on experience on different flexible pavement design methods. Students learned in this course how to follow standard procedure of tests and specifications requirements by AASHTO, present hand-written technical information in a clear and orderly manner, interpret results and make decisions necessary to improve design, and work in a team environment. The adaptation of the Marshall and Superpave mix design methods vary from state to state therefore, the exposure to different design methods will prepare students more for their professional career.

The questionnaire results and feedback showed that students, many of which started internships in such related topics, found the laboratory very useful and constructive. Future work includes adding more tests such as the Dynamic Shear Rehometer (DSR) for testing binder "rheological" properties and the dynamic complex modulus.

Implementing Field Work in Teaching Transportation Engineering Course

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EXTENDED ABSTRACT

Transportation engineering course is an upper division technical elective for the civil engineering concentration at the University of Tennessee at Martin. The course is an entry-level transportation course that covers general knowledge in different transportation fields including traffic characteristics and flow theory, geometric design of highways, transportation planning, roadway capacity and level of service, highway materials, and pavement design. Classically, the transportation engineering course has been taught in the classroom through a format consisting only of lectures, homework, and exams. Transportation engineering course material includes many traffic studies that require field work to comprehend. A need for having a hands-on experience in this class was found necessary. This paper describes the vital value of field work to the students by implementing in-field transportation projects. Two main projects were adopted: (1) Spot speed study and (2) Intersection volume count and traffic signal assessment. Spot speed studies are vital for measuring different variables and factors needed in the design and analysis of the highway system. Observed speeds are used for capacity analysis, geometric design, safety measures, speed trends and assessment. Students used a hand held radar to collect the speed data.

Using basic statistical analysis, data are further analyzed. Highlights of analysis include frequency distribution of speeds, important design percentiles, and statistical measures. Decisions are made and conclusions are drawn from the analyzed data. Traffic signal analysis and assessment comprises the second study assigned for the transportation engineering class. It is a significant study for intersection evaluation in terms of proper signal timing, intersection capacity, and level of service. Tally sheets and electronic counters for collecting data are used.

Tabular and graphical representation of collected data is presented. Students analyzed their signalized intersection results using HCS 2000 software such as adequacy of intersection traffic light timing, volume to capacity ratio, approaches delays, and levels of service.
Field traffic studies strengthened the traffic theories presented in the classroom. Spot speed study and intersection analysis and signal assessment helped students gain the following benefits: study implementations, familiarity with standard procedures and standard forms, data presentation techniques, data analysis, field experience and applications, group work, presentation skills, interpretations of results, suggestion of solutions, and professional software implementation.

This paper describes the minimum requirements for establishing the aforementioned studies and intended objectives illustrated by examples of students' work. Future plans are to develop an additional three-hour laboratory to accompany the transportation engineering class. The laboratory will include additional studies and projects that will be vital to re-enforce the transportation material taught in the classroom environment.

A Use of HEC-RAS as Instructional Tool

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EXTENDED ABSTRACT

The University of Tennessee at Martin offers an undergraduate program leading to a B.S. in Engineering, with concentration in either of Civil, Electrical, Industrial, or Mechanical Engineering. Recently, a Hydraulics and Hydrology elective course has been made available for Civil Engineering students - providing an introduction to open channel flow. Students are exposed to the commonly used and widely accepted Hydrologic Engineering Center-River Analysis System (HEC-RAS), open channel flow software, near the end of the course. This paper is a report on the way in which HEC-RAS is presented to the students.

The students are first required to solve a specifically designed open channel flow problem without the aid of HEC-RAS. This problem is nontrivial, so that it is impractical to solve without a significant effort. However, solution can be obtained manually with assistance of spreadsheet software, within a reasonable period of time. The students then run HEC-RAS on the same problem to check their calculations. The way in which the open channel flow problem is specified accommodates illustration of all the basic features of HEC-RAS for sub-critical flow.

The goal is to provide an instructional experience that tends to militate against students becoming overly dependent on the software. Although focused on HEC-RAS in an undergraduate Civil Engineering elective course, the issues discussed apply widely. Highly advanced modern software often seems at odds with the use of pencil and paper to carry out calculations. The above scheme of introducing HEC-RAS is suggested as but one approach to effectively bridge the gap from fundamental theory to technically advanced software.

Visualization and Computational Techniques for Teaching Polymer Chemistry to Engineering Undergraduates

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EXTENDED ABSTRACT

Despite the fundamental grasp of a chemical reaction gained by understanding its underlying mechanism, many engineering underclassmen appear not particularly compelled to push electrons, rupture bonds and envision transition states. Nevertheless, understanding reaction mechanisms plays an important role in developing novel organic structures for tailored engineering properties. In contrast, most mechanical engineering students quickly assimilate 3-dimensional visualization of meter scale structures *via* computer aided design (CAD) graphical communication. These hurdles in organic chemical education to engineering underclassmen have prompted the utilization of visualization and computational techniques for synthetic pedagogy. Molecular modeling and computational kinetics were braided with CAD techniques.

Preliminary results indicate that intertwining these techniques aids in developing the engineering student's chemical reasoning skills and significantly decrease formulaic memorization.

Development of judiciously chosen pedagogical organic polymerization examples has heavily involved undergraduate research students in addition to faculty collaboration across academic disciplines and institutions. This project encourages mechanical engineering students to better communicate with chemical professionals as well as helps "close the loop" on the first-year experience by making the traditional science-engineering partition increasingly transparent.

Pedagogical Visualization and Computation of Anionic Polymerization Reactions

Molecular modeling of anionic initiation mechanisms *via* nucleophilic attack is detailed for a variety of organic monomers. Molecular modeling is used to demonstrate monomer susceptibility as well as transition state structure and thermodynamics. Anionic polymerization propagation kinetics was modeled as a function of temperature, solvent, impurity concentration, chemical initiator and counter cation identity using facile systems dynamics software. The computational dynamics subroutine was amplified to model sequential addition block copolymerization kinetics as a function of monomer identity. Innovative CAD designs were generated by students, which superimposed abstract mechanistic organic molecular models onto recognizable mechanical mechanisms. Similarities in mechanistic repetition as well as significant differences in both length scale and energy transport were emphasized. The 3- dimensional atomic Cartesian coordinates from energy minimized molecular models were scaled by students within the mechanical engineering CAD classroom to rapid prototype tangible molecular assemblies. Increasingly challenging, *multi*-planar CAD molecular models were utilized to poignantly illustrate both conformation and steric hindrance to engineering students.

An Online Community for Chemical Engineering Educators

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EXTENDED ABSTRACT

It has often been claimed that teaching is the role of a professor for which there is the least formal preparation. A new professor will be thrown into a classroom and be expected to teach, often without any training in how to teach effectively. While there are many opportunities for preparation (National Effective Teaching Institutes, training provided by one's institution, conferences such as ASEE's Annual Conference), it is often difficult to get the sort of timely help a new faculty member might wish to have to teach a new course successfully. This paper introduces a web-based forum that provides just-in-time strategies for classroom effectiveness. In this scenario, experienced faculty would also benefit from the experience of others teaching similar courses.

Beyond the course teaching responsibilities, there are numerous engineering education related topics for which the ability to share and aggregate information and documents in a central virtual location would be invaluable. The Chemical Engineering Division (ChED) of the American Society for Engineering Education (ASEE) is addressing these needs by launching a virtual community for chemical engineering educators, the ChED Forum (http://www.asee-ched.org/Forum). Faculty members worldwide will be empowered to share suggestions, comments, and resources. This knowledge is valuable but perhaps not readily disseminated by traditional conference papers and presentations; the ChED Forum would provide access to this knowledge instantaneously. Additionally, timely announcements, such as calls for papers, REU opportunities, employment opportunities, and other similar announcements will be aggregated on (or linked to from) a single website.

This paper will introduce the current design of the ChED Forum, describe its intended use, describe its use to date, provide instruction on posting and reading from the site, and provide a vision statement for the future development of this community.

A Micro-Macro Transport Sequence for the ChE Curriculum: Role of Up-Scaling

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EXTENDED ABSTRACT

The transport sequence, i.e. momentum, mass and energy, in many departments of chemical engineering is taught following a unit *operation-based approach* (MacCabe et al., 2004)or, alternatively, by using concepts already scaled-up (Felder and Rousseau, 2004) from microscopic variables giving the impression to students that every case is "divorced" from a general type of conservation equation. Thus, students perform analysis by using macro-balances for every process they face without a proper up-scaling (Arce et. al., 2005; Oyanader et al., 2007) from the microscopic concepts so important to achieve a masterful command of the concepts and to understand limitations of process descriptions. Moreover, the introduction course on mass and energy balances follows the same type of approach without, for example, selecting proper control volumes or surfaces in connection with the fundamentals conservation equations (Higgins et al., 2007). One of the results is that when students need to apply these concepts to the micro (and even nano) scales, they often get confuse since it looks like that an entirely new discipline must be learned.

In the approach we are experimenting with at Tennessee Tech University, students follow a different sequence. This is rooted in fundamentals conservation principles (based on microscopic variables) for the energy, momentum, and then mass processes. Students are introduced to heat transfer by radiation (no "media") first; then they are exposed to conduction and diffusion (media without a bulk motion); afterwards, they learn momentum conservation in order to describe convective-based transport and, finally they are exposed to diffusive convective transport. All the concepts are taught in an integrated sequence that allow students to sequentially learned concepts and build knowledge. In addition, concepts are introduced at a *microcospic* level and, by *spatial scaling* to various levels, i.e. averaging in lines, surfaces, or volumes, students are automatically introduced to the key up-scaling concepts; these are needed to describe any process ranging from micro-level to a macro level.

The first introductory course is now centered on process analysis from a fundamental point of view and with the identification of the proper averaging surfaces or volumes.

Fuzzy Synthetic Evaluation of Engineering Institutions: A Consensus Driven Democratic Approach

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EXTENDED ABSTRACT

Quality in Engineering Education is necessary and can be considered as an agglomerate of various parameters ranging from the organizational level to the socio-cultural and ethical level. It therefore requires a systemic and synergic study with a systems approach involving all necessary elements or parameters of the system to judge and evaluate its quality. Further, existence of a high level of subjectivity in such parameters cannot be over emphasized. Quantitative techniques may therefore be inadequate in modeling such real world problems, as these are more possibilistic than probabilistic. This is where fuzzy set formulations are helpful.

The basic purpose of this study is therefore to identify the parameters that influence the quality of an engineering education system and rank out different engineering institutions based on the parameters using a second-generation system design paradigm.

Twelve major quality parameters of effect pertaining to engineering education systems have been identified. A fuzzy synthetic evaluation has been carried out for the quality rating of six engineering institutions situated around Agra in view of each such parameter. The result has also been validated for these institutions taking employment potential as the yardstick.

Online, Pre-Instructional Questioning Strategies: Do Formative Evaluations Correlate with End-of-Course Summative Evaluations in Engineering Graphics Courses?

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EXTENDED ABSTRACT

During the fall 2006 semester at North Carolina State University, students in an introductory engineering graphics course were asked to complete a reading assignment each week and take an online assessment before coming to class for additional instruction. The online assessments were completed using WebCT Vista. After all assessments were completed, students were asked to provide feedback by filling out a survey. Scores on the assessments were correlated with each student's scores on homework, midterm exam, final project, final exam, and final average.

The participants in this study were 22 engineering majors enrolled in one section of an introductory engineering graphics course. Students were enrolled in the following engineering departments: aerospace engineering, mechanical engineering, civil engineering, electrical engineering, computer engineering, and paper science and engineering. Participants included 10 sophomores, 10 juniors, 1 senior and 1 continuing education student.

A total of 8 online assessments were created for this study using WebCT Vista. The assessments ranged from 10-20 items, and students were required to complete them before coming to class. Multiple options for grading student assessments exist within the software. For this study, students were given two attempts at each assessment. Their grade was determined by the average of the two attempts. The assessments covered chapters in Fundamentals of Graphics Communication.

Analyses indicated that there was no significant correlation between students' mean scores for online assessments and their performance on homework, the midterm exam, the final project, and the final exam. Doing poorly on the online Vista assessments did not appear to indicate that a student would do poorly on these other measures. There was a significant correlation between the online assessments and the final average in the course. The post-assessment survey seemed to reflect that students felt the online assessments helped them prepare for class and also for the midterm exam. Only 2 students reported reading the chapters completely before taking the assessments. Most students' first look at the reading material came while taking the assessment.

Although no relationships existed between the online Vista assessments and other formative measures in the course (with the exception of the students' final average in the course), the assessments appeared to be a useful instructional tool for helping students prepare for class and to help them study for the midterm exam. Recommendations for further study include conducting the study again with a larger group from the introductory course and replicating the study at another university with a similar population.

Unifying the Code-base for a Client-Server E-Government Application

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EXTENDED ABSTRACT

The Family Network Partnership at USM started the Sword system as a pilot project in the year 2000 with help from the local government. The School of Social Work identified an untapped Juvenile Accountability Incentive Block Grant provided by the federal government to the states, and came up with the proposal for the Sword as a way of helping out Forrest county Detention center and Youth court. The aim was to track juveniles through the justice system. Over the years, the system has grown organically and currently serves several agencies in three counties in southern Mississippi. The original framework has undergone several transformations to meet the needs of the various counties. As each county had diverse systems and requirements, the application was customized to suit the county needs, resulting in multiple versions. The major challenges with continued growth of the system are maintenance of multiple versions and the need for inter-county data access.

In order to solve these problems and efficiently expand into other jurisdictions, the code from differing versions had to be unified into a single application serving diverse needs. This would also allow users to easily access and analyze data from other counties. Unifying the different versions to create one single application involved three tasks.

(1) Existing Databases were merged. All information that was distributed in separate databases is stored in one single master database. This required a significant change in the structure of and relationships among tables in the database.
(2) Server code was unified. The various versions of the server written in C++ were analyzed to develop a standard protocol for data transfer and handling.
(3) Client Code was unified. Features provided in all versions are provided in a single client application. Further, features, which were hardwired in each client, is available as user-level customization options.

This paper describes the process and challenge of unifying the code-base of Sword to produce a single application that can best serve the needs of the juvenile justice system in southern Mississippi.

Model-Based Software Design Practice

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EXTENDED ABSTRACT

Current software engineering practices involve modeling as a key activity in the building of efficient and usable software systems. Software development's initial phases include the creation of a complete model of the user group, followed by comprehensive formulation of the task models which comprise the system. These are integrated into the conceptual model, which is evaluated and validated with usability inspection methods. The relationship between building conceptual models and developing systems from these solutions provides a sound basis for industrial-strength software engineering called model-based software engineering (MBSE). This paper illustrates the process of two fundamental, complementary sets of activities from domain engineering and application engineering.

Domain Model

The Domain model is first initiated with the user's model which is a conceptual representation of the user and their tasks. Through the creation of a user profile, the personal and educational characteristics of the user are incorporated into the user's model. The task characteristics of frequency, complexity, structure, decomposition, etc. are described to the client and validated. A requirement modeling language describes the ways in which the application is to be used, thus developing a final conceptual representation of 1) the User's model. Several additional models complete the Domain model activities: 2) the Analysis model describes the basic classes for the system; 3) the Design Model portrays functional and non- functional representations 4) the Implementation model describes the organization of the software system; and 5) the Test model consists of test components, test procedures and test cases.

Application Model

The application models are iteratively derived from the multiple domain models in the traditional phases of specifications, design, implementation and testing. The application depends upon how organizations choose to: structure the development, engineer proposed solutions to the final solution, and evaluate and verify the software system. Although MBSE is a relatively new practice in the software development industry, it is an important process which mimics the natural style of human thinking. People have goals that govern their production of work. All work is processed into human thinking as models which are analyzed for the best possible solution. The practice of model-based software engineering, with its methods of creating efficient and usable software systems, will play a key role in the future of industrial software design.

Understanding Open Source Software

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EXTENDED ABSTRACT

Experience in the classroom has shown that students have a limited understanding of Open Source software. Many students view Open Source software as just a free alternative to proprietary software. Students are always interested in free, whether it's free software or free pizza. At other times students' understanding of Open Source software can be expressed as a dislike of Microsoft or other proprietary vendors' products.

Educators need to provide better understanding of the importance of these software licenses to their students. Open Source software is gaining popularity. Recently news reports have portrayed India's Kerala state moving to Linux for its 2,724 high schools. Likewise, some schools districts around the US are using an open source product called OpenOffice to replace Microsoft Office. With tight school budgets, superintendents are realizing the cost savings of using the OpenOffice products for their campuses.

Commercial Open Source packages are often not free of costs but they are usually less expensive than their proprietary counterpart. Many vendors, such as Red Hat, have repackaged a "free" version to make it more viable for enterprises solutions. They provide training, maintenance, and support by adding licensing, or other service fees, to previously low or no cost products.

Lectures on Open Software are being introduced into the IT Project Management course at the University of Southern Mississippi. These lectures have focused on the economics of using Open Source for systems, tools, and applications. Most often systems and tools such as, Linux, OpenOffice, and MySQL are the prime candidates for installations in organizations but many other Open Source applications could also be considered.

First Year Experience as a New BEST Hub

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EXTENDED ABSTRACT

BEST, which stands for Boosting Engineering, Science, and Technology, originated in 1993 in Dallas, TX. The initial goal of BEST was to foster new interest in the applied sciences in middle and high school students by offering them an exciting team based technical design experience. The centerpiece of the program is robot competition, with a new, challenging game each year. While being energized by the excitement and fanfare of live robotic competition, the program also engages students with visual arts and writing skills, offering awards in other areas such as technical notebooks, school table/booth display, most creative design, and team spirit.

BEST Inc. has been promoting the expansion of the regional competition. With no BEST hub in the state of Tennessee, Lipscomb University's young engineering program responded to the opportunity to become the "Music City BEST" hub for Tennessee. With this commitment made less than six months before game day, we had to learn and execute very quickly.

As a new hub we faced many challenges: 1) minimal initial staffing from the engineering faculty, 2) not much time to recruit schools to participate, 3) how to source the myriad of specific game kit parts, 4) understanding/building the required playing field, and 5) understanding the game rules and awards system.

The final paper will address, post-game, our experiences as a first year hub, including the areas of school recruitment, robot technology, logistics, and an assessment of team learning experiences.

Comparison of Upwind and Central Schemes for Optical Flow Velocity Estimation

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EXTENDED ABSTRACT

One of the popular approaches available in Computer Vision for 3D structure recovery and motion recovery is to use optical flow velocity estimates. Estimating optical flow velocity from two given input images is an inverse problem that involves satisfying the well-known optical flow constraint, which is a hyperbolic equation. Traditional approaches for optical flow velocity estimation use central difference approximations for the image derivatives that appear in the optical flow constraint. However, it is well-known in the hyperbolic solver literature that solving a hyperbolic equation with central differencing schemes without explicitly added dissipation results in numerical instability. Upwind schemes have proven to be very successful in solving hyperbolic equations. But in order to upwind, one needs to know the signs of the velocity components. In the case of the inverse problem, one does not know the velocity components since they are the unknowns and so their sign is not available. Thus, how to upwind becomes a question. It turns out [1] that even though one does not know the velocity components, since one knows the images at two time levels, one can form the local time derivative at each pixel, and one can use (the negative of) the sign of this local time derivative to properly upwind the spatial derivatives. In this paper comparisons between the traditional methods of computing optical flow velocity estimates and the new upwind method will be presented. These results show that the new upwind method is a promising alternate to the traditional central-difference based methods.

Alternative Web-Programming Frameworks for the Classroom

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EXTENDED ABSTRACT

There is so much hype and praise concerning the use of "Ruby-on-Rails" (RoR) for web development that it is likely to become the default Model-View-Controller (MVC) development framework. However Ruby-on-Rails is not necessarily the best choice for the classroom or for less demanding applications. One consideration is the issue of web-site hosting. Ruby is not as popular, i.e. available, on internet servers as other languages; it is even scarce, whereas languages such as Java, Python, Perl, and PHP are to be found on the majority of internet servers. Another consideration is the "canon" of languages already established in the computer curriculum. This is most likely to include C, C++, Java, maybe PHP, and a few others, but rarely Ruby. Students are not as likely to have already been exposed to Ruby and it is likely that it will have to be learned within the context of the development course. Even if a language such as PHP, the author's choice, is not a prerequisite it is very similar to C++ and Perl and it is feasible to require students to learn it through available, online tutorials. These and other reasons suggest the use of a MVC framework based upon languages other than Ruby-on-Rails, e.g. PHP. This paper discusses the strengths and weaknesses of framework choices and makes recommendations that are especially suited for the information technology classroom.

Improving Student Preparation for Study of STEM Disciplines SPIN Information Night Programs

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EXTENDED ABSTRACT

Preparation during before and during high school for college study of science, technology, engineering, and mathematics, STEM, degrees in college is most critical to the success of students as they enter these more academically challenging programs in college. Hence, sharing of the needed preparation in terms of class completion and work ethic development with prospective students and their parents at the 10th grade level or earlier is critical to these students' success in college. Science and Pre-Engineering Information Night, SPIN, is a newly developed program at Northern Kentucky University. It is modeled from some 16 years' experience of the second author in these kinds of programs offered by the University of Missouri-Rolla in conjunction with community colleges in Missouri. The program consists of contacts with high ability high school sophomore students' parents by partnering with area high schools. These contacts are in the form of a written invitation sent to the students' parents for a SPIN night program where information is presented regarding needed high school preparation for study in the STEM disciplines. Basic career choice information is offered. All of this is geared into a fast-paced 45 minute-long presentation to the parents and students. Following the presentation, laboratories are open for tours with faculty members present to visit with the attendees. STEM professionals from the community share in this open house. This paper will provide details of this strategy including the communication process used to invite the target audience as well as the SPIN event program plan.

Incorporating Technology into the Traditional Engineering Mechanics Lecture

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EXTENDED ABSTRACT

The advancement of information technology has provided faculty with many opportunities to adopt and incorporate it into traditional classroom teaching. However, the new technology is not always better. For many topics, the best strategy is still the traditional chalk and talk lecture. There are three critical requirements in getting new technology adopted on a large scale.

1. The new technology should be able to facilitate student learning and understanding. It should be better than a traditional lecture.
2. The new technology should be easy to use. Learning to use the technology should not create excessive work for the faculty member. Class preparation should take approximately the same amount of time as for a traditional lecture.
3. The new technology should be reliable and convenient.

Dr. Carroll is currently using a technological method for teaching engineering mechanics courses that meets the criteria listed above. A key component to the method is that the faculty member projects complex figures on the board and then uses chalk (or markers or a smart board or a tablet) to modify the figures. This teaching method blends the traditional lecture with the new technology, utilizing the new technology to improve the quality of the traditional lecture. From the instructor's perspective, preparing the lecture takes approximately the same amount of time as preparing a traditional lecture. The use of technology has been well received by the students.

A method was also was developed for conducting distance office hours to assist the students with their homework. Homework files were created with one problem per page, and a software program Webex® was used with a tablet computer to facilitate the distance office hours. Students can log into the distance session and ask for help on a specific homework problem. The faculty member can capture the student's screen, displaying the homework problem in question, and use the tablet computer to help the student get started with the solution. Control can be transferred back and forth between the faculty and student. It was common to have 20 to 30 students logged into the distance office sessions at the same time. Students found these sessions to be convenient, effective and helpful. The faculty member found the sessions to be convenient and an effective use of his office hour time.

Data was collected measuring student satisfaction with the new teaching method, and student performance on the final exam. The data shows clearly that students like the proposed teaching method, and that they are learning the material better as measured by performance on the final exam.

Interpreting Student-Constructed Study Guides

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EXTENDED ABSTRACT

Constructivism stresses the individual construction of knowledge and concepts and, as such, has had tremendous influence on perspectives of teaching and learning. While constructivism focuses on the individual mind, constructionism stresses a collective generation of meaning. Student-constructed study guides is a way for students to start connecting their prior knowledge and experiences to new bodies of information. The literature on this specific area, student-constructed study guides, is quite limited and not totally on-point. This research was conducted in a junior chemical engineering thermodynamics course that was offered in Spring 2006. As a first step in addressing the research question mentioned above, we examine this issue in one class at one institution. Accordingly, a more specific version of our research question would read: What strategies do CHE 3020 (Chemical Engineering Thermodynamics 2) students at Tennessee Technological University use to decide what to include in their self-constructed study guides? Owing to a small class size and local nature of this research, qualitative methodologies were used. Two semi-structured interviews were conducted with students individually over the course. The first interview will take place after the first exam and the second interview will take place after the third exam. Focus groups were conducted after the second exam. Field notes were taken during the interviews. Interviews were tape-recorded and transcribed verbatim and discussed with the students for accuracy. Categorizing strategies were used to code data. Categorizing strategies in qualitative research was done to fracture or split the data in order to rearrange it into categories that enhance the comparison of data within and between categories and to help in the development of theoretical concepts. In addition to interviews and focus groups, the students' self-constructed study guides were also analyzed. This research uncovers strategies students use in constructing their study guides. By understanding how students construct their study guides, the course instructor could help future students to enhance their academic performance.

Development of Interdisciplinary Curricula and Labs in EET/MET/CET

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EXTENDED ABSTRACT

This paper discusses the development of Interdisciplinary Laboratory experiences between Electrical Engineering Technology (EET), Mechanical Engineering Technology (MET), and Civil Engineering Technology (CET) programs at Alabama A&M University. The EET and MET curriculum has been enhanced to bring the students from both majors together in a set of five common courses during the junior and senior years. Each of the courses is designed to address practical professional skills and issues to better equip the student to work in a diverse, team-based, environment. Three laboratories are used to develop projects and experiments to bridge the three areas of Electrical/Mechanical/Civil engineering. The projects include instrumentation, data acquisition, control, and analysis of machines and test equipment important to the fields of material testing and manufacturing. This paper will focus on a Pneumatic Manufacturing System, a Universal Hydraulic Testing Machine, and a Structural Load Frame. An assortment of control technologies is used to provide the students a broad view of the methods used in industry.

Intelligent Web-Based Grading of Multi-Step Problems

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EXTENDED ABSTRACT

This paper describes a process that I have developed to grade typical math, science, and engineering problems like a fair, conscientious, consistent human grader but via a browser interface. Specifically, it grades multi-step problems for which the answers to any given step may be obtainable from prior-step answers, possibly in several different but equally valid ways. Unlike typical online math grading schemes, this process:

- Grades answers that can be numeric or symbolic;
- Allows the student to repeatedly submit sets of answers, to any or all steps, and in any desired order;
- Gives maximum deserved partial credit for the correct use of prior-step answers, whether submitted or not; and
- Informs the student of intermediate steps where errors might have occurred.

Students can thus focus on the steps of the solution process that are needed for a given problem, rather than working backwards from a final answer. This can add great value to the time spent working a tutorial or doing homework; and exams that use these features can distinguish between careless mistakes and significant misunderstanding. Problems are quickly and easily made gradable, and the useful feedback described above is built-in and occurs with no extra work on the part of the problem's creator. However, problem-specific hints can be accommodated if desired.

Knowledge Assessment Using Online Quizzes

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EXTENDED ABSTRACT

The proposed paper describes an online quiz system used by the author in several courses at the University of Louisville. These courses include CEE 320 Elementary Structural Analysis; CEE 420 Matrix Structural Analysis; and CEE 422 Fundamentals of Steel Design.

A key feature of the system is that all quizzes are administered and graded online. The online feature gives the author exceptionally flexibility in assessing student knowledge. This paper will describe the structure of the quiz system as well as how it is currently used by the author. The system consists of two types of quizzes: those that administered in-class and those that are administered out-of-class.

Common features of the two types of quizzes include: the ability for the student to submit the quiz as many times as desired during the availability period; a five percent penalty each time the quiz is re-graded (that is, the second try is worth 95%, the third try worth 90%, and so on); questions are not graded individually but the students are told only how many answers he/she has correct; each quiz consists of five multiple choice questions; three questions are taken from "current" material; two questions are taken from prerequisite material; and hints are provided to guide the student to the correct answers.

Current testable material includes material taken from the current reading assignment or from material presented in a recent class. Prerequisite material can be any material taught earlier in the semester or from other courses that are prerequisites for the current course.

In-class quizzes are administered at the beginning of each class period. The quiz is available for seven minutes. The out-of-class quizzes begin at the end of a class period and are available to the students until the beginning of the next class period.

Virtual Reality Environments and Authoring Tool for Web Based Training and Education

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EXTENDED ABSTRACT

Text and 2D drawings, sketches, graphs and figures have been the traditional tools to supported training and education in many areas. With the improvement of technology, new approaches are emerging such as Virtual Reality Environment. Virtual Reality Environments have become increasingly popular in the past few years.

Virtual Reality Environments have been used successfully for many applications such as flight simulations, medical training, scientific simulations, education and many more. More recently, however, Virtual Reality Environments have been making a significant impact on the Internet. People are able to not only create virtual worlds, but to place them over the World Wide Web so that others may view it and even interact with it within their Internet browser.

This paper provides a quick overview of one of the current technology available to develop Virtual Reality Environments accessible through the Internet. This paper provide the most common features that virtual reality modeling language offers the user and how these features can be utilized in the creation of a web training and education

It is anticipated that this paper will help the advancement of scholarship in engineering education by providing a foundation for a variety of teaching tools using this or similar technologies.

Using the Moodle Course Management System to Manage Accreditation Tasks

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EXTENDED ABSTRACT

The Computer Science Bachelors degree at the University of Southern Mississippi is accredited through ABET, Inc.

The accreditation process requires that assessments be performed to determine how well student performance meets the program's objectives and, perhaps more importantly, the assessment process needs to lead to ideas for improvement of instruction.

Faced with these needs we determined that we wanted an objective assessment of success which could be applied repeatedly year after year with different teachers. This assessment needed to be done in a system accessible to multiple instructors and needed to pinpoint particular topics which students failed to understand well so that we could improve the teaching process. We decided to implement a pilot project using the Moodle course management as a possible tool to assist us with the assessment task.

In this paper we document our work in a pilot project to develop assessment questions for our Operating Systems class and derive student performance metrics based on results on these questions. We describe the reasons for selecting Moodle for this project, how the software is used to develop a quiz bank and the metrics available in Moodle. Finally we report on the results of the pilot project.

We believe that Moodle can become an instrumental part of our on-going assessment process. Our pilot project shows that Moodle can help achieve the goals of documenting learning and pin-pointing opportunities for improvement.

SWORD, an Information Server for Juvenile Justice

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EXTENDED ABSTRACT

Historically the juvenile justice system in southern Mississippi kept records on cards which had to be indexed, filed and then retrieved to move clients through the system. University of Southern Mississippi's SWORD system is a client-server database which was developed to improve the quality and reliability of client tracking. SWORD currently serves six southern Mississippi counties with 16 client sites and 2 servers with information on over 8,000 juveniles cataloged in the database. The system provides a way to store, retrieve, and modify information about clients for the detention center, juvenile court, and youth counselors. The information stored includes personal information about the client such as contact, education, prior incident reports, and medical needs. Youth court case information includes charges, dispositions, court records and case notes. SWORD also supplies various administrative reports concerning detention center use, counselor workload, and court activity.

Prior to implementation of SWORD, juvenile records had to be moved between offices or duplicated posing a logistical problem for county attorneys with offices located away from the youth court. SWORD solved this problem by allowing secure encrypted client access via the Internet. Authorized users can access juvenile records from multiple locations. Further, SWORD protects sensitive data by enforcing a variety of access levels. Data integrity is protected by limiting the capabilities of users. Data backup is provided automatically.

This paper outlines the SWORD architecture and discusses the technological parameters and practical considerations which contributed to its design. Also discussed are major challenges to further development of SWORD including legacy code and equipment, varying agency requirements, improved research data access and interface development with other state and federal level data banks.

Networking Students Come to the Aid of Hurricane Victims

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EXTENDED ABSTRACT

An internship can provide excellent work experiences but on occasions may be less than satisfactory. It is quite rewarding when an internship comes along that provides an excellent opportunity for learning, leadership, and contributions to mankind. Just such an occasion occurred soon after Hurricane Katrina lashed the Mississippi shores with winds and waves for more than 6 hours on August 29, 2005. Concrete bridges spanning bays and inlets were destroyed, beach front homes vanished, highways and streets washed away, and forests lay flat as Katrina made her way inland. Everywhere one looked the world appeared distorted and twisted as though viewed through a piece of bad glass.

In response to the desperate need for support services, a volunteer organization known as Radio Response was organized by Mac Dearman, a wireless internet service provider (WISP), in Rayville, Louisiana. Radio Response provided communication services to the center of the storm's landfall, Waveland and Bay St. Louis, Mississippi. The call for help brought some of the most skilled communications specialists in the country to help rapidly build a WISP network that was strung from water towers and trees. Likewise, the call for equipment was responded to by many companies around the country.

Using volunteer help and donated equipment, RadioResponse responded to the need for contact with the outside world for the inhabitants of this wasted area. Not only did the inhabitants have a dire need for personal contact with their friends and relatives, much needed FEMA assistance was best obtained via non-existent Internet access or telephone. RadioResponse stepped in to provide wireless network access, VoIP phone service, and computer LAN networks at various sites around the area.

Matt Justice and Peyton Gwinn, University of Southern Mississippi students were granted internships to assist with the implementation and management of the Radio Response WISP. By mid October, 2005, the volunteers from around the country had left and Matt Justice, a USM senior, was the last man standing and in charge of managing and maintaining a vital system for the citizens of the effected area. Matt graduated in December and Peyton Gwinn continued Matt's work in the effected area. The Radio Response network not only supplied services to the citizens of the area, but also important communications to the many volunteers and volunteer organizations housed in tent cities throughout the area. The working conditions, problems solved, and the personal joys of those that labored to build and support this network may never be fully appreciated. This opportunity allowed these interns to be responsible for managing a vital wireless network and provided the interns with invaluable real-world experiences.

Developing a Graphical User Interface to Improve Learning of Stochastic Theory in Hydrosciences in the Classroom

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EXTENDED ABSTRACT

In the modeling of natural phenomena in hydrosciences, stochastic theory receives significant emphasis due to heightened awareness of the limitations of deterministic approaches to modeling. Most Civil Engineering degree programs, however, introduce students to the concepts of stochastic theory at the graduate level. This makes it challenging for the fresh graduate student to grasp the theory and successfully implement it in their research experiments in parallel. A computer-assisted graphics-based learning system can potentially enhance the capacity of students to conduct independent research more effectively by training them in computational applications of stochastic theory early in the undergraduate classroom. However, to assess the validity of our assumption that stochastic theory education can be improved through a GUI-based computer instruction and to further identify if current curricula has an inherent demand for such approaches, there is a need to first survey the curriculum that is adopted by the universities nationwide.

The objective of this paper is two fold: i) to gauge the current state of instruction of stochastic theory for water resources in US universities and thereby identify the potential for curriculum improvement and ii) to demonstrate a proof of concept of a computer-assisted Graphical User Interface (GUI) to improve the current state of learning in the classroom of stochastic theory for hydrosciences. Our study indicates that 84% of the total 241 relevant courses surveyed are available only at the graduate level, while 4.5% and 11.5% were either dual-listed or undergraduate-level courses, respectively. It is worthwhile for the CE educators to consider creating more undergraduate variants of such courses and offer them to students early in their education experience. To further popularize stochastic theory education in context of water resources, more computer-assisted graphics-based schemes should also be used in the undergraduate classroom. The illustration provided herein is a GUI that connects a comprehensive space-time stochastic model for generating rainfall fields that exhibit complex natural variability. Our main finding, based on on-going educational software development, is that effective instructional software building requires evolution from the simplest configuration if its continual upgrade is to continue in liaison with student software developers that are usually available from a computer science department of the university.

Practical English: A Technical Communication Course Developed for Kyungpook National University Based upon a Technical Writing Course in Mississippi State University's Bagley College of Engineering

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EXTENDED ABSTRACT

This presentation describes a technical communication course offered at Kyungpook National University (KNU) in Daegu, Korea, during the summer of 2006. KNU's Department of English Language and Literature sponsored the course—Practical English—which was taught in English by an American technical writing instructor employed by Mississippi State University's Bagley College of Engineering. Practical English was closely modeled upon a pre-existing technical writing course for engineering students at Mississippi State University, an American partner university of KNU.

Technical Writing (GE 3513), the basis for Practical English, is a junior-level course required of all engineering students at Mississippi State University. The major emphases of GE 3513, with a typical enrollment of 20-25 students per section, include helping students identify clear writing objectives; compose documents for various audiences; effectively design written documents and presentations; develop strong verbal communication skills; and recognize the importance of revision, grammatical correctness, and collaboration throughout the writing process.

Practical English (taught over four weeks) initially resembled GE 3513 in both major emphases and student enrollment and makeup. It was designed for a section of 20-25 junior- to senior-level engineering and science majors. However, the course changed substantially to accommodate student interest in the course and departmental needs, eventually boasting an enrollment of approximately 50 sophomore- to senior-level students from various majors, about half of which were technical (mechanical engineering; electrical, electronics, and computer engineering; chemistry; and biotechnology) and half of which were non-technical (economics, political science, business, French, Russian, Chinese, English language and literature, and English education).

Topics discussed include detailed descriptions of both GE 3513 and Practical English (for the latter, its original design and evolution over the summer term); major course assignments, including samples and assignment modifications in response to student needs; students' expectations of the course; the grading system and rubrics used; and qualitative and quantitative student assessment of the course.

Using the *Challenger* and *Columbia* Disasters to Discuss Technical Communication and Professional Ethics: A Multifaceted Approach

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EXTENDED ABSTRACT

This paper describes the use of the space shuttle Challenger and Columbia disasters as case studies for technical communication and professional ethics in a required junior/senior-level engineering-communication course at Mississippi State University. Students in this course have traditionally read background material, watched documentaries, and discussed technical documentation on both disasters as part of the course's standard curriculum. These low-stakes activities, however, suffer from a lack of time and context necessary to place ethical professional behavior in its proper, realistic institutional and cultural constraints. How, then , can engineering schools provide their students with substantive, ethics-relevant experiences and content that both engage students in active learning and allow schools to measure their success with ethics education against stated program objectives and outcomes? Armed with consistent enthusiastic student responses (both formal and anecdotal) to minimal ethics coursework, engineering-communication instructors transformed the shuttle-disaster case studies from informal, low-stakes activities into iterative, high-stakes writing and speaking assignments focusing on various topics relevant to both disasters as well as technical communication and professional ethics. Benefits of this recent transformation have thus far included (a) more focused and substantive writing/speaking assignments in general; (b) evidence that students engage more with the modified course content overall than in previous semesters; (c) improvement in both the quality and quantity of student feedback during class discussions; and (d) more effective and thorough responses to ABET's "Criterion 3. Program Outcomes and Assessment," particularly items d, f, g, and h. The paper discusses these benefits in detail and provides an overview of the newly modified assignments' components, a discussion of the grading methods used with the assignments in question, and an analysis of relevant student feedback from several semesters' worth of end-of-course questionnaires.

Implementing Technical Writing into the Undergraduate Steel Design Course

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EXTENDED ABSTRACT

Undergraduate structural design courses are typically limited to students calculating strength requirements and required structural member sizes. However, during the limited semester course time, a student normally is unable to gain a sense of the "grand picture" of a building's structural response or the interaction of the various structural members discussed in the undergraduate steel design class. Additionally, although writing skills are crucial in a job setting, a student normally is not challenged to improve their writing skills in a structural design course. Conversely, if writing is incorporated into the course by examining course specific case studies, students gain a better understanding of the course material while improving their writing skills.

Case studies are an effective means to enhance traditional content in the classroom and create student interest in the course material. During the Fall 05 and Fall 06 semesters, I used a building case study along with technical writing and approximate, back-of-the-envelope calculations, to improve student comprehension of structural behavior. The approach, initially developed by Dr. John DeWolf, was tried in my undergraduate steel design course at the University of Arkansas. Fourteen students participated in the 2005 Fall class and nine participated in the Fall 2006 class. The class was assigned to evaluate, using a case study article, the Boston Company Building with its characteristic wind bracing system. Specifically, students were required to write about technical concepts such as gravity load transfer and the structure's response to wind loading. A second component of the assignment was to determine approximate loads on a specific major structural member of the building. The written section was to be concise, limited to approximately 250 words. The approximate calculations were also to be concise.

Submitted assignments and comments afterwards showed that the assignment was successful in stimulating student interest and promoting future classroom discussions. This paper presents how technical writing can be incorporating into an undergraduate steel design course and its benefits.

Writing for Engineering: Benchmarks in the BS in Engineering Program at East Carolina University

Rita Reaves
East Carolina University

EXTENDED ABSTRACT

ABET learning outcomes for engineering programs include the following:

a) An ability to apply knowledge of mathematics, science, and engineering
b) An ability to identify, formulate, and solve engineering problems
g) An ability to communicate effectively
j) A knowledge of contemporary issues

In support of these learning outcomes, faculty in the BS Engineering program at East Carolina University are strongly committed to the importance of building communication skills. Our engineering program is designed as an integrated collaborative engineering environment (ICEE), giving students the opportunity throughout their four-year undergraduate program to communicate knowledge to solve engineering problems. Within this integrated engineering environment, and with strong endorsement and input from our Engineering Advisory Board, faculty have designed a sequence of writing benchmarks including lab reports, memo reports (engineering analysis), professional logs, research reports, project reports, oral presentations, and collaborative report writing required for success in engineering.

Our goal is that employers will seek out our graduates because of their demonstrated ability to write and speak effectively, to conduct sound research on engineering problems and contemporary issues, and to work collaboratively and creatively in engineering teams. While students have opportunities to develop written and oral communication skills in many courses, including those at the freshman level, major focus is given to developing technical writing skills in the six courses required for all graduates of the BS in Engineering at East Carolina University.

Engineering faculty members realize that a key responsibility and challenge is to bring students to an awareness of writing as a public activity. In contrast to writing primarily as a private transaction to one teacher or evaluator (that is, the writing they have done throughout most of their academic experience), engineering students learn that writing for engineering means that many people may contribute to and review drafts of their work. This paper presents ways to lead students into sharing their work with others, assignments for writing in different rhetorical contexts and in a variety of professional formats, and strategies for making it work.

Teaching Engineering Ethics Through a Nanoscale Case Study

Christian Hipp
University of South Carolina-Columbia

EXTENDED ABSTRACT

This paper presents a nanoscale case-study that applies an integrative approach to teaching engineering ethics. This case study involves an NSF-sponsored report on converging technologies for improving human performance. Public debate is widening, policy makers are demanding explicit consideration of ethical, legal, and social aspects, and popular books are explaining the achievements and promises of nanoscience. Since ethical decision-making is essential to the engineering profession – demonstrated by the ethics requirement in ABET approved engineering curricula -- engineers should be presented with the ethical implications of engineering within and among nanoscale applications. This case will illustrate the ethical complexity and convergence in engineering domains themselves and in engineering interfaces with other domains within the context of emerging technologies.

Promoting Multidisciplinary Research in Environmental Engineering Among Undergraduates through REU Participation

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EXTENDED ABSTRACT

The Research Experiences for Undergraduates (REU) program supports active research participation by undergraduate students in science and engineering to promote retention of undergraduate students and recruitment of graduate students. The REU program in Environmental Health Engineering at the University of Alabama, Birmingham (UAB-REU) provides undergraduates, who show potential for graduate study, early exposure to and preparation for multidisciplinary engineering research. Students of at least sophomore-level standing are recruited on a nationwide basis to undertake research in the UAB Schools of Engineering and Public Health. The UAB-REU program matches participants with faculty mentors that conduct research in the participant's field of interest for eight weeks to undergo project-based research training.

For the past four years, the UAB-REU program has consistently increased participant interest in pursuing graduate study in science, math, engineering and technology (STEM). One of the primary goals of the program is to increase the enrollment of students of color in graduate study in STEM fields. From 2003 to 2006, over forty students have participated in the UAB-REU program from a variety of under-represented racial groups (African-American, Hispanic, Indian, and Asian Americans) and academic backgrounds (Engineering, Biology, Neuroscience, Physics, Computer Science, Marine Science and Chemistry). Over 80% of past participants are currently pursuing academic degrees or have professional careers in STEM fields.

This research study sought to evaluate the training and mentoring strategies of the UAB-REU program through a survey analysis of past participants. The evaluation was carried out in two steps. In step one the participant's descriptive data (year of study, GPA, major) and program expectations are extracted from the REU application. In step two the students complete an on-line questionnaire after completion of the program, which is designed to assess the contribution of the UAB-REU program on the participant's attitude and progress towards a career in STEM fields. The questionnaire consisted of a combination of interval scale, categorical and open-ended comment questions.

Findings indicate that over 75% of the participants are either currently enrolled in a graduate program, or plan to attend graduate school in the next two years. In addition, results of the survey indicate that the UAB-REU program: (1) increased overall participant interest in future research and graduate study in STEM fields; (2) increased confidence among participants of color and women participants of their ability to excel in STEM fields; and (3) increased participant interest in a STEM career through faculty-mentor relationships.

A Microfabrication Laboratory Class Targeted to Freshmen

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University of Louisville

EXTENDED ABSTRACT

A new freshman-level course is under development at the Department of Electrical and Computer Engineering at the University of Louisville. The aims of the course are to increase undergraduate retention through a hands-on laboratory experience in the cleanroom, improve recruitment of potential engineering students, provide the students with an early introduction to planar fabrication techniques, and fabricate transistors that can be used in future laboratory classes.

A cleanroom laboratory course is traditionally only offered to seniors and graduate students. This course makes the cleanroom accessible to undergraduates and freshmen in particular, with a future aim of involving high school students. To the author's best knowledge, there is no similar course offering in the nation offered at the freshman level. The lab takes place in a state of the art, 10,000 sq. ft class 100/1000 cleanroom in the new Belknap Research Building. The students start with a bare silicon wafer, have to perform all the processing steps themselves (under the watchful eye of a TA), and test the transistors. Finally, the students package the transistors with custom packages that the students assemble, and yet are compatible with traditional breadboards. At the end of the semester, the students take home a wafer and packaged transistors that can be used in future labs or projects. There is only a minimal lecture component, as the course emphasizes learning by doing. The first course offering is a pilot run in Spring 2007 with 9 students.

It is anticipated that student retention will be improved because the course immerses the students in an extensive, hands-on lab that has a tangible product. Also, the silicon wafers may be shown to family and friends, creating pride for the students and providing strong word of mouth advertising for electrical and computer engineering.

Teaching Electrical Engineering via Television

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Virginia Tech, Blacksburg, VA

EXTENDED ABSTRACT

The Commonwealth of Virginia has two major research universities, Virginia Tech (VT), located in Blacksburg in SW Virginia, and the University of Virginia (UVA), located in Charlottesville in central Virginia. All the high tech employers in the state are located more than one hundred miles from UVA and more than 200 miles from VT. The large distances between working engineers employed by industry and government, and the research universities that offer advanced degrees made acquiring a master's degree difficult once BS graduates entered the workforce.

In 1984 the State Council for Higher Education in Virginia (SCHEV) concluded that there was a need to distribute graduate engineering education via television to numerous locations around the Commonwealth so that working engineers could attend advanced courses to improve their job skills and earn master's degrees. The state council created the Commonwealth Graduate Engineering Program (CGEP) with a consortium of five Virginia universities that had graduate engineering programs. Televised graduate engineering classes were originally distributed via satellite, with an audio-only return link. In 1998 transmission was moved to compressed digital video over optical fiber using a dedicated network and subsequently to the Internet using asynchronous transmission mode (ATM). This allowed the transmission of two way video signals. In 2006, the system was upgraded to use the H.323 video conferencing standard. This allows parallel transmission over the Internet of video and computer generated images such as PowerPoint slides. The availability of large high resolution monitors allows the instructor to derive and discuss long equations that would not be readable on an NTSC TV screen.

The separation of instructor and students through an electronic medium makes learning more difficult for the students and teaching more difficult for the instructor. The demographics of students enrolled at the distant locations are significantly different from the average graduate student in a typical on-campus MSEE program. They are older, may have been away from the classroom for many years, usually have full time jobs, and are frequently out of town traveling for their employer. Deadlines and schedules that work for on-campus classes will not work for televised classes, and a great deal of flexibility is needed. Graphical materials prepared for televised classes must take account of the equipment at distant locations to ensure that all transmitted material is readable. Where high resolution monitors are not available, a large font must be used on slides and the instructor must write large for the document camera. Examples of good and poor practice in the preparation and transmission of graphic material are given in the paper.

Teaching via television has proved to be a powerful way to extend the benefits of graduate education to a much wider audience than just students on a typical university campus. Although the infrastructure to support televised teaching is expensive, there are hidden economies in this form of teaching. Full time students on a university campus require space and facilities in which to learn, are not productively employed in an industrial sense, generate no wealth, and frequently are supported from public funds through graduate assistantships. Most of that expense is saved when the student works full time and takes classes part time.

Developing Undergraduate Mentorship Skills Through BEST

Greg Nordstrom, Anthony Andriano, Nathan Tanner
LipscombUniversity

EXTENDED ABSTRACT

This paper discusses the use of undergraduate engineering students as mentors to junior-high and high school students competing in the Boosting Engineering, Science, and Technology (BEST) robotics competitions.

BEST mentors are a key element in the competition, donating their time and effort to advise teams throughout the entire engineering process, from initial requirements definition, design and implementation, and into the competition itself. Mentors provide guidance, offer ideas and advice, act as sounding boards, teach specific engineering skills on an as needed basis, and act as construction supervisors overseeing the robot building process.

Design of Innovative Computer Networking Labs for Senior and Graduate Networking Courses and Supporting Research Projects

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EXTENDED ABSTRACT

In computer networking technology courses, experiments with large networks are essential for students to understand the problems and complexity of real world networks, the Internet, and the underlying solutions and technologies that make our Internet so useful, scalable, and reliable. Networking equipment are very expensive and few laboratories have the funding to purchase enough equipment to build a large network. An alternative for large network experiments is to use computer simulations. This paper describes a computer simulation program written in C++ which is still under development and evolving. The simulation package was used in senior computer networking courses, has been a research tool for the computer networking project conducted in the department, and for graduate students to explore and verify new ideas and algorithms in computer networking area. Using the package, students can generate arbitrarily large network topologies with configurable degree of connectivity, simulate and test a particular multicast algorithm, simulate and test a unicast routing algorithm, and simulate and study the performance of common buffer systems. The package currently supports a limited set of functions and is planned to support more functions that are suitable for senior level computer networking labs in the future. Further development of the package will be based on input sought from students and faculty. This paper also presents a content distribution (such as IPTV) application of the simulation package showing how a novel multi-source, multi-root network configuration supports fault-tolerant content servers, which are placed strategically in the network. The source code is open to the students and faculty who may be interested in enhancing the capability of the simulation software over time. Using the network simulation software, the students came to appreciate the complexity of large networks, were stimulated when seeing the robustness of the multicast algorithm, developed a deeper understanding of the algorithm and a real interest of computer network protocols. The students started to appreciate the usefulness of the computer simulation technique in verifying protocols.

Using a Two-Cycle Engine to Integrate Manufacturing Engineering Technology Curriculum

Robert W. Hewitt
The University of Memphis

EXTENDED ABSTRACT

In an effort to increase the richness and scope of our students' learning experience, the Manufacturing Engineering Technology program at the University of Memphis is developing a curriculum context based on a .40in^3, two-cycle engine. The purpose this context is to provide a real-world, product-based framework with which to integrate and expand the learning experiences from different courses and lab exercises. Many traditional lab exercises have been expanded and updated to incorporate the design and production of the engine's major components. Additionally, when the scope of developing or redesigning a component or process goes beyond that of a regular class or laboratory assignment, students have been able to take these tasks on as senior projects. The engine has twelve major components that are currently being designed and manufactured by the students. As they endeavor to produce the engine, students apply technology such as parametric solid modeling, rapid prototyping, sand and plaster mold casting, tool and fixture design, as well as CNC machining. As students are exposed to the design, manufacturing, and quality challenges presented by the project, they are better able to see the limitations and constraints that would otherwise be simply theoretical and easy to ignore. The constraints imposed on them in the context of the physical design and manufacture of the engine are encountered as they would naturally be in a real-world manufacturing environment – subtle and unforgiving. This paper gives an overview of the project, and outlines some of the successes as well as some of the shortcomings experienced by integrating the curriculum in this way.

Integration of Math and Physics into Electronic Engineering Technology Courses

Zhaoxian Zhou

School of Computing, University of Southern Mississippi

EXTENDED ABSTRACT

The Electronic Engineering Technology (EET) Program plays an important role in the University of Southern Mississippi (USM). The EET program strives to create a learning environment that nurtures the development of critical thinking skills, and develops technology expertise. Traditionally, our courses in Engineering Technology, such as Electrical Power, tend to cover a lot of details from a technical point of view. Advanced mathematics as an analytical tool is typically not incorporated into instruction. This method has advantages, however, we have found that, without a solid understanding of science and physics behind the technology phenomena, it is not practical for the students to memorize easily all the technical information. The EET program at our university has just merged into the School of Computing, and is trying to improve the teaching-learning environment by incorporating more science and advanced mathematics into engineering technology curriculum. This paper discusses how higher-level mathematics and physics can be integrated into the instructional process of EET courses. As an example, this paper presents how we help the students to incorporate their knowledge and skills in algebra, calculus, geometry, trigonometry and physics into Electrical Power, which has long been a required course for EET in USM. This method has proven to be effective by student survey. Students have demonstrated a clear understanding of the technical information in the field of Electrical Power by the integration of higher-level math and physics.

Conclusions:

In this paper, we present the procedure how we adopt a new method to teach a senior course Electrical Power in the University of Southern Mississippi. By this method, math and physics are incorporated into an electronic engineering technology course. A statistical report suggests that the students have a better understanding of engineering technology problems from this new teaching method than from traditional teaching method. The students have increased interest to engage in lifelong learning processes, have further exposure to other EET areas, and enjoy the learning experience. The instruction method has better learning results than traditional ones.

Poster Session Abstracts

The Southeastern Section of the American Society of Engineering Education (ASEE) has solicited extended abstracts from undergraduate students to present in a poster session at this year's conference. The students will be entered in one of the following categories:

- Freshm an/Sophomore Engineering and/or Engineering Technology Design Teams
- Junior/Senior Engineering and/or Engineering Technology Design Teams
- Undergraduate Research

The following section contains the extended abstracts from this year's student participants. During a morning judging section, they will be evaluated on their abstract, poster, and communication skills. In the afternoon, the Research Division encourages all conference attendees to stop by and learn from students about the wonderful projects going on throughout the section.

Autonomously Controlled E-Maxx: ACE

Tim Adams and Trevor Garson
Embry-Riddle Aeronautical University

EXTENDED ABSTRACT

In recent years, national disasters and global conflict have provided no shortage of dangerous search, rescue and reconnaissance missions to be performed by specialized personnel. Addressing the desire to spare human beings from these dangerous missions there has been a growing emphasis on the development of low-cost autonomous vehicles. Continuing the tradition of autonomous vehicle development at Embry-Riddle Aeronautical University, the Autonomously Controlled E-Maxx, or ACE, seeks to provide on the ground search and reconnaissance capabilities in a low cost scalable platform.

As a ground vehicle, ACE is designed to autonomously navigate through a series of GPS waypoints while avoiding obstacles in its path. Upon reaching areas of interest, ACE is designed to employ search patterns to locate and provide both visual and thermal reconnaissance on targets or areas of interest. During mission, the ground vehicle remains in constant communication with a student designed ground station, relaying live video feed, GPS coordinates, directional headings and thermal readings as well as other meaningful information to human operators.

Unmanned Ground Vehicles (UGVs) such as ACE are capable of providing close-in interactions with targets that are not possible with an aerial platform. However, ACE is designed to employ the strengths of unmanned aerial vehicles by operating in concert with the previously designed Embry-Riddle AutoNAS aerial vehicle. Through interaction with the vehicles' ground station databases, targets can be designated from the aerial vehicle and the UGV deployed to provide further investigation. This interaction and other capabilities can be supervised from the ground station which provides a graphical user interface to simplify the operation of the vehicle.

On the organizational side, ACE is composed of a multi-disciplinary team consisting of fifteen engineers organized into functional design teams. Design team roles vary from embedded operating system development to quality assurance engineers responsible for overseeing the adherence to a defined TSP (Team Software Process) based development process. Seeking to keep costs low and utilize knowledge previously gained, effort was put forward to utilize free and open-source software development tools as much as possible. In addition, commercial off the shelf components were chosen to construct the ground vehicle and modular design techniques are employed to improve system maintainability. A sample of key technologies employed include the Propeller 8-core multiprocessor, field programmable gate array (FPGA) utilization and a diverse database system employing Pyro (Python Remote Objects) to manage remote procedure calls.

As development of the system continues, additional capabilities are added and verified according to the overall project task plan. The final goal of the project is not only to provide all desired functionality, but to create a system flexible and scalable enough to allow future design teams to add even more diverse functionality.

PARAMETER UTILIZATION IN THE CROSS DOCK PROBLEM

Chad Bournes, Jennifer Cloud, Vanessa Kasten, Jake Mitchell, Chris Potts, Tarrah Wilkerson

Tennessee Technological University *h*

EXTENDED ABSTRACT

In the cross dock environment arriving freight, measured in handling units, is moved from a trailer to a stripping door to a destination trailer at a loading door (Elizandro). The goal in the cross dock problem was to find the most efficient layout of shipping and receiving doors, subject to material and distance constraints. This representation of the cross dock problem was an application of the quadratic assignment problem (Taha). A genetic algorithm was created to search for the five best configurations. The algorithm incorporates set parameters, e.g., number of chromosomes, mutations, and gene splices, that affect the performance of the search (Cheng). This research study identified which algorithm parameters have the greatest affect on finding the best solutions in the least amount of time.

The project was completed as part of the Advanced Operations Research course, a senior elective in the Tennessee Tech Dept. of Industrial & Systems Engineering. Dr. David Elizandro, professor of Advanced OR, was the advising professor. All six students in the course were members of the team. Two were primarily responsible for managing the genetic algorithm program, two were responsible for the program interface design and management, and two for the poster design. All students conducted trials within the designed experiment to test the effect of different parameters in the cross-dock configuration. This project improved the procedure to identify layouts that reduce distance traveled by freight in a cross-dock setting by finding better solutions. The data for this project was provided by Averitt Express – Cookeville, TN. The final results will be sent to Averitt to use in their shipping department.

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Evaluating Fracture Toughness of Polymers

Seth Cannon and Dr. Judy Schneider
Mississippi State University

EXTENDED ABSTRACT

The use of polymeric materials is increasing in many engineering applications. For an engineer to design with these materials, the mechanical behavior must be understood with regards to processing and environment. Of particular interest is the ability of a material to withstand impact loads, or fracture toughness, as a function of temperature. A drop tower is currently being used to evaluate the fracture toughness of polymers at ambient and cryogenic conditions. This gives the flexibility to test flat panels, in addition to traditional Charpy and Izod specimens.

Modeling Aspects and Control of Counter Gravity Systems

Malik Davis
Tennessee Tech University

EXTENDED ABSTRACT

The research performed was used to develop a controller for a counter gravity casting machine to be used in the foundry setting. The counter gravity casting machine is originally a single input single output, SISO, system that uses a transducer to turn voltage into a pressure that is used to control the position of two pneumatic valves, reverse and forward acting. The valves are connected to a flask where the pressure in the flask depends on the position of the two valves. This setup uses a PID controller to control the voltage that is being sent to the transducer and thus controls the pressure in the system.

Research Background

While the original setup has the advantage of being very simple, it tends to respond poorly within certain pressure ranges. The poor response is attributed to the pressure in the plenum that dramatically decreases during periods of high flow rate through the two pneumatic valves. After a period of high flow rate, the system struggles to reach pressures any higher than its current state. The research done describes different methods and controllers that avoid the problem with high flow rate.

Research Conclusions

For many applications in the foundry industry, a SISO system is sufficient and can be applied flawlessly in cases where the plenum pressure is not an issue. The implementation of a two input controller however is able to solve the issues related to a drop in plenum pressure while also substantially increasing response time. The two input controller in development is still in its early stages and has many improvements that can be made. The original controller worked off of a lookup table to determine the voltage sent to control the valves. The new controller still uses lookup tables; there are two different tables that are used depending on whether or not the user is trying to increase or decrease the pressure in the system. The new controller also uses slopes instead of current pressures to determine how much to open or close the valves. The new controller attempts to operate in regions where there is not a dramatic drop in plenum pressure. Thus the system with new controller responds quickly to changes when a large increase in pressure is needed. For the foundry industry, development of two input controllers can produce improved performance and future money savings as smaller pressure tanks can be used to achieve better performance than systems under single input control with larger tanks.

Dissipation of Energy in Structures Due to Earthquakes

Steven J. Fulmer and Mathew C. Butsick
The Citadel

EXTENDED ABSTRACT

Design criteria for bridge foundations as well as pier and wharf type structures are based on a performance driven design procedure that allows the design professional to detail piles based on their anticipated level of inelastic behavior during an anticipated earthquake. More specifically related to this study, the design professional provides an appropriate amount of spiral reinforcing to ensure that plastic hinges which develop in the pile are capable of adequate rotation as required by a pushover or time history analysis. It is often assumed that pushover results are conservative as compared to those obtained from time history analysis. However, experimental testing of precast prestressed piling has shown hysteretic curves are pinched in many instances and the loss of energy dissipation may make pushover analysis non-conservative for design of such structures. The purpose of this research is to analyze an actual bridge in Dorchester County with pinched and fully developed hysteretic curves using time history analysis and to compare these results to those obtained from pushover analysis to determine the applicability of the method.

FAMILIES OF HYGROTHERMALLY STABLE ASYMMETRIC LAMINATED COMPOSITES

Robert A. Haynes
Georgia Institute of Technology

EXTENDED ABSTRACT

Coupling between deformation modes of laminated composites can be used to tailor the elastic response of a structure advantageously. This coupling between applied forces and curvature deformations such as extension-twist or extension-bending coupling can only be obtained with asymmetric layups. However, asymmetric stacking sequences usually result in significant post-cure warping and hygrothermal instability.

Previous attempts to design laminates with elastic tailoring focused first on obtaining the desired coupling properties and then trying to meet the hygrothermal stability constraints. These stacking sequences have not been shown to be optimum in terms of the magnitude of extension-twist coupling nor the number of plies. To this end, an alternative approach is adopted in this work whereby a rigorous, systematic search for hygrothermally stable laminates is performed. In the present work, hygrothermal stability is considered to be the objective rather than a constraint.

Simple, material-independent, necessary and sufficient conditions for hygrothermal curvature stability of a laminated composite plate have been derived from the approximations of Classical Lamination Theory. It is then proven that no asymmetric solution to these equations exists for laminates with less than five plies. With the derived equations, a single independent solution is found for laminates of five plies. Multiple families of hygrothermally stable asymmetric stacking sequences are presented for six-, seven-, and eight-ply laminates. Further, it is shown that they imply hygrothermal twist stability in a geometrically non-linear model as well.

Verification using a finite element method was performed to demonstrate the validity of the derived solution. Similarly, an experimental verification was made by manufacturing two laminate plates: an antisymmetric stacking sequence conforming to the derived hygrothermal stability conditions and its corresponding symmetric stacking sequence; matching post-cure warping displacements between the two laminates indicate comparable hygrothermal stability. Finally, a numerical sensitivity analysis demonstrates the robustness of the solution with respect to small errors in ply orientation, reflecting manufacturing tolerances.

In conclusion, this work provides a comprehensive method for the design of hygrothermally curvature-stable composite laminates. When applied to asymmetric stacking sequences, the laminates will retain their elastic coupling properties. Rather than optimizing a laminate design for a given coupling with hygrothermal stability as a constraint, laminates with the desired coupling can be selected from within the derived hygrothermally stable families. The material independence of the stability conditions provides robustness against variability in material properties.

Ultrasonic Evaluation of the Fusion Level of Expanded Polystyrene Foam

James Klein
Tennessee Technological University

EXTENDED ABSTRACT

The quality of the metal parts produced using the lost foam casting (LFC) process has been shown to be a function of the properties of the expanded polystyrene (EPS) foam used in the process. As much as 90% of the problems associated with the LFC industry are believed to be direct results of problems with the foam used.

An important EPS foam property is its fusion level. This is a measure of how well the polymer chains have intertwined and / or joined at the bead to bead boundaries. Research has shown that fusion level does have a strong effect on mold fill times and thus an effect on the quality of the metal cast.

For the purposes of this research, a thru-transmission, low frequency ultrasonic testing technique was and is being used, though future plans are being made to incorporate a C-scanning, pulse echo apparatus. A correlation between fusion level and ultrasonic velocity in the foam is trying to be established. It is well known that sound velocity is a function of both the medium's stiffness and inertial properties. For solid media the stiffness property is a combination of Young's modulus and Poisson's Ratio and its inertial property is density. It has been shown that the stiffness of polystyrene is strongly dependant upon its fusion level.

Major difficulties in this research have resulted from localized property variations in the polystyrene - especially from variations of density. The presence of a density gradient makes it impossible to independently determine the stiffness of the foam using sound velocity measurements. Further work is being done to produce a test that will allow for the determination of localized density. The present focus of this task is on determining localized acoustical impedance. Once local density is known, local stiffness can then be evaluated.

Testing has shown that ultrasonic velocity can vary significantly across the area of a given foam plate. Typical sound velocities in the foam are on the order of 700 m/s and can vary 20-30% across a given plate. The target resolution for velocity and general property variation evaluation is 1 cm^2 but will be ultimately determined by the ultrasonic transducers available.

Traffic Engineering Research in South Carolina

Timothy J. Lewis
The Citadel

EXTENDED ABSTRACT

During my junior year, I took my first transportation engineering class and developed an immediate interest in the subject. My interest in transportation led to me to seek opportunities in research and analysis outside of the classroom. Beginning in October of my junior year, I was able to work as a research assistant for The Citadel's Department of Civil and Environmental Engineering where I had the opportunity to work on research projects that involved:

- *Traffic analysis for West Carolina Avenue.* This research was requested by a neighborhood association in the historic area of Summerville, South Carolina due to excessive traffic in the area. The project consisted of extensive data collection including 24 hour traffic counts, intersection turning movements, corridor inventory, stop sign compliance, and travel time studies. I was also responsible for evaluating data and developing the findings into a capacity analysis, travel time comparisons, traffic circulation patterns and improvement alternatives. A final report was prepared and presented during a neighborhood association meeting and at a town meeting where the Mayor and Town Council were present. Traffic calming alternatives that I recommended included speed humps, intersection diverters, as well as both short and long one-way pairs.
- *Scenic corridor study in conjunction with the local government on Bohicket Road in Charleston, South Carolina.* The Bohicket Road research consisted of conducting highway safety and crash analysis, involving 239 crashes occurring over a three year period. I was also responsible for calculating crash rates, identifying causation factors, conducting highway capacity and level of service analysis for two-lane and four-lane roadway segments using present and future traffic volume flows. The project also required a detailed inventory of corridor conditions including fixed object hazards, roadway geometric features, access points, and traffic control devices, and preparation of materials for a policy report.
- *Rural crashes in South Carolina communities.* For this project, I collected data and evaluated site conditions at rural locations across the state in order to evaluate roadway safety. This research was conducted in conjunction with Clemson University, Department of Civil Engineering, and included documenting site conditions and inventorying roadway/land use features in Sumter, Camden, Dillon, Conway, and Latta, SC for the purpose of analyzing the relationship between site conditions and vehicle crash factors.

The technical results of these projects will be summarized in my presentation. Through participation in these research projects I have learned how to use scholarly references, technical standards, developed familiarization of traffic analysis methods/software, how to properly present technical issues to the public, ability to defend my work, knowledge of the public and private sectors of work, and it has helped me choose transportation engineering as my career path.

The Effect of a Helium Environment on the Grain Structure of Cast Aluminum

M.C. Merrill
Mississippi State University

EXTENDED ABSTRACT

Currently, a large automotive manufacturer use the lost foam casting process to produce their aluminum engine blocks, but they have recently begun looking for an alternate method of casting with the goal of decreasing the size of the dendritic grains. Dendritic grains are type of grain structure in metals where the grains look like intertwined pine needles. Because the average grain size decreases as the cooling rate increases, Helium was used in an attempt to increase the thermal conductivity of the mold, thereby decreasing the dendritic grain size.

Four experimental setups were chosen, using a portion of the full engine block casting. The first setup was the control; it was cast in an air environment and without added chill. The second setup was poured in air, but a metal chill was placed inside the cylinder being cast. The third and fourth setups had both the metal chill and a helium environment. The difference was the flow rate of twenty cubic feet of helium per hour and eighty cubic feet of helium per hour in the third and fourth setups respectively.

The first step in the experiment was to determine the solidification times. For the control specimen, the solidification time was five 5 minutes and 55 seconds. The solidification time for the specimen with a chill in air decreased by 3.1 percent, but the solidification times for the specimen with helium present decreased by 59.7 percent (20 cubic feet per hour) and 62.5 percent (80 cubic feet per hour). The next step in the experiment was to compare the resulting microstructure to determine the effect on the dendritic grain size. After sectioning, grinding, polishing, and etching two samples from each casting, six micrographs of each sample were taken at 100X magnification from each sample. The images were then loaded into Scion Image. Using the measure function of Scion Image allowed the creation of ten random lines of known length on each micrograph. For each random line, the number of intercepts with grain boundaries was counted. The average grain spacing was calculated for each micrograph by taking the total length of all the random lines and dividing by the total number of intercepts. The average dendritic grain size for the sample poured in air without a chill was 60 µm. The sample poured in air with a chill only showed a decrease in average dendritic grain size of 3.3 percent. The average dendritic grain spacing for the specimens with helium present decreased by 16.7 percent (20 cubic feet per hour) and 20.0 percent (80 cubic feet per hour).

In conclusion, the helium environment does decrease both the solidification time and the dendritic grain spacing in the resulting casting. The fact that the decrease in both the solidification time and the dendritic grain spacing for both flow rates was approximately the same indicates that the amount of helium flowing into the casting environment is inconsequential as long as the environment is flooded with helium.

Progressive Solutions for Stormwater Management in Louisville, KY

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EXTENDED ABSTRACT

Research Purpose & Significance

The purpose of this research is to determine alternative solutions to managing rainfall and storm runoff in the Louisville region. As development increases in a city's community, so does the amount of impervious surfaces and storm runoff. Surfaces such as roads, rooftops, and parking lots replace the natural landscape and therefore disturb the area's natural hydrologic character. Where the Louisville region has continued to rely on traditional stormwater management practices, this research aims to investigate more sustainable options for the future. This research will also seek to suggest as Louisville continues to grow and strive to become a regional leader in industry, education, culture, and lifestyle, so shall our storm management excel in the areas of improved water quality, environmentally responsible development strategies, and integrated management of stormwater between public and private institutions.

Research Overview:

Louisville has made great strides in recent years to become a leader in education, culture, industry, and commerce. Projects in point include Museum Plaza, two new Louisville bridges, a new downtown Louisville arena, Geek Squad Inc. headquarters in Bullitt Co., UPS expansions, University of Louisville athletics, facilities improvements, and research milestones, and landmark achievements in health care and medical procedures. All of these recent projects bring further growth and development to the community. In turn, our storm systems and their management will need the ability to handle the increased volume, pollution, and high flows that will be created. Furthermore, this research has discovered that several cities throughout the U.S. have made pioneering developments in environmental awareness, stormwater management, and sustainable development for the future success of their citizens. Such strategies and techniques include Low Impact Development (LID), Best Management Practices (BMP), Green Building, porous pavements and pervious concrete, advanced stormwater solutions products, and integrated management with combined initiatives between public and private entities. All of these practices have shown to provide effective and cost-saving water conservation and control, pollution prevention, sustainable site design and planning, and environmental benefits for the local community.

Conclusions:

Louisville is growing. This is not only a blessing, but a potential problem. Where other cities have made forward-thinking decisions for the benefit of the local communities, local wildlife, and the citizens they serve, this research contends that Louisville is at the point of making similar decisions. There are several strategies, projects, tools, and techniques that can be directly implemented into Louisville's planning and design for flooding and drainage solutions. With the increase in development will come the increase of potential problems due to increased runoff, peak flow and volume, and higher levels of pollution. However, with proper planning, projects, and municipal programs, Louisville will set the standard for effective and efficient stormwater management.

Non-Deterministic Design of Utility-Scale Wind Energy Systems

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EXTENDED ABSTRACT

Introduction

The wind is an increasingly significant source of energy with the rising price of non-renewable fuels. The purpose of this project is to determine the specific intensity and frequency of wind speed required to sustain a large-scale wind farm with power output on the order of hundreds of megawatts. To this end, a non-deterministic methodology will be developed to analyze the viability of wind energy systems.

A deterministic analysis method considers the majority of design parameters to be known or fixed and may only perform trade studies on a few parameters at a time to optimize performance. In the case of the energy market though, this is not an advantageous strategy since several factors related to economic viability such as energy prices, interest rates, government incentives, acquisition costs and maintenance are highly variable and cannot be assumed to be known. A non-deterministic, statistical approach to wind turbine design has the advantage of predicting with corresponding levels of certainty the power output and economic viability of an energy system. The resulting data can be correlated to wind surveys of the United States along with state-by-state tax incentive information to find the best locations for wind energy expansion in the nation.

Objectives of Research

The primary goal of this project is to define the envelope of operating conditions for a large-scale wind project while considering variables of both engineering and economic significance. The National Renewable Energy Laboratory s (NREL) Hybrid Optimization Model for Electric Renewables (HOMER) will be incorporated into the previous analysis using YawDyn and PROPID to determine the economic returns on investment in hypothetical financing cases. Cost factors will now be assigned a mean value along with a probability distribution. Monte Carlo simulations will be run for a large number of variations in the assumed economic and engineering cost factors to develop an accurate estimate of the life cycle cost of the design. A documented analysis methodology using HOMER in addition to YawDyn and PROPID will be presented for use on large scale wind energy development.

The Effect of Charged Nanoparticles on the Separation of Proteins by Gel Electrophoresis

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EXTENDED ABSTRACT

Currently, there is an interest in novel drug delivery systems, diagnostic capabilities and improving separation of biomacromolecules such as DNA and proteins. One possible approach is to add charged nanoparticles to the polyacrylamide gel electrophoresis system to observe the difference in, for example, protein separation efficiency. Another approach included creating templated pores by polymerizing a polyacrylamide gel with various macromolecules (including DNA, xanthan, and SDS) randomly dispersed throughout the gel and removed before performing polyacrylamide gel electrophoresis, which improved protein separation efficiency[1]. In this project, polyacrylamide gels were successfully cast and crosslinked with well dispersed, charged nanoparticles of varying diameters (Southern Clay Laponite RD and an experimental Laponite) at a concentration of approximately 1% (w/w). The dispersion of the nanoparticles, or filler, is characterized by the visual clarity of the resultant gels, environmental scanning electron microscopy as well as X-Ray diffraction, provided by Southern Clay Products. The charged nature of the nanoparticles is expected to improve the protein separation efficiency of the polyacrylamide gel, by comparison to the analogous system where templated pores were introduced into the gel or regular manufactured gels. Future work could include, for example, modifying the current drug delivery systems to optimize the performance capabilities of pharmaceuticals.

Reference:

1. Rill RL, Locke, BR, Liu, Y, Dharia, J, Van Winkle, D, "Protein electrophoresis in polyacrylamide gels with templated pores," Electrophoresis 17 (1996) 1304-1312

Application of Lyapunov Exponents to Damaged Ship Stability Cases

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EXTENDED ABSTRACT

Introduction

Ship capsize is a chaotic phenomenon; this may be the most apt description for a process that cannot yet truly be predicted in random sea states because of the sensitivity to initial conditions. Many mathematical and statistical methods have been employed to determine the probabilities of ship capsize in certain sea conditions, including programs such as the U.S. Navy's SMP, CRNAV and Marin's FREDYN, and SAIC's LAMP. However, because of the chaotic nature of the problem there is no way, as of yet, to completely accurately predict ship capsize in a series of random waves. Recent innovation in hull design has been heightening the awareness of these issues. This very real problem is where the mathematical study of chaotic processes may one-day allow for the real-time prediction of whether a ship is facing imminent capsize.

Lyapunov Exponents

The author uses a mathematical technique called the Lyapunov exponent to study the motion of ships in extreme sea conditions. The Lyapunov exponent is basically a measure of the "stretching" of a group of points in a phase space based on their initial conditions. This stretching can come in the form an expanding or contracting nature, and may best be visualized by a ball of initial condition points. Because of the local deformations, or stretching, of the flow, the ball of initial condition points in k dimensions will become an k-dimensional ellipsoid whose axes are deforming exponentially as defined by these Lyapunov exponents. Therefore, the exponent provides a measure for the separation of initial conditions points as they evolve in time. This technique can be applied to many different types of systems, including the complex nonlinear dynamics of a ship facing capsize in random seas.

Application to Damaged Ship Stability

For this study the author used the Finite Time Lyapunov Exponent (FTLE), which simply defines the exponent over a short time interval instead of an infinite time series, to study the motions of a ship in a damaged ship stability case. A MATLAB code was used that calculated the Lyapounov exponent and FTLE for Roll and Pitch vs. Time for numerous runs of approximately 2,500 seconds long. It was found that there was strong correlation between large amplitude ship motions and spikes in the numerical value of the FTLE. This promising data shows that the Lyapunov exponents may very well be a valid way to predict the advent of large amplitude ship motions in a chaotic system such as a damaged stability case.

Conclusion

The nonlinear motions of a ship in a random seaway is a complex problem that is difficult to solve. This method shows potential for being able to predict the advent of large amplitude ship motions that could lead to catastrophic results, such as ship capsize. The Lyapunov exponent certainly holds promise to being able to predict these motions, and this research will hopefully help validate its use in the field of nonlinear ship dynamics.

Thomas the Train as a Mobile Communication Stand

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EXTENDED ABSTRACT

The purpose was to design a mobile communication stand (MCS), which is functional and appealing to a child. The stand will house a Vantage Communication Unit (VCU) which is an interactive touch screen communication system for Gabriel, a 3 year old child at Siskin Children's Institute with arthrogryposis, which prevents his speech and limits limb movement. Gabriel uses the VCU to communicate with teachers, classmates, and family, but because he has to crawl he has to rely on help to move the VCU. Gabriel needed a Mobile Commutation Stand (MCS) to assist him in his activities. The team wanted the MCS to be more then a simple functional tool, but a tool that Gabriel can enjoy. Gabriel's favorite children's character is Thomas the Tank Engine, which was the inspiration for the design and appearance of the MCS.

The team was formed from individuals choosing a project from six proposals. The team had an open structure; meeting on a weekly basis to identifying objectives and separating work among team members. Members observed Gabriel identifying his needs and VCU use needs. Sketches were created of the desired MCS. The sketches were transferred to Solid Works for dimensional plans for construction. The Solid Works design parts were then assembled view was created, showing the first glimpse of the train. We then took the Solid Work design plans and created a prototype.

The MCS operation is the most important way to understand the role in providing assistance to Gabriel. The MCS body is constructed of pine wood, which was the most cost effective sturdy material available. Train parts were shaped using ban saw and other tools. Coaster wheels were used to allow movement over multiple surfaces, 360 degree mobility, and a turning radius of 17 inches. The Cow Catcher is designed to prevent the unit from tilting on its side, while a drop down train hitch keeps the unit from tipping back. The placement of a handle behind of the train allows Gabriel to push or pull the unit, also facilitating transportation when not in use. A second smaller handle is placed in front to help movement of the unit from that side. The VCU mount is 11 inches off the ground at a 45 degree angle, which give greater access and viewability. The VCU is held in place by "V" shaped clamp with a spinning bar to securely hold it. A team member was able to paint the unit to resemble Thomas the Train, providing the magical touch.

MCU meets the needs of Gabriel and his VCU providing mobility, accessibility, viewability, and greater independence at school and at home. The MCU was such a success, a request was made for a future project for a walker.

The Effects of Micromixing on Heterogeneous Catalysis in Microbioreactor Channels

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EXTENDED ABSTRACT

The results of a numerical study of the fundamental interactions of engineering design and micromixing on conversion in packed microchannels are presented. Previously, channel-based microreactors made of molded silicon plastic were designed, fabricated, and experimentally tested. These reactors have enzymes immobilized on the channel walls by various methods. They also contain molded packing particles to add reactive surface area and to redistribute the fluid. An intuitive packing arrangement was used in experimental studies and modeled successfully by computer simulation. A computer simulation study has been conducted in order to understand how changes in packing arrangement and number of packing particles affect micromixing and conversion efficiency. The behavior in empty and pack channels is compared. The experimental reactors have been simulated using CFD-ACE+ multiphysics software. The focus of this study is to vary the placement and number of packing particles to more efficiently meet conversion goals while taking into account micro fabrication and operational constraints. Microfluidic fundamentals such as Reynolds number (Re), shear stress, and pressure drop are also explored due to variations in design features. The micro scale dimensions of the channel cross section (125 by 500 micrometers) cause all flows to be laminar. Behavior in the range $0.1 < Re < 100$ is examined.

Objectives

To improve fundamental understanding of micromixing and increase conversion efficiency of microbioreactors through the design of packing configurations.

Theory

The Computational Fluid Dynamics software produced by ESI (Huntsville, AL) is used to model the packed microchannels. All inside surfaces of the microchannels, including the packing, are programmed as reactive surfaces. The reaction taking place is $H_2O_2 \xrightarrow{\text{catalase}} H_2O + \frac{1}{2} O_2$. CFD-ACE+ solves the following equations using finite-volume analysis: Navier Stokes Equation (momentum continuity), Conservation of Mass, Michaelis-Menten Kinetics, and Species Conservation.

Results

Significant increases in conversion are found due to coated packing over the range $0.1 < Re < 100$. These increases are always greater than the increase in reactive surface area. Conversion has been increased by as much as 150%. Changes in the positions of the particles improved conversion as much as 35%. Pressure drop increases with packing population and fluid velocity. Pressure drops and shear stresses may be problematic for heavily packed channels at Re=10.

Monitor Mount System

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EXTENDED ABSTRACT

Design Problem

A touch monitor and mounting system was needed for a family with quintuplets. The children are 22 months old and have a variety of abilities and disabilities. As young children, they are fascinated with the computer but do not understand how to make it work. Due to the children's young age and disabilities the computer the children will use must be accessible through a touch monitor. The computer monitor must be able to be moved up and down so that the screen is visible and accessible to each child depending on what level is most appropriate for them. One of the children uses an adapted wheelchair for positioning. Currently on the market there is nothing that would meet the family needs.

Purpose and Project Goal

The Monitor Mount System (MMS) purpose is to provide a touch interface that fosters child development, and to provide adjustability so that it can accommodate the different needs of each child.

The goal of this project was to

1. Design a touch screen mount system that is useable and accessible to the customer
2. Prototype and test the design
3. Implement and present design

Team

Each team member voluntarily signed up to participate in this process based upon a project proposal. Each member was given certain responsibilities based on their skill set. The team used a project team structure where there was no defined project leader and everyone was accountable for their own duties and success of the project.

Device Design

The team used various engineering design tools such as brainstorming, objective trees, function-node diagrams, functional block diagrams, sketches, morphological charts, and pair-wise comparison tables to come up with the final design. The final design showcased a rolling cart that houses a CPU. Attached to the cart is a monitor arm that provides multi-axis positioning of a 19" LCD flat panel touch screen monitor. The cart is designed to be maneuvered into many different positions so that it can be used by all of the children. The MMS was completely custom built to meet the family's needs and wants.

Results

The MMS has had immediate results since being setup in the family home; all the children can easily touch the screen to control the learning programs. The family has noted that one child has already started to develop new skills since using the programs on the computer. Hopefully over time all the children will show the same increased development.

Isolation of Endothelial Cells from Peripheral Blood by Microfluidics

EXTENDED ABSTRACT

Endothelial cells are known to play key roles in the pathogenesis of several diseases, such as Sickle cell disease. Isolating circulating endothelial cells from peripheral blood is a more viable alternative to tissue biopsies. Small numbers of circulating endothelial cells in whole blood requires techniques that can accomplish reliable isolation. Commonly used methods for depletion of erythrocytes in blood and isolation of nucleated cell populations include density gradient separation and NH_4Cl lysis. These methods are harmful to the cell and cause stress, activation, and loss of certain cell populations. In addition, the methods are labor intensive, time consuming, and imprecise, with varying protocols among separate labs. A new technique, microfluidics, is cheap, automated, and efficient, addressing the flaws in the aforementioned techniques. In comparison to density gradient separation and NH_4Cl lysis, microfluidics causes less activation and preserves all cell populations. Endothelial cells, in particular, are very sensitive to stress and a majority are destroyed in current clinical isolation protocols. Preliminary results show microfluidics recovered 1.9×10^6 endothelial cells/ml from whole blood, as opposed to 3.27×10^5/ml and 4.19×10^5/ml endothelial cells from density gradient separation and NH_4Cl lysis, respectively. Using microfluidics, we have shown reliable and reproducible isolation of circulating endothelial from peripheral blood in numbers not possible using conventional techniques.