MISSOURI S&T CERTI *Center for Educational Research and Teaching Innovation*

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Hello S&T instructors! Congratulations on finishing another semester. Is it possible to go from dismal teaching evaluations to becoming an award-winning teacher? Find out how Greg Hilmas did it. Also in this issue, we congratulate 50+ award-winning faculty members, hear about why Chem 1 is going to a "buffet" model in the spring, and offer resources for teaching Millennials.

CERTI NEWSLETTER

Center for **E**ducational **R**esearch and **T**eaching **I**nnovation at Missouri S&T

Greg Hilmas

Maximizing Student Learning

When Greg Hilmas got the nerve to turn around from the chalkboard where he had been writing feverishly to look at his first classroom of students at Missouri S&T, he saw them shaking their writing hands in fatigue.

Greg Hilmas, recently named Missouri S&T Curators' Professor of Ceramic Engineering and winner of 11 Faculty Excellence Awards and eight Outstanding Teaching Awards. Photo by B.A. Rupert

That was another good reason to keep facing the board. Due to a mixture of nerves and lack of preparation, Hilmas said that his first group of students mostly saw the back of his head.

The year was 1988 and his first teaching assignment was a Mechanical Properties of Materials class. Hilmas was taking over for a retiring professor who had promised him all summer that he would share his teaching notes. The summer dwindled down to two weeks before the semester when he found 10 pages of hand-written notes and six journal articles in his mailbox.

"It was crazy!" says Hilmas, who was recently named Curators' Professor of Ceramic Engineering in the materials science and engineering department. "I was

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(View previous newsletters)

Congratulations to Outstanding Teaching Award Winners

Thirty-three Missouri S&T faculty have earned the **Outstanding Teaching Award** for

so focused on writing notes and preparing quizzes and tests to think about how to teach. I just murdered those students."

Student course evaluations that semester were not good, but he took students' comments to heart. "I still do today," he said. Criticisms included his penchant for facing the board, and never asking questions or trying to discover if the students understood the material.

The next semester everything changed. His hand-written notes that he referred to now had large question marks inserted in regular places, reminding him to stop and ask questions. He cut down on the amount of material he tried to cover so he could focus on student understanding. And he looked his students in the face regularly rather than writing on the board all of the time.

"I didn't care if I got through everything I planned in the lecture," he said. He welcomed interruptions because he wanted students on the same page with him. Two years later, Hilmas began winning Faculty Excellence Awards, winning 11 consecutive awards between 2000 and 2010, along with eight Outstanding Teaching Awards in that same time span.

Here are some other practices Hilmas has put in place to maximize student learning:

1. **Realize that the first day of class is the most important one of the semester.** Hilmas says it doesn't matter whether an instructor is tough as nails or laid back, the important thing is that students clearly understand what is expected of them and why instructors do things the way they do them. If instructors can convince the students why their strategy is important to their success, it will normally create buy-in, as long as they are consistent throughout the semester.
2. **Keep the class atmosphere active and lighthearted, where students are not afraid to ask questions or offer wrong answers.**
   On the first day of class, Hilmas will set the tone for active learning, explain policies about cell phones and other electronic devices, and learn student names through ice-breaker activities.
   Hilmas also will begin modeling the types of questions he will ask students in subsequent class meetings. His questions are not asked of the class at large but to individual students throughout the semester. Students do not know who he will choose each class, so everyone figures out that they have to come to class prepared.
   In the Ceramics in the Modern World class, made up of mainly sophomores and co-taught with Jeff Smith, he tries to keep the atmosphere friendly, supportive and even humorous where students know they won't be punished for attempting an answer that is incorrect.
3. **Assess student learning in more ways than formal tests and homework.**
   How does Hilmas know if students are getting the material? In his senior level class, he takes time to have students explain to him step-by-step how to solve a real-life problem using the information they have so far in the course.
   He calls on different students for the various steps in the problem-solving. One will give him the correct formula, one the variables, and another the "why" behind it. The exercise can be high pressure for some students, so Hilmas allows them to call on someone else to help them in the class.

2010-2011, which is given each year to faculty members by the Outstanding Teaching Award Committee based on student evaluations. They are:

Dr. Akim Adekpedjou, mathematics and statistics;

Dr. Neil Anderson, geological sciences and engineering;

Dr. Michael Bruening, history and political science;

Dr. Gerald Cohen, arts, languages and philosophy;

Dr. Petra DeWitt, history and political science;

Dr. Andreas Eckert, geological science and engineering;

Lorie Francis, arts, languages and philosophy;

Dr. Lance Haynes, arts, languages and philosophy;

Dr. Gregory Hilmas, materials science and engineering;

Dr. Irina Ivliyeva, arts, languages and philosophy;

Dr. Ronald Kohser, materials science and engineering;

Dr. Kurt Kosbar, electrical and computer engineering;

Dr. Vy Le, mathematics and statistics;

Dr. John McManus, history and political science;

Dr. Gary Mueller, mining and nuclear engineering;

Dr. Dev Niyogi, biological sciences;

Dr. Matthew O'Keefe, materials

Usually in the space of a few class periods, everyone will have participated, and so Hilmas can assess how the each student understands the material before written examinations.

4. **Give opportunity for students to learn from their mistakes.**
   Hilmas gives his senior class the opportunity to turn in homework a second time within another week for full credit, correcting any mistakes that he has marked. Often he will give them a hint about where they went wrong in their problem-solving, without giving them the answer.
   He also lets them work collaboratively on homework, however, he reminds them that they will need to be able to process the material individually in order to do well on the tests. Hilmas admits he is a hard grader, and he doesn't believe in partial credit for the final answer because, as he puts it, "There is no partial credit at NASA."
5. **Teach in a way that works for you.**
   While he can lecture from PowerPoint slides, Hilmas prefers to write on the chalkboard and have students copy it down in their own handwriting. "I believe there's a firm connection between writing and the brain," he said. "They won't remember the lecture notes unless they write them down."
   Similarly, his policy on laptops in the classroom reflects what he has found works for him and his students. A few semesters ago, he invited students to have their laptops open in class. Only a few students took him up on his offer, however, he found that those students' grades were significantly lower than the rest of the class. He now suggests that students not use laptops to increase their own chances of success.
6. **Include hands-on experiences and application to the real world**.
   Hilmas loves the application side of things, so it is no coincidence that he uses a lot of hands-on experiences in his classes. He worked in industry for three and a half years before coming to the university, and his experiences there as well as with his research help him to use stories and examples that students can relate to. He believes that teaching that makes connection with real-world applications has its own intrinsic motivation for students to learn. "The best teachers should be the best researchers. They're the ones going out in the field and who are on the cutting edge of what is going on," he says. "They can transition that into the classroom. This is especially good at S&T where there is so much application."

7. **Make time for students.**
   When he gives advice to new faculty members who want to improve their teaching, Hilmas recommends making time for the students both in and out of class. When a student comes to his door, he will drop everything to talk to that student, even if it is not during official "office hours."
   "I'm here because I like the students," he says. "When I came here, I didn't think I would be impressed with the students, but I am very impressed. I also like being on the cutting edge in my research and passing that knowledge on to S&T students."

science and engineering;

Clayton Price, computer science;

Dr. Kenneth Ragsdell, engineering management and systems engineering;

Dr. David Riggins, mechanical and aerospace engineering;

Dr. David Rogers, geological sciences and engineering;

Dr. V.A. Samaranayake, mathematics and statistics;

Dr. John Seiffertt IV, electrical and computer engineering;

Dr. Oliver Sitton, chemical and biological engineering;

Jeanne Stanley, arts, languages and philosophy;

Dr. R. Joe Stanley, electrical and computer engineering;

Dr. J. Greg Story, physics;

Dr. Daniel Tauritz, computer science;

Dr. Jeffery Volz, civil, architectural and environmental engineering;

Dr. David Westenberg, biological sciences;

Merilee Krueger Wilsdorf, psychological sciences;

Dr. David Wronkiewicz, geological sciences and engineering;

Dr. Reza Zoughi, electrical and computer engineering

(Information courtesy of Missouri S&T Communications Office)

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Chem 1 Goes to Buffet Model

If they had a reality makeover show for course redesign, Chemistry 1 at Missouri S&T might be on it. Starting in spring 2012, the gateway class, which serves more than 1,000 students per year, will move to a "buffet" model of instruction in contrast to the traditional lecture and recitation.

Klaus Woelk, interim chair of the chemistry department, and Emma Satterfield, chemistry lecturer, principal re-designers of the new model, share their thoughts about the pilot this spring.

Question: Chem 1 has already seen many innovations during the last few years, such as being the first course on campus to use clickers, and extensive usage of online student discussion boards and homework. So, if it's not broken ... ?
Woelk: What was broken in Chem 1 was not the course but our faculty distribution, the teaching load. I currently have 19 chemistry faculty, and six of them were engaged in that single course. At the same time we were teaching 200- and 300-level courses in one class. It takes away the opportunity for seniors to take higher-level classes as an elective. So basically we were not able to teach our full curriculum. In the redesign, we will engage only two to three faculty and have the others available to teach the upper-level electives.

Question: Where did the idea to redesign the course come from?
Woelk: The initiative is from the governor of Missouri to have the 13, public, four-year institutions redesign large enrollment, multi-section courses. Then-Provost Kent Wray came to me and asked if chemistry would be an appropriate course for this because it is the largest course on campus. By seeing that we could solve (the faculty) problem by redesigning it, I agreed. I am also convinced it will result in better learning. Then we wrote a proposal to NCAT (National Center for Academic Transformation) and it was accepted.

Question: Can you discuss the space and faculty saving that you are anticipating in the fall?
Woelk: In the fall (2012) we want to increase the section size from 200 to about 400. There's no classroom for 400 students on this campus so, of those 400, half of them need to be somewhere else monitoring the lecture while it's going on, and 200 can actually come to class face-to-face. By doubling the size, we don't need four back-to-back lectures anymore conducted by four individual professors; in the fall semester we will only need two. And depending on how successful this concept runs, maybe further down the road we will only need one. This is where the saving of faculty that actually teach physically in the lecture comes into play. I would like to take those faculty and have them teach classes on the upper level for graduate education.

Question (to Satterfield): What is your role in this?

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How will students experience Chem 1 starting in the spring?

Here is a snapshot of how five students might experience the same content in Chem 1 next semester:

1) Chris will go to the face-to-face lecture only twice a week and attend a collaborative learning group with 23 other students in a two-hour block once a week.

2) Gina will "attend" the same lecture as Chris, but it will be from her laptop in her dorm room. She will participate in the lecture with computer keystrokes instead of clickers, and her polling data will be included with those in the face-to-face class. She also will attend the collaborative learning group so she gets face-to-face time with her classmates.

3) James opts for an entirely online experience. He will participate in the lecture identically to Gina from his laptop, but instead of the collaborative learning groups, he will complete online modules covering the same topics while being monitored by TAs on his progress.

Satterfield: I will be teaching the course in the spring, and I am assisting with the writing of the new content. We also have a couple other assistants (chemistry GTAs Travis McDowell and Johnathan Harper) helping with content.

Question: What outcomes do you hope to see at the end of the pilot this spring?
Woelk: At the end of the pilot, we will not see an effect in saving faculty because of the lower enrollment and because it's a pilot. But we certainly hope to see more effective learning on the side of the students, and we will hopefully see that students who engage online will have at least the same success as those that are actually in a face-to-face classroom.

Question: Why do you believe there will be improved learning?
Woelk: I am convinced that this is a better way of teaching chemistry. I think the new model will be at least equivalent but most likely better than the old way. Just moving from three one-hour lectures to two, and having two hours of collaborative learning instead of one-hour recitation each week will be more effective. In addition, the students who are involved in the online modules will have the opportunity to form their own learning groups. Some students may wish to work with these modules on their own; we will let them. It doesn't mean, however, that we don't care about these students.
Satterfield: We will be monitoring the students' progress very closely to make sure they stay on task and are making progress. Working with the online modules doesn't mean that students don't have face-to-face contact with their instructors or TA's. There will still be LEAD centers almost every day, and we will extend our office hours. If students are struggling, we will request that they meet with us.

Question: What do you think will be the biggest challenges for the students taking the non-traditional aspects of the course?
Woelk: I say time management. Students are responsible for their learning. They're given more freedom to work on their own time, and for some students that might be a challenge. It's (also) a challenge for us to continually remind them that they need to stay engaged.

Question: What do you see down the road – will this have an effect on other large enrollment classes on campus?
Woelk: The general initiative is that this model is tested at one university and then offered to others if the outcome is successful, so I expect that we will introduce this model to other universities, particularly within the state of Missouri, but also nationwide as a successful new method of teaching large, entry-level science classes. It's not limited to chemistry.
I have a couple of other instructors who are actually closely monitoring our progress. I have talked to some who are interested in particularly the buffet style that we offer. I think being open to options is always good, and I like that I have discussions with instructors who are actually interested in improving the teaching and education just as much as I am. We can certainly learn from each other.

4) Tyrone also likes the idea of the online modules instead of the collaborative group, but he chooses to be in the classroom for the twice weekly face-to-face lectures.

5) Rachel will attend the traditional lectures three times a week in the classroom and recitation once a week. This option, however, will no longer be offered after the spring 2012 semester.

"I am convinced this is a better way of teaching chemistry."

--Klaus Woelk, interim department chair of S&T chemistry, on the Chem 1 buffet model of instruction to be piloted in spring 2012

For a transcript of the full interview, go to the CERTI website.

SPRING 2012 CLICKER TRAINING

Clickers – It's not too late to sign up to use clickers in your spring courses. Faculty are adopting clicker technology to enhance instruction and make grading more efficient. Contact Diane Hagni for more information. The **spring clicker training** will be held Wednesday, Jan. 4, at 1:30 p.m. in IDE 105.

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photo by D. Hagni

Strategies for Success in the Millennial Classroom

Approximately 80 S&T instructors participated in the annual Curators' Teaching Summit held this past fall, featuring the topic of teaching Millennial students.

The campus' Curators' Teaching Professors served as moderators for three lively sessions of discussions around lunch. The September session looked at the characteristics of Millennial students and typical classroom experiences of faculty. The October session went more in-depth as to handling various classroom scenarios, and the final session in November looked at three case studies with brainstorming on solutions to some common issues.

"... the Teaching Summit (which I also attended last year) has helped me in the classroom. Thanks for such great events and I hope more will come in the future."

Dr. Akim Adekpedjou
Mathematics & Statistics
Winner of 2010-2011 Outstanding Teaching Award

Video clips and discussion notes have been posted online for reference. Go to http://certi.mst.edu/events/curators.html for these and other resources on teaching Millennials.

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23 Faculty Honored for Contributions

Twenty-three Missouri S&T faculty have been honored for their contributions to the university with Faculty Achievement, Research, Service or Teaching Awards in 2011. Congratulations to the following award-winners:

Receiving the 2011 Achievement Award -
Dr. Petra DeWitt, history & political science
Kellie Grasman, engineering mgt. & systems engineering
Dr. Ryan Hutcheson, mechanical & aerospace engineering
Dr. Rachadaporn Seemamahannop, Center of Environmental Science & Technology
Dr. Jeff Thomas, civil, architectural & environmental engineering

Receiving the 2011 Service Award -

Dr. Susan Murray, engineering mgt. & systems engineering
Dr. J. Keith Nisbett, mechanical & aerospace engineering
Dr. Henry Pernicka, mechanical & aerospace engineering
Dr. David Westenberg, biological sciences

Receiving the 2011 Teaching Award -

Dr. Diana Ahmad, history & political science
Dr. Michael Bruening, history & political science
Dr. Ronald Frank, biological sciences
Dr. Irina Ivliyeva, arts, languages & philosophy
Dr. Henry Pernicka, mechanical & aerospace engineering
Dr. David Richardson, civil, architectural & environmental engineering
Dr. David Riggins, mechanical & aerospace engineering
Dr. Jeffrey Schramm, history & political science

Receiving the 2011 Research Award –
Dr. Martin Bohner, mathematics & statistics
Dr. Genda Chen, civil, architectural & environmental engineering
Dr. Jun Fan, electrical and computer engineering
Dr. Robert Landers, mechanical & aerospace engineering
Dr. Sanjay Madria, computer science
Dr. Susan Murray, engineering mgt. & systems engineering
Dr. Matthew O'Keefe, materials science & engineering
Dr. Hai-Lung Tsai, mechanical & aerospace engineering

Information provided courtesy of Missouri S&T Communications Office