

# 'Freeform Classroom' could counter engineering's sophomore slump

July 13 2016, by Emil Venere

---

New research aims to measure the effectiveness of a teaching approach that allows students in challenging engineering courses to access hundreds of instructional videos and animations while encouraging interaction with each other and faculty online.

The system, called the Purdue Mechanics Freeform Classroom, might help answer a national call by the U.S. Council on Jobs and Competitiveness to increase the number of engineering graduates by 10,000 annually.

"There is a need for more engineers in terms of quantity, but also in terms of quality," said Jennifer DeBoer, an assistant professor of engineering education who is leading the research. "Graduates need to have the ability to collaborate and to be part of a cohesive and productive group."

The Freeform Classroom could play a role in boosting the number and quality of engineering graduates, in part by helping sophomore-level students overcome daunting challenges in core engineering courses.

"The phrase sophomore slump has come into engineering education parlance," DeBoer said.

The research was detailed in three papers that were presented during the American Society for Engineering Education's Annual Conference & Exposition in June in New Orleans. Purdue faculty and students

presented about 90 papers at the conference.

Edward Berger, a Purdue associate professor of [engineering education](#) and [mechanical engineering](#), said students may find sophomore-level classes especially trying and are at greater risk of failing or withdrawing than at other times in their academic careers.

"Retention of engineering undergraduates, in particular during the sophomore and junior years, is a major national concern," Berger said. "They are taking courses like statics and dynamics and thermodynamics, and the intensity and workload are just very high."

The research is part of a project funded over four years with a \$1.4 million grant from the National Science Foundation and led by DeBoer, Berger and Jeffrey Rhoads, an associate professor of mechanical engineering.

The Freeform Classroom approach has been used since 2009 to teach a sophomore-level dynamics course and was pioneered by Charles Krousgrill, a Purdue professor of mechanical engineering. He and Rhoads have expanded and led efforts to refine and implement the Freeform Classroom for dynamics, a key introductory course focusing on engineering systems in motion. Since introducing the Freeform Classroom the number of students receiving a D, F or who withdrew from the course has steadily decreased, going from 22 percent to around 10 percent.

"We don't know for sure that it's just the Freeform piece that's causing this improvement," DeBoer said. "There are a lot of other facets, so we need to be able to say whether it's the Freeform environment that's causing this. And if so, what is it about the Freeform environment? Is it the way in which students engage with the environment and their level of engagement? Is it other characteristics of this Freeform environment that

have been added over the years?"

The Freeform classroom applies "active, blended and collaborative" (ABC) learning, in which students talk to each other or to the instructor either face-to-face or on a course blog and use various online materials while collaborating to solve problems.

"You rarely see all three of these ABC parts combined in a single classroom, and I don't know of any other examples in sophomore-level engineering courses," DeBoer said.

As part of the research, the Freeform Classroom has been used at Trine University in northeastern Indiana and will be used at the Purdue University Northwest campus this summer. One goal of the research is to understand how students in different institutions respond to and experience the Freeform Classroom.

"Purdue West Lafayette is a big research-intensive institution where this was developed, but Trine is a very different kind of place," she said. "The ethos is very different. The class size is much smaller, the whole institutional environment, the nature of the relationships between the faculty and students, is much different."

The researchers used a "dynamics concept inventory" method to survey the students using a series of multiple-choice questions designed to show whether they understand the fundamental concepts behind dynamics principles.

"We believe we can use this instrument or measurement tool as a really good way of understanding whether students are increasing their conceptual understanding through this class," DeBoer said.

Students and faculty are being interviewed to help shed light on their

experiences in the Freeform Classroom. For instance, nine students were interviewed out of about 30 in the Trine University dynamics class, and results based on those data will appear in future publications.

"We are still processing that information, but I think those interviews will also help us understand what their experience was," Berger said. "The Freeform environment was very different from all of their other classes. We are trying to understand at some baseline level whether they liked it and if it helped them learn the material, and what their challenges and frustrations were."

Trine assistant professor Maria Gerschutz, chair of biomedical engineering, is a co-author of one of the three research papers and is involved in providing feedback. She was recently named 2016 Outstanding Teacher of the Year in the Illinois-Indiana section of the American Society for Engineering Education.

The research uses reflective writing from the participants to delve into the "lived experience" of the instructor over one semester.

"We solicited reflections from Dr. Gerschutz where she was talking not only about teaching the content but whether she was frustrated by having to make sense of this new material, whether the students were excited, and the quality her own actual day-to-day experience, not just the mechanics of the class." DeBoer said.

Future research also may study Freeform's effectiveness in STEM fields other than mechanical engineering, in a collaboration with Purdue's Center for Instructional Excellence.

Purdue hopes to account for about 5 percent of the national goal of producing 10,000 additional engineering graduates per year. Preparing more engineers to meet the world's grand challenges also is part of a

[range of initiatives](#) including one focusing on "transformative education" designed to broaden Purdue's global impact and enhance educational opportunities for its students. To address the national need for more engineers Purdue is increasing the number of [students](#) and faculty in the College of Engineering by 1,500 and 107, respectively.

Information about the Freeform Classroom is available at [purdue.edu/freeform](http://purdue.edu/freeform). The three papers are available at these links:

- [Rigorously Assessing the Anecdotal Evidence of Increased Student Persistence in an Active, Blended, and Collaborative Mechanical Engineering Environment](#)
- [Transforming a Dynamics Course to an Active, Blended, and Collaborative Format: Focus on the Faculty](#)
- [Analyzing an Abbreviated Dynamics Concept Inventory and Its Role as an Instrument for Assessing Emergent Learning Pedagogies](#)

Provided by Purdue University

Citation: 'Freeform Classroom' could counter engineering's sophomore slump (2016, July 13)  
retrieved 25 April 2024 from

<https://phys.org/news/2016-07-freeform-classroom-counter-sophomore-slump.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.