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Hello S&T instructors: Time to catch your second wind as we approach mid-semester and St. Pat's break. In this edition, read about how faculty handle classes of [100-plus](#) on a regular basis, predictions from an internationally known engineering educator about [upcoming changes](#) in teaching engineers, being proactive about [end-of-course evaluations](#), and other news.



**CERTI
NEWSLETTER**
Center for Educational
Research and Teaching
Innovation at Missouri S&T

Perils and Potential of the **LARGE** Class

How many students does it take to make up a large class at Missouri S&T?

That's not a joke awaiting a punch line, but a reality that many S&T faculty are grappling with as they look for effective ways to handle growing class sizes.

CERTI recently sat down with four S&T instructors who regularly teach sections of 100 or more students and who also have been recognized for their excellence in the classroom:



- (pictured from left) [Elvan Akin](#), associate professor of mathematics and statistics, who has taught 100-plus students in each of her Math 15 (Calculus 2) sections during her 10 years at S&T;
- [Clayton Price](#), associate teaching professor in computer science, who currently teaches 110 students in his CS01 sections;
- [Amber Henslee](#), assistant professor in psychological sciences, teaches approximately 100 students in general psychology each fall semester;
- [Ryan Hutcheson](#), assistant teaching professor in the mechanical and aerospace engineering department, who regularly teaches four sections of IDE20, each of which have 100-140 students, and an engineering mechanics class of close to 100.

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Give Us Your Suggestions!

Is there an instructor you would like to see featured in the CERTI newsletter? What about a teaching technique that you have found to be helpful? Email your ideas to [Diane Hagni](#) for consideration for future CERTI newsletter issues.



"A large class is one where you can't really get to know your students," says Price. "I would say anything over 25." A veteran instructor of 33 years at S&T, Price also taught large sections of students in the math department for 20 years before moving to computer science.

"You can know names up to about 25 or 30 students," Hutcherson says, which is key to allowing student-instructor interaction. More than 30 students, and communication issues become complex, says Akin. The current average class size at Missouri S&T is 29.

Challenges are multiplied

It's always a challenge to put names to new faces, but much more so when there are several dozen names to master. Yet, these instructors make it a point to learn as many student names as possible. "When they ask a question, I ask them to say their names," says Akin. "Anytime I interact with a student, I say their name until I get it," says Price. "Usually by the end of the semester, I'll know most of their names."

All of the challenges in regular teaching are multiplied when student classes are larger, such as perennial grading issues.

"Having larger classes does affect assessment," Henslee says. "We don't have any graders in the (psychology) department. When I think of something new or innovative to add to the class, the very next question is, how am I going to get all of this grading done by myself?"

Hutcherson says the students' weekly assignments are handled by graders, however, he grades all of his exams himself. He found out the hard way not to delegate viewing the students' final presentations to others. One semester he did so and his course evaluations took a nosedive. Students commented that they expected the instructor to be present for all of the first and final prototype testings of the student designs, although that meant 22 hours of watching student presentations.

Work-arounds and solutions

Hutcherson adopted personal response devices (clickers) a few years ago in response to student complaints that their peers were not attending class. At the time, there was about a 50% attendance rate in IDE20. Those who attended did not see any tangible reward for being in class and also became frustrated with their non-attending peers when it came to group work in the lab. They wouldn't have a clue as to what they were supposed to do having missed the instructions from class. Clicker points now give students an incentive to be present in lecture, and Hutcherson has seen attendance grow to 80%.

Henslee and Akin also use clickers throughout their class periods to review, identify misconceptions and help the students gauge their own understanding of the material. Price, however, calls himself "old school," using no technology but a chalkboard in his teaching. In his larger classes, he says he makes up for not being able to look each student in the eye or nudge them when they are falling asleep by creating as much energy as possible.

"I am very dynamic in my lecturing. I run up and down in front of the class," he says. "And I try really hard to make my lectures humorous. I make a joke of everything I can to keep everyone engaged."

Henslee agrees that humor works, especially the self-deprecating variety. Her best work-around for large class challenges, though, is to *walk around*.

On the Road With Course Redesign

[Klaus Woelk](#), interim chair of the chemistry department at Missouri S&T, is taking the expertise he gained in leading a [major course redesign effort](#) at S&T to help other four-year institutions in the state with redesign initiatives.



Woelk is serving as one of four state-wide Missouri Learning Commons Scholars, funded by the Next

Generations Learning Challenges grant from the Gates Foundation.

Two years ago, Woelk was asked to redesign Chemistry 1 at S&T as part of Gov. Jay Nixon's proposal, involving all 13 public, four-year institutions in Missouri. Goals were to improve student learning, persistence and program completion, and reduce the costs of instruction in large undergraduate gateway courses.

With the usage of the buffet model for Chem 1, Woelk was able to reduce the number of instructors needed from six to two, with no decrease of students served, thus freeing up faculty to teach higher level courses in the chemistry department.

In the redesigned course, students spend twice as much time as they did in the traditional course in collaborative learning experiences, while also

"I have taken to walking the whole time while I lecture," says Henslee. "There have been times when there are students in the back rows, texting or Facebooking, and I lean down and quietly say, 'Can you please stop that?'" she says. "That was happening a lot more frequently when I was up on the stage. It decreased when I got down and started walking around."

She also uses videos and as many real life examples as she can, whether it comes from her personal work as a clinician or from other examples.

Akin says the content of her courses keeps her at the chalkboard for much of her class, but she uses questions to keep from losing students. She, too, uses clickers, but also poses verbal questions, especially targeting students that seem to be distracted or are talking among themselves. One quirk of human nature that she has found is that students tend to sit in the same seats all semester, even though they are not regulated by a seating chart.

"Maybe I don't know all of their names, but I know where they sit," she says. Akin stresses that it's important to keep your demeanor friendly when trying to engage students, rather than becoming negative toward them, even if they are being distracting while instruction is going on.

In addition to clickers, Hutcheson uses questions, comedy and videos for engagement. "Questions and comedy seem to work better in the afternoon classes," he says. "At 2 o'clock you ask questions and you get answers." That doesn't work as well for his two 8 a.m. sections, though. "The videos work universally. You play a video and everyone gets quiet and watches it."

Handling expectations

Most of these instructors also have to deal with the relevance issue, as the students they teach are primarily non-majors and not always enthusiastic about having to take the class. They come into the course with pre-set expectations, according to Henslee.

"On the first day of class, after going over the syllabus, I hand out notecards and ask for anonymous comments – what do you expect from this class? What do you expect from the instructor?" she says.

She finds that there are several unrealistic expectations from students, such as they want to take the class for an easy A or they want to have information dumped into them rather than actively being involved in their learning. The next class period, she lists the realistic and unrealistic expectations on a PowerPoint slide and goes over each one, so the students know where their perspectives land and where she, as the instructor, is planning to take them.

Despite all of the challenges inherent in larger classes, it is possible to find unexpected benefits. Price appreciates being able to go into a lower level class with no notes, using his concentration to interact more with students instead of being solely preoccupied with content. In the higher level classes he teaches, "I can't devote as many brain cells to making jokes," he says. "I haven't used notes in the lower level classes in a long time."

"I like the dynamic," Akin says of the larger classes. "In the beginning it was hard, of course, but once you do it awhile, you learn what works."

Each of these instructors have been recently recognized on campus for their excellence in teaching: Akin was awarded the "We Love Your Class" award from Freshman Engineering in 2012; Henslee was awarded the 2012 Teaching Award; Hutcheson the 2011 Achievement Award, and Price the 2012 Achievement Award.

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having a variety of choices about how they would like to receive lecture and recitation instruction – face-to-face, online streaming, or online asynchronous.

The full implementation of the project in fall 2012 compared to fall 2011 showed no significant changes in A/B letter grades, but an increase in C's and less D/F grades.

As a Missouri Learning Common Scholars, Woelk assists in workshops and one-on-one consultations for both on- and off-campus redesign efforts.

"I certainly enjoy conducting these workshops," says Woelk, "not only to talk about my redesign experiences but to learn about what other schools have done. We can learn a lot from other schools and their redesign attempts."

He will also be responsible for helping to evaluate this year's redesign proposals across the state; the [solicitation process](#) is now under way. Redesign projects can garner \$5,000 in funding. It is expected that matching funds will be available from the respective campuses. An honorarium and travel expenses for Woelk and the other Scholars are covered by the Next Generations grant.

Woelk is a member of S&T's Center for Educational Research and Teaching Innovation (CERTI) and served as director of S&T's New Faculty Teaching Scholarship program and Freshman Faculty Forum. He has won numerous

Is a Revolution Coming to Engineering Education?



Richard Felder, Hoechst Celanese Professor Emeritus of Chemical Engineering at North Carolina State University and one of the leading voices for engineering education in the world, will be on the S&T campus March 14 to make the case for an engineering education revolution to meet the challenges of the 21st century.

“Engineering education is changing, whether we like it or not.” – Richard Felder

Felder has won numerous awards and two honorary doctorates for his contributions to engineering education, culminating with his being selected last year by the American Society for Engineering Education as the first recipient of its new Lifetime Achievement Award in Education.

“Schools that insist that what worked 20 years ago should still work now are going to become obsolete,” he says. “Students are going to start voting with their feet.”

Felder’s presentation, “Science, Technology, Engineering and Mathematics (STEM) Education in Five Years – Or Sooner,” will be the keynote address at the S&T Teaching and Learning Technology Conference at 10:30 a.m. Thursday, March 14, in Butler-Carlton Hall, Room 125. The event is free.

Felder’s talk will include a survey of the challenges confronting engineering professions currently, the changes that are being proposed, and predictions of what will happen in the next five years. He cites a number of factors that are converging to bring about an engineering education crisis:

- Fewer secondary school students are interested in engineering careers and, once these pared-down cohorts enter the university, attrition rates are high, even among students with strong academic records.
- U.S. accreditation systems are now outcomes-based, where assessment has moved from examining what has been taught to documenting what students have learned.
- Employers of engineering graduates continue to complain that their new hires lack crucial skills in the workplace necessary for their success.
- Jobs that engineers did 25 years ago are increasingly being offshored, Felder says, yet what is taught in most engineering classes is still designed to prepare students for those jobs. The skills that tomorrow’s engineers will need – critical and creative thinking, multidisciplinary teamwork, intercultural communication, to mention just a few – have not yet made it into most engineering curricula.



teaching awards, including the coveted “We Love Your Class” award, the Wilbur Tappmeyer Award for Excellence in Teaching Undergraduates, the Missouri S&T Teaching Excellence Award, and the University of Missouri President’s Award for Innovative Teaching in the inaugural year.

Go to the [Missouri Learning Commons](#) website for more information.

Educational Research Mini-Grants RFP

The request for proposals for the 2013-2014 educational research mini-grants, sponsored by CERTI and funded by the Vice Provost for Academic Affairs, is now available on the [CERTI website](#). Proposals are due April 15.

For more information, contact Diane Hagni, hagnid@mst.edu.

Free Teaching and Learning Conference March 14-15

Richard Felder will be the keynote speaker for the 2013 Teaching and Learning Technology Conference held on campus March 14-15 in Butler-Carlton Hall. Felder will speak at 10:30 a.m. Thursday, March 14, in BCH 125.

There will be a number of break-out sessions, a vendor reception, door prizes, and a plenary talk by [John Hogan](#), S&T associate professor of geology, at the close of the conference at noon March 15.

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- A growing body of educational research and cognitive science demonstrates that traditional lecture-based instruction is ineffective at promoting the types of thinking needed in modern engineering practice.

What makes learning happen wasn't happening ...

When Felder began teaching in the university classroom in 1969, he was unaware of the challenges that were on the horizon. What he was uncomfortably aware of, though, was how his carefully crafted lectures were met with a sea of glazed eyes week after week. An average score of 43 on his students' exams shocked him as well; the material on the test had been explained, he felt, in excruciating detail. "I figured out things were not going quite the way I had in mind."

Still, for 15 years Felder continued teaching conventionally, until he went on sabbatical leave, and an encounter with a childhood friend who had become an educational psychologist challenged his teaching philosophy. He discovered an entire body of solid research existed about teaching and learning, and "what makes learning happen wasn't on the list of things I had been doing in my class."

He did some reading, went back to his classroom after the sabbatical, and tried out a few simple research-proven strategies. "Once I started trying some of these things, I found out that they worked beautifully in my chemical engineering classes," he says. "Then I started writing about it."

Teaching: To cause to learn

For the past 20 years, Felder has been engaged full-time in faculty development, presenting workshops around the world and writing extensively, along with his wife and colleague, Rebecca Brent. He is one of the coordinators of the ASEE National Effective Teaching Institutes, where engineering faculty participate in three days of intensive teacher training. Nearly 1,200 engineering faculty members from 236 different schools have attended the event since 1991, including 38 from Missouri S&T, which has sent more participants than any other school in the country!

Felder prefers to define teaching as "to cause to learn" rather than "to present information." His workshops stress implementing active learning strategies into traditional lecture formats, so that students are more engaged in the learning process and professors aren't the only ones doing the thinking. These active learning teaching methods are not just good ideas, he says; they are rigorous, research-based methods that have been shown to promote learning and skill acquisition better than traditional lecturing can do.

Felder can sympathize with the overworked STEM professor who is also doing research in his or her field and thinks there is no time to spend on improving teaching. For nearly 10 years, he did both educational innovation in the classroom and extensive engineering research and publishing. He admits it was not easy, but it was possible to manage both successfully. Fortunately, making changes in the classroom does not have to monopolize all of an instructor's time. In his workshops, Felder emphasizes proven teaching strategies – including active learning – that can be done with almost no training and require very little preparation time. For more information, go to Felder's website, "Resources in Science and Engineering" at http://ncsu.edu/effective_teaching.

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Steps to Better End-of-Course Evaluations

The best way to avoid unpleasant surprises in end-of-course evaluations is to be proactive about getting feedback from students earlier in the semester.

Mid-semester is an ideal time gather some helpful information. Here are some ideas:

- Attach a page to the back of the midterm exam asking students about how long they studied, which class activities helped them the most, which helped the least, which topics remain difficult for them, and how the instructor helped or hindered their learning.
- Or, instead of open-ended questions, use declarative statements with a Likert scale for students to rate anonymously a couple of different times in the semester.
- Let students know they can be negative, but not mean-spirited. Feedback must be constructive.
- Be sure to respond to student feedback and discuss changes you are willing to make or give reasons why some changes are not feasible.

Faculty Focus articles 7.30.12 and 1.2.13 provided information for this column.

Instructors Share on Generating Good Classroom Discussions



Above, [Katie Shannon](#), associate teaching professor of biology, shares with a group of faculty how she motivates even her quietest students to participate in classroom discussion at a CERTI faculty learning community held Feb. 1.



[Shannon Fogg](#), associate professor of history, also shared at the event and had participants try out an activity she uses in the classroom to generate discussion with primary source documents. She handed out packets of letters and other documents written in foreign languages (left), asking participants to glean as much information as possible and share with the rest of the group.

To see the PowerPoint

presentation for the event with additional resources, go to <http://certi.mst.edu/events/flcs/>.

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Mission Possible: Motivating Students to Learn

Ten of the campus' highly motivating instructors, as identified by recent end-of-course evaluation scores, shared tips and strategies for motivating students at CERTI's brown-bag lunch event March 6.

After a brief presentation on motivation theory by Merilee Krueger, associate teaching professor of psychological sciences, the rest of the time was spent with participants discussing motivation in a variety of scenarios: large classes; required, non-major courses and culturally diverse classes.

Some of the tips for motivation provided from the discussions were:

- Establish personal connection with students – learning names, sending introductory emails, offering forums for in- and out-of-class connections, etc.
- Have a passion for what you teach: Your positive attitude is critical, contagious and will be reflected by students
- Look for ways to help students understand they are not alone in struggling with a concept, idea or skill.

For a complete list of the suggestions, go [here](#).