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* [Matthew Ohland](#)

Research findings contradict myth of high engineering dropout rate

WEST LAFAYETTE, Ind. - Research findings suggest that, contrary to popular belief, engineering does not have a higher dropout rate than other majors and women do just as well as men, information that could lead to a strategy for boosting the number of U.S. engineering graduates.



Jessie Powell redirects her team's robot
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"Education lore has always told us that students - particularly women - drop out of undergraduate engineering programs more often than students in other fields," said Matthew Ohland, an associate professor in Purdue University's School of Engineering Education. "Well, it turns out that neither is true. Engineering programs, on average, retain just as many students as other programs do, and once women get to college they're just as likely to stick around in engineering as are their male counterparts."

The research also shows that hardly any students switch to engineering from other majors, pointing to a potential strategy for increasing the number of U.S. engineering graduates, Ohland said.

"A huge message in these findings is that engineering students are amazingly like those in other disciplines, but we need to do more to attract students to engineering programs," he said. "If you look at who graduates with a degree in social sciences, 50 percent of them started in social sciences, and for other sciences it's about 60 percent. If you look at who graduates with a degree in engineering, however, 93 percent of them started in engineering. The road is narrow for students to migrate into engineering from other majors."

Findings were drawn largely from a database that includes 70,000 engineering students from nine institutions in the southeastern United States. Ohland manages the database, called the Multiple-Institution Database for Investigating Engineering Development, which followed students over a 17-year period ending in 2005.

Data show that the nine institutions vary dramatically in how well they retain engineering students over eight semesters,

ranging from 66 percent to 37 percent. Those findings indicate policies and practices at some institutions may serve to retain students better than those at other institutions.

The findings suggest educators should develop a two-pronged approach to increase the number of engineering graduates: identify which programs best retain students and determine why they are effective, and develop programs and policies that allow students to more easily transfer into engineering from other majors.

A report prepared by the National Academy of Sciences found that a federal effort is urgently needed to bolster U.S. competitiveness and pre-eminence in engineering and science. Meanwhile, emerging nations such as India and China far outstrip the U.S. production of engineers.

One reason for the lack of migration into engineering is that institutions usually do not provide universal prerequisites, such as calculus, which can be applied to engineering, Ohland said.

"At one institution in the database, everybody takes the same calculus course," Ohland said. "There isn't calculus for business, or calculus for the life sciences, and this makes it much easier for students to transfer to engineering later in their academic careers. Most institutions, unfortunately, don't do it this way, meaning you'd have to take calculus over again if you wanted to transfer into engineering, and this discourages students from switching."

Some of the findings were reported in 2008, and newer findings have been accepted for publication in a future issue of the *Journal of Women and Minorities in Science and Engineering*.

"The findings in both of these papers are counterintuitive," Ohland said. "People naturally assume there is a female persistence problem because only about 20 percent of undergraduate engineering students are women."

By comparison, women earn more than half of bachelor's degrees in psychology, agricultural sciences, biological sciences, chemistry and social sciences.

"The problem of few women in engineering, however, is one of recruitment, not retention," Ohland said. "The problem is complex and is certainly affected by engineering's culture. It is likely that engineering cannot attract significantly more women unless the profession changes. Rather, a critical step in attracting more women to engineering is to accept women as they are and to be excited about how the engineering profession might be different if it were more gender balanced."

The database only includes institutions in the southeast because the partnership to collect the data was first formed there. Future work will include institutions in other geographical areas, but Ohland said there is no reason to assume results from other regions won't be similar.

"Certainly, we expect to see differences at private institutions, particularly those with low enrollments, but large public institutions probably all have similar behaviors," Ohland said. "These data should not give people the impression that persistence in engineering education isn't a concern. Yes, engineering retains students as well as other majors, but that might be because we pay so much attention to engineering retention."

The 2008 publication was authored by Ohland; Sheri D.

Sheppard, a professor of mechanical engineering at Stanford University; Gary Lichtenstein, a consulting professor at Stanford; Özgür Eris, an assistant professor of design and mechanical engineering, and Debbie Chachra, assistant professor of materials science, both at Franklin W. Olin College Of Engineering; and Richard A. Layton, an associate professor of mechanical engineering at the Rose-Hulman Institute of Technology.

These earlier findings earned Ohland's team the William Elgin Wickenden Award for best paper from the *Journal of Engineering Education*. The award was issued by the American Society for Engineering Education in June 2009.

The more recent work on women in engineering was authored by Susan M. Lord, a professor of engineering, and Michelle Madsen Camacho, an associate professor of sociology, both at the University of San Diego; Russell A. Long, director of project assessment in engineering education, and Mara H. Wasburn, an associate professor of organizational leadership, both at Purdue; as well as Ohland and Layton.

The database was created in 1996, and Ohland began managing it in 1998 while a postdoctoral researcher at the University of Florida.

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FILE PHOTO CAPTION:

Purdue undergraduate engineering student Jessie Powell redirects her team's robot as it tries to follow a line on its way to lifting a weighted aluminum can. New research findings suggest that, contrary to popular belief, engineering students don't have a higher dropout rate than students in other majors and women do just as well as their male counterparts, information that could lead to a strategy for boosting the number of U.S. engineering graduates. (Purdue University file photo/Andrew Hancock)

A publication-quality photo is available at <http://news.uns.purdue.edu/images/+2009/boiler-green-robots1.jpg>

ABSTRACT

**Persistence, Engagement, and Migration
in Engineering Programs**

Matthew W. Ohland, School of Engineering Education, Purdue University; Sheri D. Sheppard, Department of Mechanical Engineering, Stanford University; Gary Lichtenstein, Department of Mechanical Engineering, Stanford University; Özgür Eris, Franklin W. Olin College of Engineering; Debbie Chachra, Franklin W. Olin College of Engineering; Richard A. Layton, Department of Mechanical Engineering, Rose-Hulman Institute of Technology

Records from the Multiple-Institution Database for Investigating Engineering Longitudinal Development indicate that engineering students are typical of students in other majors with respect to: persistence in major; persistence by

gender and ethnicity; racial/ethnic distribution; and grade distribution. Data from the National Survey of Student Engagement show that this similarity extends to engagement outcomes including course challenge, faculty interaction, satisfaction with institution, and overall satisfaction. Engineering differs from other majors most notably by a dearth of female students and a low rate of migration into the major. Noting the similarity of students of engineering and other majors with respect to persistence and engagement, we propose that engagement is a precursor to persistence. We explore this hypothesis using data from the Academic Pathways Study of the Center for the Advancement of Engineering Education. Further exploration reveals that although persistence and engagement do not vary as much as expected by discipline, there is significant institutional variation, and we assert a need to address persistence and engagement at the institutional level and throughout higher education. Finally, our findings highlight the potential of making the study of engineering more attractive to qualified students. Our findings suggest that a two-pronged approach holds the greatest potential for increasing the number of students graduating with engineering degrees: identify programming that retains the students who come to college committed to an engineering major, and develop programming and policies that allow other students to migrate in. There is already considerable discourse on persistence, so our findings suggest that more research focus is needed on the pathways into engineering, including pathways from other majors.

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