Thinking Like a Pro: How Experts and Novices Solve Problems Differently | College of Engineering

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Jan. 7, 2016 – Engineering education experts at Utah State University are narrowing in on new insights into why young engineering students drop out of their programs or change majors.

It’s an increasingly important conversation as government and industry leaders push for more college graduates in science, technology, engineering and math, or STEM, fields. And yet nationwide, only about half of all engineering students complete their degrees.

One expert says part of the problem is that engineering students need more experience in design and problem solving earlier in their college careers. Engineering Education Professor Kurt Becker is an expert in design learning and thinking. He is leading a new study aimed at understanding the cognitive behavior of engineering students and expert engineers.

Becker says one of the primary goals in teaching engineering is for students to become expert designers. This new research may help identify why some students succeed in engineering while others leave after a discouraging experience or a lack of understanding about what an engineer does.

He and collaborator John Gero, a research professor at the University of North Carolina at Charlotte, are trying to understand how changes in undergraduate engineering curricula can help engineers in training think more like seasoned professionals.

“If we can get students engaged earlier on in the design and problem-solving process, in theory they should become more interested in the concept of engineering,” said Becker. “Their college experience would be more like what a career in engineering is all about.”
In an upcoming study, which received a $698,000 grant from the National Science Foundation, Becker and Gero will observe student teams from USU and UNC – and teams of professional engineers – participate in a design challenge. Their mission: design a device that assists the elderly with raising and lowering double-hung windows.

“Everyone knows what it’s like to operate a stubborn window,” said Becker. “There are various engineering and social constraints involved, which makes this a typical engineering design problem.”

The researchers will observe as two-person teams of students and teams of professional engineers sketch, brainstorm and discuss ways to solve the problem. Becker says after analyzing the video footage of these design sessions, he’ll be able to categorize the participants’ behaviors.

“Ultimately we’re trying to better understand why experts think a certain way, and why novices think another way,” he said. “If we can identify key differences, our hope is that we can design an engineering curriculum that helps students early in their engineering program better understand the design process and learn some of the best ways to solve complex, big-picture problems.”

Becker’s research highlights an important gap in how engineering students mentally map their way through a problem. His studies also demonstrate the need to redesign certain elements of engineering curricula to help students understand the importance of ‘human-centered engineering design’ – a term used to describe the broader goals of an engineering task, not just its individual parts.

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