Research Brief
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Conceptualizing Engagement: Contributions of Faculty to Student Engagement in Engineering

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The concept of student engagement, now prominent in the engineering education and higher education communities, has a long intellectual history. Yet only recently has attention focused on the role that faculty play as designers of educational environments to support student engagement. The authors seek to show in this article that whether referring to specific components of undergraduate education or to the full experience, faculty members play a critical role in creating conditions conducive to student engagement. This role can be referred to as *faculty engagement*.

Defining Faculty Engagement

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The authors take some initial steps toward defining a faculty engagement construct. They use an inductive process of reviewing the literature on engineering education as well as that concerning learning in higher education more generally, in order to advance their argument regarding the importance of faculty engagement based on three perspectives of faculty engagement and its implications. The first of these perspectives is based on the *Engineering Change* study. This study establishes a baseline for the preparation of engineers and provides a model for future assessments of undergraduate engineering education and student learning. The second perspective is from the APPLES1 data set from the Center for the Advancement of Engineering Education (CAEE). Findings from APPLES (along with findings from other studies) suggest that faculty members who make a conscious effort to include students in their research activities can have a positive impact on student progress in key learning outcomes, further suggesting that the decision to develop and provide such experiences for engineering students is yet another dimension of faculty engagement. The third perspective is from the U.S. Air Force Academy (USAFA) which studied the degree to which students disengage from classroom activities with a view to understanding the conditions that keep them connected. This study included an interactive "intervention" that represents a promising effort to address the quality of the faculty-student interaction while concurrently providing the means for faculty members to calibrate feedback more precisely to the students and heighten faculty awareness and understanding of what students are learning.

Implications for Research and Practice

The authors have argued that student engagement is, in part, a function of faculty engagement. The goal of the researchers was to act as provocateurs rather than theorists in the hope of spurring interest in this line of inquiry and encouraging others to explore how the researchers might define and measure faculty engagement and assess its impact on student engagement.

The authors proposed that what faculty do in their programs and courses, both inside and outside of the classroom, might influence student engagement. Through the examples presented in the previous section, the authors contend that engineering faculty do matter: their engagement in the teaching and learning functions of their programs affects the quality of student engagement. The evidence presented here shows that faculty decisions and actions are influential not only when faculty are interacting with students, but also when students are not present. There are implications for further research from each set of data that was utilized to make the argument about the relationship between faculty engagement and student engagement.

Research on Correlates of Student Engagement

Data from the *Engineering Change* study suggest that faculty participation in the teaching and learning activities of their programs, curriculum planning and revision, assessment, and professional development related to teaching, constitutes a form of "faculty engagement" that influences the quality of student learning. However, this study is limited in its ability to determine the absolute degree to which particular faculty behaviors influence students' educational experiences and learning because the study instruments were only designed to establish baseline measures of these critical programs and faculty activities.

A new study in development may partially remedy this weakness in the evidentiary basis for the claims made in the current paper. This three-year initiative, *Prototype to Production: Conditions and Processes for Educating the Engineering of 2020* (NSF-EEC-0550607, Center for the Study of Higher Education, 2008), will assess current levels of alignment between undergraduate engineering program goals, curricula, and instruction and the goals of the National Academy of Engineering's Engineer of 2020 Project.

And although there is evidence that continuous improvement and assessment create the conditions that support high levels of student engagement and learning, further investigation is needed to understand this relationship in engineering programs and schools. What can colleges do, in addition to changing their faculty reward systems, to increase faculty willingness to spend time improving their undergraduate courses and programs?

Research on the Impacts of Faculty-Student Interaction on Engagement

The APPLES study will permit continued exploration of the kinds of faculty-student interactions that promote engagement inside and outside the classroom, but there are many more questions to answer about how interactions with engineering faculty lead to the development of valued skills, dispositions, and attitudes in engineering undergraduates. The nature of the student-faculty relationship as it evolves over time is also worthy of further investigation, particularly as the student progresses from pre-engineering courses into the engineering major and increased opportunities for interacting and collaborating with faculty outside the classroom begin to emerge. Additionally, researchers should examine the institutional factors that foster both faculty and student engagement in engineering and innovative approaches for assessment. Particularly noteworthy are the ongoing and parallel efforts to develop assessment tools by researchers and groups who represent diverse backgrounds, expertise, and perspectives. For example, quantitative survey instruments addressing issues related to engagement are being designed and piloted by the Center for the Advancement of Engineering Education (PIE, APPLES), Penn State's Center for the Study of Higher Education (to assess the impact of EC2000), and the Center for the Advancement of Scholarship on Engineering Education (NSF-funded project "Measuring Student and Faculty Engagement in Engineering Education").

Research on Promoting Learning Engagement in the Classroom

The authors of this paper have argued that a first principle for engaging and high performance classrooms and learning environments involves improved sightlines into student cognition. Making cognitive models more visible is essential to the task of the instructor to balance between student ability and performance goals. One approach to making learner engagement and cognition visible is the use of collaboration systems such as those implemented by the USAFA and described in this article, but more research is needed to understand their potential, as well as the impact of other approaches for expanding and sustaining student engagement.

Virtually all theory development related to flow (conceptualized in formal classroom settings as involving simultaneously high levels of concentration, interest, and enjoyment in the learning task) entails the individual rather than the group. With technologies available that help sustain the crucial equilibrium of challenge and ability not only for the individual but for a larger group in a common learning activity, and that mediate increased concentrations of high-quality feedback and interaction, the intriguing question arises of how to sustain classroom performance "in the zone," with students routinely immersed or engaged in classroom activities.

Implications for Engineering Schools and Programs

If the active involvement of engineering faculty in classrooms and programs has a measurable impact on student learning, then colleges and universities must do more to develop awareness of the multiple contexts in which teaching and learning occur and how these contexts influence student development, particularly among faculty and administrators. The research efforts discussed in this paper suggest that good instruction is a multi-dimensional construct that encompasses (a) what faculty do in class, (b) what faculty do with students, formally and informally, and (c) what faculty do individually and with their colleagues to improve engineering courses and programs.

To develop greater awareness of multiple impacts of faculty actions on student engagement, new faculty orientation programs could share evidence of the important role that many types of faculty behaviors have on student engagement and learning. ABET's EC2000 accreditation criteria created an incentive for continuous improvement and assessment of engineering programs, but compliance rather than whole-hearted adoption may stunt the impact of this change on the criteria for accreditation. Strong and sustained curricular leadership at both the school and program levels is needed to encourage greater use of continuous improvement practices and to encourage better systems of assessment and decision-making. Finally, targeted professional development efforts, rather than generic approaches, are needed to help faculty meet the challenge of engaged instruction.

The authors have focused on the critical role that faculty have in designing and implementing educational experiences that fully engage students simply because student engagement is a joint responsibility which relies on the attitudes and behaviors of both students and faculty. Given recent concerns about the ability of the engineering field to attract and retain students, particularly underrepresented and women students, encouraging engineering faculty to take on this responsibility should be a high priority.