Board 113: Engineering Faculty's Academic Influence on Student Persistence: Faculty Use, Knowledge, and Comfort in Providing Encouragement to Students

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Work in Progress (WIP): Engineering Faculty's Academic Influence on Student Persistence: Faculty Use, Knowledge, and Comfort in Providing Encouragement to Students

Abstract: This work-in-progress paper focuses on how engineering faculty's perception of providing encouragement can influence student persistence. Previous literature has shown that faculty influence has a significant role in the academic outcomes of students and their persistence by increasing students' self-efficacy. However, little is known about faculty members' perspective on providing this encouragement, especially in the engineering academic climate which has a reputation for being "chilly." This pilot study seeks to close the literature gap by developing and validating a scale, the "Faculty Encouragement Behavior Scale," to understand engineering faculty perceptions of providing encouragement to students.

Introduction

The National Academies of Sciences and the National Science Foundation has published several reports emphasizing the strategic importance of effective interventions for increasing STEM degree completion among racial/ethnic minority men, women of all racial/ethnic backgrounds, and other underrepresented students [1-4]. While women account for over half of all college degrees earned in the United States, the National Science Foundation reports that women comprise one of the lowest rates of engineering degree recipients [5].

Within the engineering workforce in the United States, only 14% of engineers are women and 13% of engineers are from underrepresented racial and ethnic groups (African American, Hispanic, Native American/Native Alaskan, and Hawaiian/Pacific Islander) [6]. These discrepancies of representation are addressed in this study as underrepresented minorities (URM). The national need to increase representation in the engineering workforce includes retaining URM students that choose to enroll in engineering programs.

Research on engineering student persistence has been studied, and assumptions around student preparedness and ability became a debate in the literature as reasons for students leaving engineering programs. Further research disproved the debate with study results indicating students who leave science, math, and engineering (SME) have similar grade point averages and SAT scores to students who remain [7]. Further studies found that a major challenge in student retention had more to do with students' perceptions of and attitudes toward the culture and climate of science and engineering classrooms and majors [8-10].

The "chilly" climate, identified by marginalized students in engineering, appeared consistently in the research literature represented by several factors including negative interpersonal relations, subtle and overt denigration of ability, favoritism toward men and majority students, experiences of sexism, gender stereotyping, and delegitimization [11-15]. Research found this chilly climate to be a more challenging issue for women and minority students in academia than factors such as lack of financial support, recruitment practices, or faculty representation [16].

Studies around URM student persistence found faculty support kept students motivated to remain in their engineering degree [9, 10, 17-19]. The literature also revealed two recent studies that found that receiving academic encouragement increases student self-efficacy [20, 21]. Encouragement is a form of verbal persuasion used to not only motivate, but to influence individuals' choices. Encouragement aligns with the need for engineering faculty to positively influence URM students to persist in their engineering program. Previous research measures student perceptions of receiving encouragement, but little is known regarding the faculty's perception of providing encouragement.

Researching faculty's perception of providing encouragement identifies a gap in potential factors impacting students' long-term engineering retention decisions. This gap in literature is especially important in engineering academic climates, which are described by URM students as "chilly." Implications may reveal opportunities for professional development to address barriers faculty experience in providing encouragement to students. Additionally, the creation and validation of a tool to measure faculty perceptions of providing encouragement can be used by institutions to identify critical areas to strengthen how we teach in engineering.

Guiding Framework

An extensive literature review showed the Academic Encouragement Scale (AES) and the Faculty Encouragement Scale (FES) as the best instruments to guide this research [20, 21]. Both measure students' perceptions of receiving encouragement in academic settings. Findings from both studies indicate that receiving encouragement increases students' self-efficacy and outcome expectations.

The Social Cognitive Career Theory (SCCT) guided the development of the survey instrument. SCCT is based on Bandura's social cognitive learning and self-efficacy theories [22]. Bandura introduced social cognitive learning theory, which proposes that psychological functioning involves a continuous reciprocal interaction between behavioral, cognitive, and environmental influences [23]. Self-efficacy is described as an individual's judgment of their capabilities to organize and execute the actions required to attain types of performances, like goals or achievements [23]. Relationships between variables in the SCCT model, like Bandura's theory, are reciprocal and incorporate contextual variables including environmental inputs that play a role in making choices [22].

Several recent studies use the SCCT framework to understand student persistence [24-27]. For this study, engineering faculty are a contextual influence shaping the behavior of the student in their learning experiences, self-efficacy and expectations, goals, actions, and outcomes. Figure 1, below, represents the guiding framework for this study.

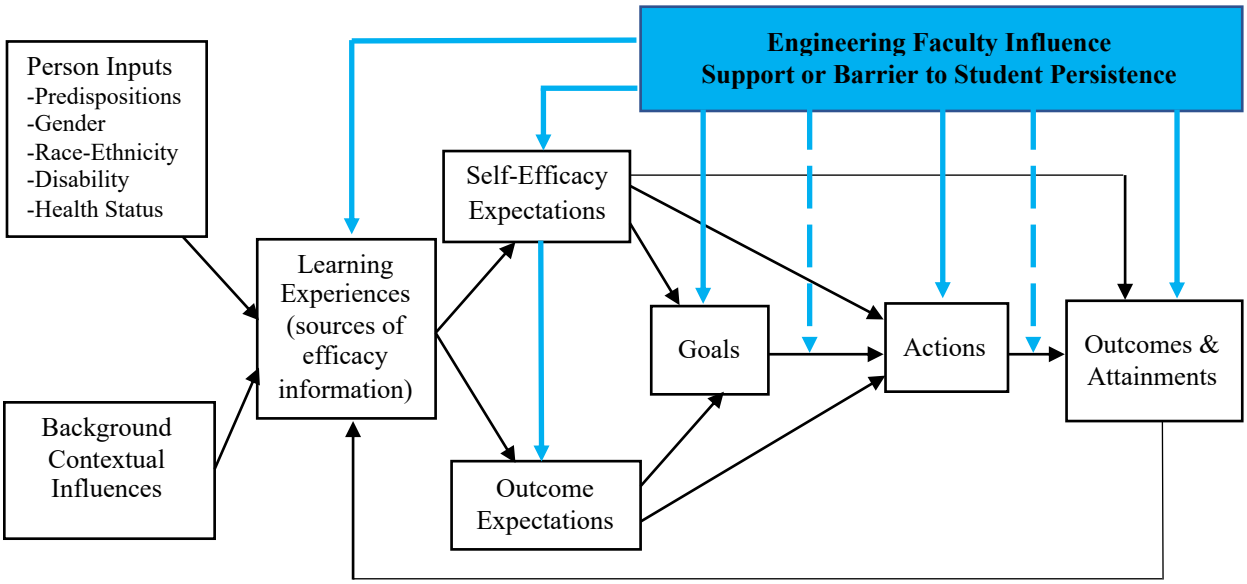

Fig.1. Social Cognitive Career Theory model with faculty influence on student learning experiences, self-efficacy and outcome expectations, and choice making
*This figure represents the guiding framework of this study, focusing on engineering faculty influence on student choices and persistence leading to degree and ultimately career outcomes.

Existing Encouragement Survey Instruments

Research by Wong defines encouragement as "the expression of affirmation through language or other symbolic representation to instill courage, perseverance, comfort, inspiration, or hope in a person within the context of addressing a challenging situation or realizing a potential" [28, p. 182]. Wong and colleagues divided academic encouragement into two areas: challenge-focused and potential-focused [20]. This research involved the development of the Academic Encouragement Scale (AES) to assess the two-factor structure of academic encouragement. Challenge-focused encouragement focuses on the difficult situations that individuals face, while potential-focused encouragement focuses on the potential that individuals possess. While challenge-focused encouragement helps individuals cope with current adversity, potential-focused encouragement helps individuals understand their value [20].

The AES was further refined to create the Faculty Encouragement Scale (FES) which measures academic encouragement received specifically from faculty [21]. The study measured engineering students receiving academic encouragement from engineering faculty [21].

Creating a New Survey Instrument

This study will draw on existing measures of encouragement using the Academic Encouragement Scale (AES) [20] and the Faculty Encouragement Scale (FES) [21]. To adequately measure faculty perceptions of student encouragement, the "Faculty Encouragement Behavior Scale" (FEBS) was created by updating the subject and wording in each item to explore faculty behavior. The modifications address the subject change from students receiving

encouragement to faculty members providing encouragement. Table 1, below, compares the survey instruments.

TABLE I.
ACADEMIC ENCOURAGEMENT SCALE COMPARISON

Instrument	AES (2019)	FES (2021)	FEBS (In Process)
Prompt	Someone I respect...	An engineering professor I respect, or am familiar with...	As an engineering faculty member, I...
Challenge-focused	encouraged me to believe in myself when I doubted my academic abilities.	encouraged me to believe in myself when I doubted my academic abilities.	encourage students to believe in themself when they doubt their academic abilities.
Potential-focused	noticed I was doing well in school and encouraged me to dream bigger and aim higher.	noticed I was doing well in school and encouraged me to dream bigger and aim higher.	notice students doing well in my course and encourage them to dream bigger and aim higher.

There are three sets of survey questions in the FEBS, including multiple choice questions and Likert scale questions. The first set of questions gathers demographic data. The next set of questions focuses on challenge-focused and potential-focused student encouragement modeled after the AES and FES. The final set of questions focuses on the engineering climate and how faculty members perceive how other faculty in their engineering department encourage URM students.

Next Steps

The next phase is to pilot the FEBS instrument and evaluate its effectiveness in measuring faculty perceptions. Once complete, data analysis will include validity and reliability of the instrument and provide data on faculty use, knowledge, and comfort in providing encouragement to students.

Significance and Implications

There are several areas within faculty professional development where this study can highlight opportunities to improve teaching and interacting with students in academic environments. This is especially applicable to URM students who may need additional support to complete their degrees. First, this research could inform faculty professional development by identifying barriers faculty may experience when encouraging students. Second, once validated, the FEBS tool can be used across institutions to measure faculty encouragement behaviors. Conducting a survey of faculty perceptions of providing encouragement allows professional development to target specific trainings needed within an institution or department. Finally, continuous learning and effective teaching in higher education are at the core of faculty professional development. This research gives engineering faculty relevant data and information to understand how encouragement impacts student self-efficacy.

This research also informs academic leadership about the importance of incorporating encouragement into teacher preparation in graduate student education. Several studies highlight concerns about whether graduate education is preparing future faculty well enough for the diverse professorial roles that include not only research, but also teaching and learning and professional service [29-33]. Academic teaching preparation is typically equated to professional development once faculty are already hired and in the classroom. This retrospective approach is problematic and does not align with the demands of faculty workload and research expectations. Shifting teaching preparation to graduate student education, or post-hire, allows colleges and universities to educate their future and/or newly appointed workforce.

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