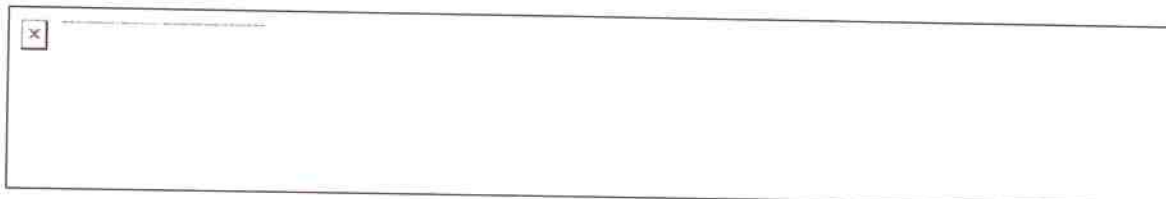


Moore, Marsha M.

From: ASEE: Connections - January Issue <connections@asee.org>
Sent: Wednesday, January 18, 2012 11:27 AM
To: Thompson, James E.
Subject: Engineering Faculty Salaries: Public vs. Private

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January 2012

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- Free Recorded Webinar Online: Advanced Physical Modeling Tackles the Complexity of Modern Engineering.

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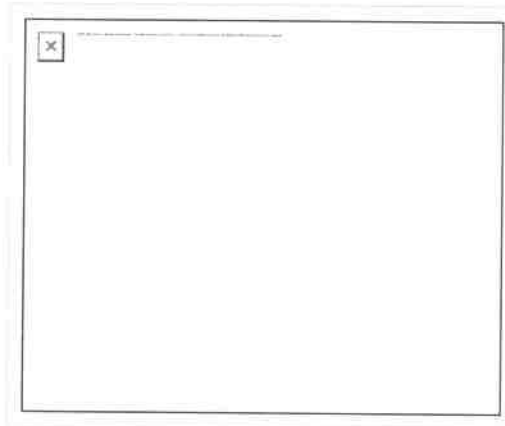
IX. SOUND OFF!

- Do you have a comment or suggestion for Connections?

I. Databytes

Median Faculty Salaries, 2011: Public vs. Private Institutions

Tenured/tenure-track engineering faculty salaries were higher for all departments and all faculty levels at private institutions as compared with public institutions in 2011. These differences were greater at the higher ranks, as the data below indicate. ASEE collected salary data from 147 public and private engineering institutions for the 2010-2011 academic year. The salaries are based on a 9-month equivalent. They do not include administrative supplements.



Salaries			
Public Institutions	Assistant	Associate	Full
Biomedical	\$82,615	\$97,810	\$134,282
Chemical	\$82,982	\$93,433	\$127,358
Civil & Environmental	\$77,649	\$90,472	\$115,503
Computer Science (inside eng.)	\$85,338	\$95,956	\$125,977
Electrical & Computer	\$84,274	\$94,737	\$122,403
Industrial & Manufacturing	\$78,517	\$92,897	\$126,495
Mechanical	\$79,919	\$90,869	\$118,023

Metallurgical& Materials	\$85,009	\$96,163	\$135,006
Total College	\$80,595	\$92,222	\$118,250

Salaries			
Private Institutions	Assistant	Associate	Full
Biomedical	\$85,176	\$99,125	\$146,408
Chemical	\$85,547	\$95,619	\$134,895
Civil & Environmental	\$79,787	\$94,717	\$127,561
Computer Science (inside eng.)	\$87,395	\$101,797	\$136,064
Electrical & Computer	\$85,379	\$100,894	\$126,031
Industrial & Manufacturing	\$83,957	\$98,681	\$131,771
Mechanical	\$81,057	\$95,375	\$126,004
Metallurgical& Materials	\$90,450	\$101,801	\$142,873
Total College	\$81,448	\$95,088	\$124,632

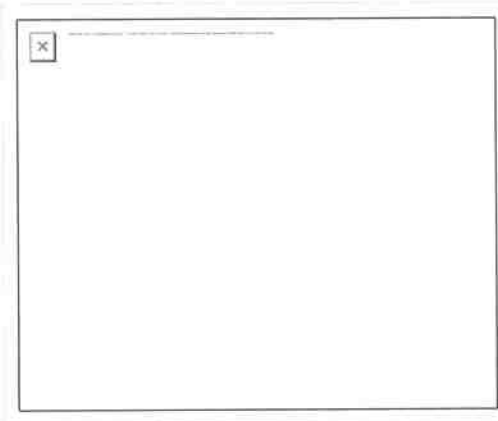
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II. Congressional Hotline

Congress Unlikely to Green-Light Consolidation Plan

The White House has an urge to merge, but the plans face a bumpy reception on Capital Hill. Commerce Department's core business functions would be merged with five other trade agencies in a new department under the consolidation plan announced by President Obama. The National Oceanic and Atmospheric Administration would be moved to the Interior Department. The other agencies to be merged into the new department are

the Small Business Administration, Office of the U.S. Trade Representative, Export-Import Bank,



Overseas Private Investment Corporation, and the Trade and Development Agency. A White House [fact sheet](#) didn't specify what would happen to the National Institute of Standards and Technology, but Science's Jeff Mervis [reports](#) that NIST and the U.S. Patent and Trademark Office would be part of a technology and innovation section within the new department. The White House indicated this could be just the first of a series of consolidations. Its chief planner was Jeffrey Zients, deputy director for management at the Office of Management and Budget. But first, Obama will have to win authority from Congress to reorganize the government, something he is asking be done with an up-or-down vote. Chances of this happening in an election year are not good. Congressional Republicans complain Obama didn't work with them. CQ quotes an unnamed Senate GOP aide as saying Obama is just rearranging deck chairs on the Titanic.

Expert: Research will Eventually Face Funding Cuts

Science magazine's Jeff Mervis enlisted two experts to comment on how scientific research was treated in the FY2012 congressional budget process. "I think there is broad bipartisan agreement on federal support for basic research," Joel Widder said during a web chat. Mike Stephens agreed that science had come out reasonably well this year, but said, "I see this year's final spending agreement as essentially a brief ceasefire in the ongoing war on the deficit." Deficit reduction efforts will resume, and funding for science agencies, "especially the largest -- NIH, NSF, and NASA -- cannot escape being drawn into this very difficult retrenchment in federal spending."

White House Praises GOP Senator's Attack on Waste

The research community may protest Sen. Tom Coburn's latest compilation of allegedly wasteful spending, but the White House isn't complaining. An Office of Management and Budget [blog](#) touts the Oklahoma Republican as "a leader in looking for ways to cut unnecessary government spending," and adds "it is clear we share the senator's commitment to cut waste . . ." Examples cited by Coburn include a \$760,000 National Science Foundation award to the University of Notre Dame to study the wireless and social networking habits of college freshmen; an NIH-funded study by Virginia Commonwealth University of hookah-smoking by Jordanian students; a \$452,642 NSF award to research the effects of providing information to citizens of India on the performance record of local lawmakers; an NSF grant to study the impact of women on the Icelandic textile industry; and a \$500,000 NSF award to develop plays that teach children chemistry and physics.

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III. TEACHING TOOLBOX

Heavy Metal

Bronze bells and songwriting software inspire a merger of engineering and music

By Alice Daniel

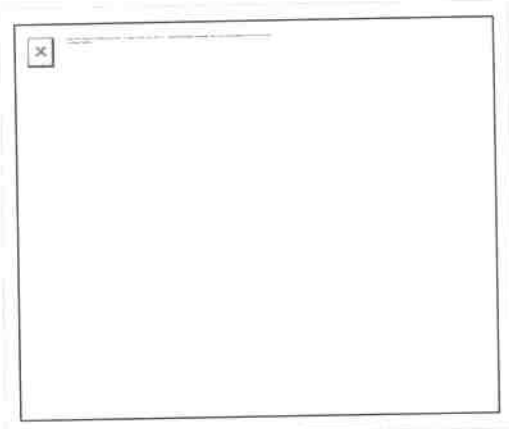
When "The Victors" peals from the 55-bell carillon high inside the University of Michigan's Burton Tower, it's likely many students below can hum the famous fight song as they stroll. One group, though, also understands the engineering and skilled labor behind the resonant tones, having sculpted and poured metal to make carillon bells, used a computer program to pre-tune the bells, and worked with lathing equipment to finesse the shape and achieve a particular sound. All these techniques were incorporated into the freshman course Shaping the Sound of Bronze. Team-taught by professors from engineering, music, art and design, and cross-listed in several departments, it is one of a number of ways teachers have found to present engineering concepts through the arts.

Fashioning metal into music allows students to experience "a real die-hard design problem where effectively they have to work together in teams and get their hands dirty," says Gregory Wakefield, an associate professor in electrical engineering and computer science and one of the instructors who introduced the course in the fall of 2010. But Shaping the Sound offers more than hands-on harmony.

An expert in signal processing and the physics of sound, Wakefield is always looking for ways to hook engineering students into a deeper understanding of Fourier mathematics. "Being a musician myself, I gravitate toward examples from the audio world," he says. The course gives engineering students "a gut-level understanding of how this stuff works, so when they have to sit down and work the math problems, they have a better sense of why it matters."

Wakefield created a modeling program to help students understand how changing the shape of the bell would affect the sound. "Fourier allows us to mathematically represent the sound in a way that we tend to hear it – the punch line being that we could then work with the students to create synthesized versions of their bells," he says. Students could change the sound of their synthesized bells on the computer, in effect pre-tune them, and then go and physically remove the predicted amount of metal from the bell. "We are able to teach the students how objects make sounds, how resonance works, how if you push a shape in different ways, it's going to sound differently," says Wakefield. "It makes a lot of sense to them because they can relate it to what they are hearing. Fourier is a little abstract."

In the process of putting this unique course together, Wakefield not only introduced his students to Fourier, but he and his university colleagues essentially modeled for their students one vital goal for the class: learning to create and design in multidisciplinary teams that include artists, musicians, and engineers. In fact, the idea for the course came from music professor and university carillonneur Steven Ball, who wanted his own students to gain a much deeper understanding of the carillon. "It really requires all the students to cross-pollinate with the other two disciplines and remain sensitive to what



the other two disciplines have to say about it," he says.

For engineering students, "there are wonderful things that artists and musicians can bring to the table in understanding how to design," adds Wakefield. In this course, students relied upon the expertise and well-trained ear of Ball to make sure the bells sounded great, and the strategies of art and design professor Lou Marinaro to make sure the bronze was poured correctly. They thus learned an important lesson in addressing customers' needs. "Ultimately the user will develop an affinity toward your product if it has been designed to meet their aesthetic tastes," Wakefield says.

Helping engineers grasp intuitively what they will later learn mathematically is also the thinking behind a Rowan University course entitled Signals and Systems in Music. "A musical note is the same thing as an electrical signal when you're studying engineering," says Linda Head, an associate professor of electrical and computer engineering at the Glassboro, N.J., school. "We wanted to show students there was a continuity between things that look very different. There's an enormous amount of engineering buried in the kind of work and analysis that musicians do and vice versa. They'll get the math later, but they have a gut-level appreciation for what these signals sound like and look like and how you can manipulate them."

Head is the principal investigator on a National Science Foundation-funded project, shared by Rowan University and Kansas State University, in which Signals and Systems in Music serves as a model course emphasizing synergies between music and engineering. In the Rowan course, which falls under general education so anyone can take it, students learn some basic music theory and then learn how to use GarageBand to compose a song using loops, MIDI instruments, and recorded tracks for their final project. "At the end of the semester we have a big jam session," says Head, who oversees the course taught by two adjunct instructors.

Like the carillon bell-making course, Signals and Systems sets the stage for looking at Fourier series. For instance, students use engineering tools like oscilloscopes to analyze sinusoid waves and multimeters to measure the voltage or amplitude of a signal. "They can recognize a particular sound is correlated with a particular wave form on an oscilloscope," says Head. "A sine wave makes a very smooth sound; a square wave has a lot of high-frequency components."

Samantha Pfeiffer, an electrical and computer engineering major, says she never expected to take a music class in college because it's not her forte. But with Signals and Systems, she says, "I got a music credit, and I got exposed to some engineering."

With students now accustomed to listening to favorite tunes on hand-held devices, that's a logical starting point for a course that combines music and engineering. In Building a Mobile Phone Ensemble, they design and develop their own new mobile phone "instruments" by writing software. They then compose new electronic musical works that they perform in ensembles at the end of the semester.

The University of Michigan course immerses students in problems that are not numbers-centric, says Georg Essl, an assistant professor in electrical engineering and computer science as well as music. "The way they think about their creative process changes. It's more of an expressive versus problem-solving creativity. It's really enlightening."

Student Anton Pugh participated in several performances last year, including one where students programmed iPod Touches to light up with different graphics when they were spun on a table. "The aesthetic component was interesting to me. He (Essl) encouraged us to go as far as we could with it," says Pugh, who is now working on a master's in electrical engineering with a concentration in signal processing. "It was definitely a different way of thinking for me because we not only had to make them functional but make them look good."

Essl says students have to engage with the musicality in order to make the technology interesting and vice versa, a task that isn't always easy. "It's about tearing down those boundaries between art and engineering," he says.

As the Michigan fight song chimes, "Hail!"

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IV. JEE SELECTS

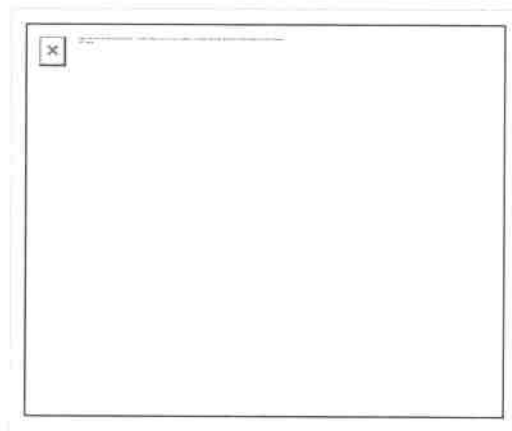
Help Yourself by Helping Others

Students gain confidence in their own skills by supporting teammates

By Senay Purzer

Imagine a student, Alex, who constantly disagrees with his team members and procrastinates in completing his project assignments. Imagine another student, Bryan, who patiently listens to his teammates and intervenes when discussions appear to take a disruptive turn. Is Alex's behavior a reflection of his self-efficacy? Do interactions with teammates affect Alex's and Bryan's achievement in class? Do Bryan's positive verbal interactions result in improved self-efficacy and learning? While much research has been conducted to study the relationship between cooperative and collaborative learning in higher education, few studies have explored the nature of team discourse and how these discussions support or hinder individual student learning.

In a mixed-methods discourse analysis study involving 22 engineering students, I investigated the relationship between team discourse, self-efficacy – perception of one's own academic competence – and individual student achievement. By combining survey and discourse analysis methods, I was able to gain an in-depth understanding of team learning processes. Thousands of verbal exchanges of the students were recorded weekly in the classroom when students worked on their design projects. These exchanges were then transcribed and coded. Quantitative data on students' pre- and post-project self-efficacy were also collected using a Likert-scale survey. Next, I interpreted my results within a



framework of two robust learning theories: Bandura's social cognitive theory and Vygotsky's social constructivist theory. Three key findings emerged from these analyses.

There is a relationship between being supportive toward peers and one's own self-efficacy. The results indicated a moderate and positive correlation between the post-project self-efficacy of a given student and support-oriented discourse initiated by that student. However, in contrast with the social cognitive theory, receiving verbal persuasions did not improve self-efficacy. This suggests that what affected students' self-efficacy and academic performance was not necessarily the negative or positive comments they received, but the amount of support-oriented discourse they themselves provided to others.

Lots of explaining, little task clarification. Students engaged in six types of discourse actions during their classroom discussions: task oriented, response oriented, learning oriented, support oriented, challenge oriented, and disruptive. Among these discourse actions, they spent most of their time answering questions and explaining ideas (response oriented) and less time identifying goals and clarifying tasks (task oriented). In addition, engaging in challenge-oriented discourse or learning-oriented discourse did not reveal correlations with self-efficacy or achievement.

Self-efficacy gains were related to task-oriented discourse. Another relationship was found between self-efficacy and task-oriented discourse. Students who were primarily told what to do had only small gains in their self-efficacy.

These results indicate that a team is not just a group of individuals who share a common goal, but a social entity with complex social, affective, and cognitive interactions. Teamwork can support individual student learning when these interactions promote self-efficacy. The results also suggest three observable characteristics of teams that reinforce learning and self-efficacy. Teams that lead to better learning for the individual members: 1) determine and assign tasks collaboratively, 2) respond to, critique, and elaborate on each other's comments, and 3) minimize off-task behavior and negative criticism.

To reinforce positive actions and achievement of all individuals, teams can be monitored closely or taught how to monitor their own interactions. Video case studies of experts and novices and how they interact in their teams can be used to stress learning through vicarious experiences. These team self-monitoring skills and video case-study reviews have been put in place as a part of the revised curriculum at several institutions following this research, and the impact will be an area for future study.

Senay Purzer is an assistant professor in the School of Engineering Education at Purdue University. This article is an extract from "The Relationship Between Team Discourse, Self-efficacy, and Individual Achievement" in the October 2011 issue of the Journal of Engineering Education.

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V. JOBS, JOBS, JOBS

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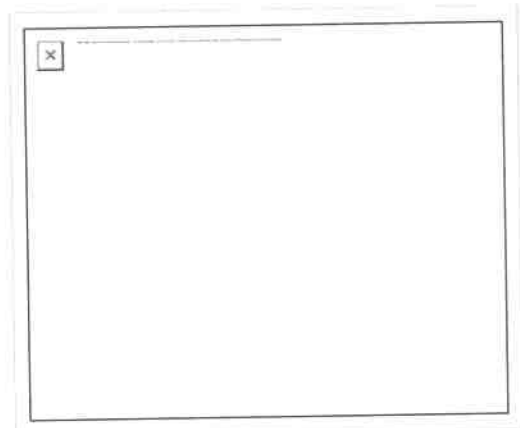
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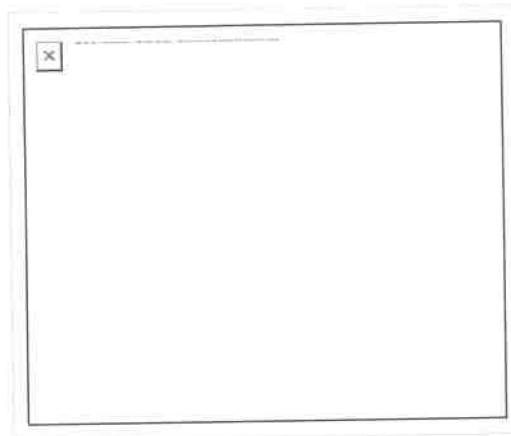
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In an economy driven by the need for innovative, reliable, cost-effective solutions, there is enormous pressure being placed on engineering educators and researchers to produce efficient designs, and efficient students. Engineering researchers must not only develop models quickly, but also require in-depth analytical tools to help them investigate the intricacies of their models at a fundamental level. Engineering modeling software needs to offer increased capabilities for researchers, and also needs to be easy and intuitive enough to be used by undergrads so they can gain greater insight into the nature of physical systems.

Fortunately, advanced physical modeling solutions are available for model development and analysis, while also increasing student comprehension. This webinar illustrates how engineering researchers are making significant strides in their work with the help of advanced physical modeling technology. It highlights the work of three researchers, and discusses such diverse projects as space rovers, hockey



sticks, parallel manipulators, and electric and hybrid-electric vehicle batteries. In this panel discussion lead by Dr. Derek Wright of Maplesoft, learn firsthand how advanced physical modeling and simulation technology can enrich your classroom and accelerate your research.

ASEE Webinar Presented by Maplesoft.

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VII. COMMUNITY ANNOUNCEMENTS

ASEE K-12 Workshop - *Proposals Sought*



ASEE's Ninth Annual Workshop on K-12 Engineering Education - "Employing Engineering for STEM Learning". The event will be held on Saturday, June 9, in San Antonio, Texas, one day before the opening of the annual conference. Proposals will be accepted **November 1, 2011 through January 27, 2012**.

Individual workshops should prominently feature hands-on classroom activities, provide take-home or classroom-ready materials and be designed to engage participants in interactive exercises. Workshops that offer tangible material to attendees, in addition to written material, are specifically solicited. Proposals addressing 1) elementary/primary grades and 2) demonstrated methods for involving practicing engineers and engineering students in the classroom are also sought.

Watch the K-12 Workshop website for updates:

<http://www.asee.org/conferences-and-events/conferences/k-12-workshop/2012/call-for-proposals>

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VIII. COMING ATTRACTIONS

Coming up in the February 2012 edition of Prism magazine:

COVER STORY: Undergraduates are catching the entrepreneurship bug, turning inventions into products and companies.

FEATURE 1: Can universities fulfill President Obama's call for 10,000 more engineers per year?

FEATURE 2: The president of the University of Maryland Baltimore County knows how students can

