WHY GROUP DESIGN PROJECTS CAN IMPROVE RETENTION

Students link their success with a future in engineering.

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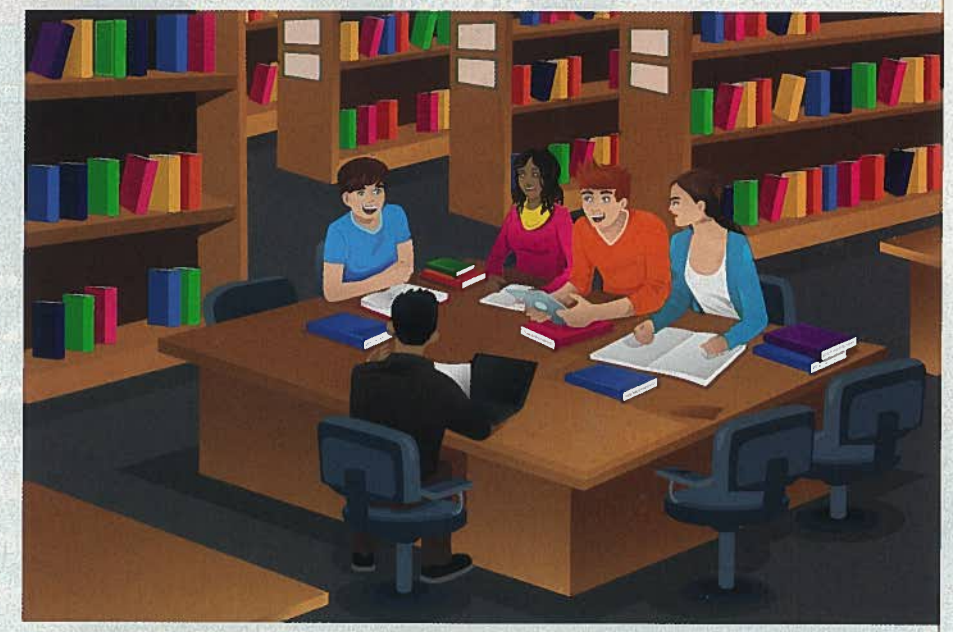
Projects are often used in engineering education, particularly in freshman cornerstone and senior capstone design classes. Projects have been touted as a way to allow students to develop professional skills: to work in teams, communicate their findings and designs, and learn independently. In this study we investigated how the use of projects can help students gain engineering content knowledge (and traditional analytical skills) and how projects might affect students' intentions to stay in their engineering major.



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We conducted our study in statics because it is an engineering mechanics course typically taught through lectures during students' second year, a critical time for retention. One section of statics was taught through lectures and the integration of group design projects, while a comparison section received the same content through lectures only. Students in the project section worked in teams of three to five people, primarily outside of class, to complete three design projects: building a device to raise a flag using basic principles of equilibrium, constructing a bridge and analyzing it as a truss or beam, and using friction to their advantage to pull a stuffed school mascot to the top of a ramp. Students in both sections completed the Concept Assessment Tool for Statics and a survey, including variables related to their development as an engineer, at the beginning and end of the semester.

As the theoretical framework for this study, we used Social Cognitive Career Theory (SCCT). This theory seeks to explain how people become interested in, make choices about, and ultimately perform in careers and majors. SCCT states that individuals' beliefs in their ability to complete a specific action (self-efficacy) affect their beliefs about the consequences if they do complete the action (outcome expectations), and that self-efficacy and outcome expectations together influence the goals students set for themselves. In particular, if students believe they have the ability to complete engineering tasks successfully and they expect positive consequences when they complete those actions, they will set goals to stay in engineering. By contrast, if students do not think they are able to complete engineering tasks, or they do not expect good consequences when they do, they will not set goals to stay in engineering.

We found that while students in both sections showed similar gains in content knowledge, students who had participated in projects connected their perceived ability to perform engineering work with their outcome expectations about engineering. As expected based on SCCT, perceived ability and outcome expectations together predicted these students' intentions to stay in engineering: The belief "I have the ability" led to the belief "Putting forth the effort will be worthwhile," which in turn led to the goal "I will become an engineer." In contrast, students in the lecture-only section did not connect their perceived ability to do engineering with the outcomes they would experience as an engineer. In other words, what these students thought about their ability to be an engineer did not influence their expectations about what being an engineer would mean. Thus, the theoretical model for career development held only for the project students, not for the lecture-only students.

This study showed that group design projects positively influence how students develop into engineers. Students who did not work on projects lost momentum in their development into engineers. While many engineering programs attempt to use extracurricular programs to support the retention of students, our study showed that group design projects in required second-year courses can also help retain students in engineering.

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