

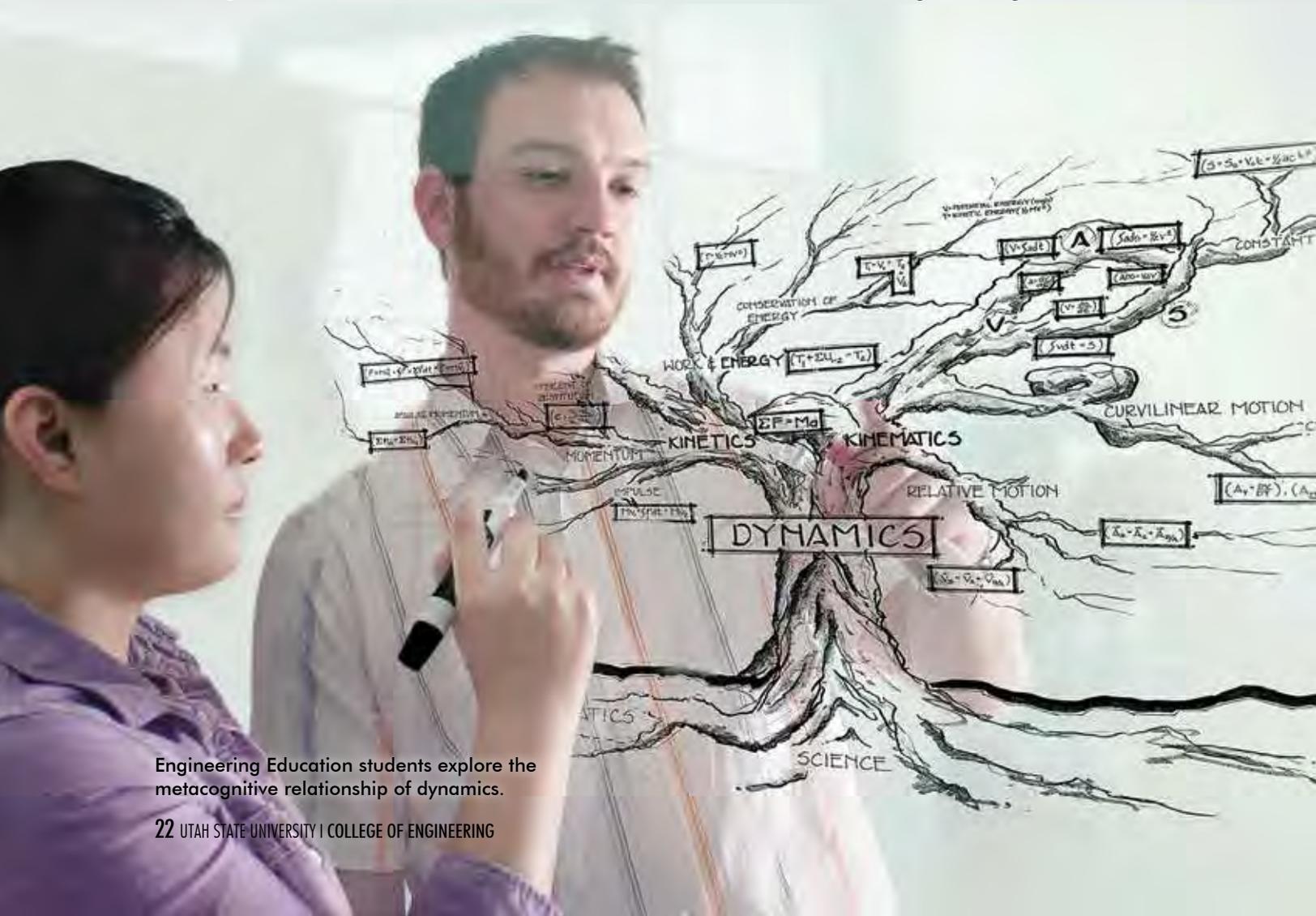
Department of Engineering Education

CEER AT LEADING EDGE OF ENGINEERING EDUCATION

The Department of Engineering Education, or EED, is tasked with teaching the fundamentals to pre-professional students and providing a relevant and sound learning experience. The department is also home to one of only three engineering education doctoral programs in the nation.

The newly launched Center for Engineering Education Research (CEER) helps faculty and doctoral students to continually develop pedagogical research and methods that will better serve students. The research conducted in CEER will have lasting effects in advising, teaching and learning experience for students that will better fulfill the department's mission — preparing pre-professional engineering students with the knowledge to be successful in their field.

Over the past eight years, the National Center for Engineering and Technology Education, or NCETE, has researched the needs of students studying engineering. NCETE, funded by the National Science Foundation, has been tasked with conducting research that improves the understanding of learning and teaching of engineering design at the high school level. However,



Engineering Education students explore the metacognitive relationship of dynamics.

“WE’RE TRYING TO UNDERSTAND THE THINKING AND LEARNING THAT GOES ON IN AN ENGINEERING STUDENT’S MIND SO THAT WE CAN MODIFY THE EXISTING CURRICULUM TO BETTER PREPARE FOR THEIR NEEDS.”

—Kurt Becker



the NCETE has fulfilled its eight-year mission and closed August 31 of this year.

“We’re evolving, taking a lot of the work [done in the NCETE], and expanding it into the Center for Engineering Education Research,” said Kurt Becker, CEER director.

One example of the expanded research can be found in the grade band being researched. CEER will research engineering education from grades 6–20, where the NCETE had a narrow 9–12 grade band.

Understanding how students learn about engineering over this wide range of ages will develop more effective teaching of pre-college engineering, and thus better prepare students as they enter collegiate studies.

The research being executed in the CEER is extremely important for the profession of engineering. In recent years, there has been a slide in the number of engineers graduating from institutions in the United States (20 percent fewer graduates, to be exact). Coupled with the fact that more than half of the professional engineering work force in the United States is nearing retirement age, the need for developing ready trained engineering students is crucial.

Current research with metacognition is being conducted with current undergraduate students. Essentially, the research explores how the students learn to think about what they are learning. This work will better help retain students within the college and combat the national trend of fewer engineering graduates.

“We’re trying to understand the thinking and learning that goes on in an engineering student’s mind so that we can modify the existing curriculum to better prepare for their needs,” Becker said.

Some of Becker’s own research deals with the cognitive process of engineering design over a continuum of years. In these studies, high school students, college freshmen and seniors and expert professional engineers are all given the same engineering design problem. Through protocol analysis, the research is focused on what each group does in their thinking. The collected data is essential in shaping effective pedagogy that will transition those studying engineering from the start of the continuum to the end, as easily as possible.

Engineering education research is not isolated to the EED. In fact, the

CEER supports cross-departmental collaboration with a goal of improving research and best practices of undergraduate engineering education. For example, faculty from the department of Mechanical and Aerospace Engineering are working with EED faculty to better understand the learning outcomes of the department’s senior capstone design class.

CEER research is also benefitting from Utah State’s nationally ranked College of Education. Becker explains that engineers tend to be drawn to more quantitative studies and that the collaborative efforts with the Emma Eccles Jones College of Education and Human Services are helping to capture both quantitative and qualitative data in the center’s cognitive research.

“The center facilitates the interdisciplinary research across engineering programs that is necessary for the development of responsive engineering degree programs,” said Becker. “Our research will better teach future engineering professionals who can rapidly adjust to the changing needs of the economies and technologies of Utah, the nation and the world.”



A USU student observing and learning during a lecture. USU Engineering professor Oenardi Lawanto researches how people learn through his National Science CAREER award project “Cognitive Metacognitive Activities in Engineering Design Education.”

THINKING ABOUT THINKING

Oenardi Lawanto’s Enthusiasm for Research Wins NSF CAREER Award

Learning about how people learn doesn’t sound like the typical topic for engineering research, however Dr. Oenardi Lawanto isn’t a typical engineering professor. Lawanto was recently recognized by the National Science Foundation and was awarded a CAREER award for his project “Career: Cognitive Metacognitive Activities in Engineering Design Education.”

“I love researching about things I’ve never learned before,” said Lawanto. “That is the reason I get so excited about metacognition; these are new things! I’ve been researching for many years, but I still get excited.”

Professor Lawanto’s excitement about his research is genuine. His career is a crescendo of enthusiasm for learning. Much like a musical dynamic increase, his passion started softly. After teaching engineering at an Indonesian university for 15 years,

Lawanto found himself getting bored.

“If it was boring for me, I can imagine it was even worse for the students,” said Lawanto. “If I don’t get excited in the classroom, how can I expect my students to get excited about engineering?”

Lawanto decided that he needed to improve. After being able to take part in multiple World Bank Institute workshops — workshops that lasted from a week to a full year — focused on improving teaching methods, his passion for learning about learning was ignited. This passion fueled his doctoral work at the University of Illinois at Urbana-Champaign in metacognition in engineering design. Now, anyone who speaks with Professor Lawanto about his work can feel his excitement.

Lawanto’s research is targeted at helping students from multiple engineering disciplines to improve design skills through self-regulated thinking. For those not familiar with the term



NSF CAREER Award winner
Oenardi Lawanto.

metacognition, which literally means being self-aware of how one processes thoughts and information, it could seem like a research vacuum, a lot of theory and not a lot of application. Lawanto’s work however, is based soundly in theory and application.

“The CAREER award requires that you have a plan, not just doing research, but to also be able to translate the findings from your research into a practice,” he said.

The funding from the NSF award will have a very real effect at Utah State. It will pay graduate and undergraduate students to participate in Lawanto's research and fund the senior capstone design projects.

Being part of a faculty program that is very unique (USU's EED program is one of only three in the nation), Lawa-

nto is contacted frequently by researchers from all over the country and across multiple disciplines. However, Professor Lawanto modestly sheds the praises of being an expert.

"I don't consider myself an expert," said Lawanto. "I'm still learning. We are all still in the learning process."

