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CAREER: Supporting Undergraduate Mental Health by Building a Culture of Wellness in Engineering

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Andrea Kunze is a PhD student at the University of Illinois at Urbana-Champaign in the Department of Educational Psychology. Prior to coming to UIUC, she completed a MS in Educational Psychology at NC State University, and a BS in Human Learning and Development at Georgia State University. Her research currently focuses on utilizing qualitative and mixed methodologies to explore people's perceptions and experiences of the social environment in which they learn or work, and how it impacts their engagement and success.

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I am a senior at the University of Illinois and am currently studying towards a Bachelor of Science in Bioengineering and Psychology. I am engaged in engineering education research as a member of the Jensen Lab. My interests lies in developing more wholistic and responsive models of student mental mental by studying both faculty and student perceptions and experiences in their departments.

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Introduction

Despite increasing national awareness, there is minimal research of the mental health crisis in undergraduate engineering programs, where some evidence suggests even higher rates of mental health problems compared with other disciplines. Further, little research has endeavored to examine the perceived norms of poor mental health in engineering, nor to understand the factors that influence these perceptions over time. Though culture and perceived norms have critical recruitment and retention implications, no research has examined the role of a high-stress culture, particularly for students who are underrepresented and may already face a "chilly climate" [1] or "climate of intimidation" [2]. Given that culture permeates all parts of the engineering education ecosystem, we posit that a culture of stress has significant implications for the field and is an unexplored barrier for students to enter and persist in engineering.

Engineering has been described as having a unique culture compared to other disciplines. In a 2010 study to describe the culture of engineering as a discipline, researchers describe engineering culture as one of "suffering and shared hardship" that values hardness [3]. A normalization or even celebration of suffering may promote a culture of high stress for engineering students. In a previous study, our team found that engineering undergraduate students described a perceived connection between poor mental health and studying engineering. For example, a student shared, "The engineering student life is stressful and sometimes detrimental to mental health." [4]. The association of high stress and poor mental health is especially concerning given the already high rates of stress for college students. Previous research has described a myriad of stressors for college students, including relationships, lack of resources, expectations, academics, environment, diversity, transitions, and others [5]. The added stressors of the "suffering" expected in engineering disciplines likely compounds with other college student stressors, causing even higher levels of stress that are detrimental to the engineering student experience.

Towards gaining a better understanding of factors that impact student mental health, our project leverages previous work on stress as a norm in engineering culture to study factors that influence undergraduate student mental health in a longitudinal mixed methods study. Our exploration of the role of mental health in engineering culture includes student, staff, and faculty perspectives. Understanding these issues will aid in the development of strategies to address a national concern of rapidly rising numbers of undergraduates who are experiencing mental health problems. We are in need of proactive solutions to address mental health challenges before they develop instead of only relying on reactive solutions (e.g. offering more counselors for students who have mental health challenges). Understanding how students resist the notion of a high-stress culture in engineering and cope positively will contribute to the development of proactive trainings and educational resources to benefit all students. Understanding what institutional and programmatic experiences engineers indicate as critical to their mental health will allow us to develop targeted interventions, more inclusive teaching practices, and thoughtful advising guidelines.

Furthermore, the study allows us to develop conceptual models about how academic culture develops in undergraduate programs. Here we describe the first phase of the project to develop new measures of students' perceptions of a high stress culture in engineering and to understand faculty and staff perspectives of undergraduate mental health.

Project Overview

The project CAREER: Supporting Undergraduate Mental Health by Building a Culture of Wellness in Engineering leverages a mixed methods design to elucidate factors that will promote positive environments to support student mental health and wellness. Our recent research found that students associate high stress levels and even the development of mental health problems with being an engineering student [4]. We argue that an enhanced understanding of the roots of this culture will enable proactive change, which will ultimately transform the field of engineering education. Using social identity theory as a lens to understand the student experience, this project's mixed methods approach will determine: 1) how students' perceptions of high-stress culture evolve over time, 2) how educators contribute to the normalization of high-stress culture, and 3) what resources can support students and educators towards fostering a culture of wellness. This summary describes the first phase of our research.

Survey Development

Towards our goal of measuring the perceptions of engineering stress culture longitudinally, we sought to develop a of measure of students' perceptions of a high stress culture in engineering. In the first step toward defining this new measure, we have developed a pool of new survey items. The survey items were developed from a previous mixed methods study consisting of a survey and interviews administered to engineering students [6, 7]. Sample items were derived from themes observed in the open response questions on the survey as well as themes from the qualitative interviews. Sample items include "High stress is expected for engineering students" and "Engineering students commonly stay up all night working". Responses were measured on a 6-point Likert scale in accordance with agreement with each statement (Strongly disagree, disagree, somewhat disagree, somewhat agree, agree, strongly agree). The use of a 6-point scale requires participants to take a stance towards agreement or disagreement, which in the case of relatively neutral opinions, may reflect the participant's unconscious bias [8]. For the pilot survey, an additional "No basis for judgement" option was added to check for questions participants are consistently unable to answer due to not having experience with the item being asked about or feeling that they did not have an opinion about the statement. The survey also collected demographic information on participants' race, gender, major, year in program, and parents' education. The survey concluded with an open-ended question: "Is there something else that was not covered on the survey that you would like to share?" to allow participants to share additional thoughts or make any clarifications as is often implemented in interview design to capture rich data [9]. The question purposefully used "something" instead of the more commonly seen "anything" as this small change has been shown to prompt sharing of additional information instead of closing the conversation [10]. A total of 81 items were developed. Items were reviewed by the project team to follow established best practices for survey item development [8, 11] and reviewed by two field experts.

Interviews with Engineering Faculty, Staff, and Administrators

A second goal of our work is to understand how engineering faculty, staff, and administrators perceive undergraduate engineering culture, particularly the role of mental health and wellness in engineering. We argue that the role of educators is critical in building a culture of wellness, and that understanding educator perceptions will guide the development of future training and resources to support educators in this role. Towards these goals we are conducting interviews with engineering faculty, staff, and administrators to understand their perceptions about the culture of undergraduate programs and the role of stress, as well as their perceptions of the roles of educators in promoting or dismantling the culture. The semi-structured interview protocol consists of 15 questions organized in three sections: understanding the mental health climate, experiences of stress, and stress management and coping. Sample items include "Have you noticed if undergraduate engineering students are able to recognize when themselves or their peers are struggling with mental health issues?" and "What have you noticed your department/program does to encourage healthy and/or unhealthy stress management/coping strategies for undergraduate engineering students?" Data will be analyzed by thematic analysis. The interviews will also be juxtaposed with previously collected student interview data to identify areas of agreement and disagreement that will support the development of training and resources for educators.

Data Collection

The research design and instruments were approved by the university's Institutional Review Board #20223 before data analysis began. Student participants for the cognitive interviews were recruited through a university newsletter calling for participation from undergraduate and first-year graduate students in engineering. Faculty and staff were similarly recruited to participate through the same university newsletter. Student participants were offered a $10 Amazon gift card for participating in the cognitive interviews and faculty and staff were offered a $50 Amazon gift card. All interviews were conducted on the Zoom platform. Participants received a study consent form to review before the interview started and were given the opportunity to ask the interviewer questions about the consent form and study before beginning the interview.

Cognitive Interviews

In the first step of validating these new survey items, our team conducted cognitive interviews [12] with 13 engineering students to refine the items. The cognitive interview protocol was designed to have participants answer survey questions while "thinking aloud." Participants read and responded to the questions aloud and were asked to both justify their answers and explain what the questions meant to them, as well as any confusion they had about any question. On average, cognitive interviews lasted approximately thirty minutes. To maintain a reasonable interview length, each cognitive interview participant reviewed a segment of the larger survey. The survey was divided into sections of roughly ten questions of similar topics. A set of negatively worded items was also generated to mirror the survey items as an additional validation check. These questions were asked in sets during the cognitive interviews. After

responding to each section, participants were asked to reflect on any errors or confusion in the items, if the items were relevant to their experience, and if any additional items might be added to better describe their experiences with engineering culture. The majority of interviews were conducted by two of the authors together, which allowed for one interviewer to follow the interview script as the other took field notes and added clarifying questions. By asking the participants a subset of our interview questions, we were able to receive more detailed responses to each question.

Faculty and Staff Interviews Initial response rates to the call for participation for faculty and staff interviews in the university electronic newsletter were low, which we attribute to the timing in the semester and COVID-19 fatigue. Interviews thus far have been conducted with four staff members in either academic or career advising who work directly with undergraduate engineering students. Staff members included those newly employed during the COVID-19 pandemic and those who are experienced at the university. Interviews were conducted by one or two research team members. The average length of the interviews was 60 minutes.

Results

Participant feedback during the interview process resulted in the fine-tuning of the survey instrument and preliminary ideas about how participants will answer survey questions. For example, participants' year in major presented a few unanticipated problems. Some participants considered their class standing to be based on their year in program, while others considered it to be based on their number of total credits (e.g., a student in their first year of a program with a year of transfer credits might consider themselves a second-year student due to program status). Participants who had entered the program more recently were less confident about answering questions about access to internships and research, as some had not yet had research or internship experiences. These participants also had not considered the stress of engineering careers as much as their more experienced peers. Many participants recommended a need to separate questions which originally included both teaching assistants and faculty (e.g., questions about the climate of classrooms; participants had had different experiences with teaching assistants versus faculty). When probed for other relevant experiences to add, participants suggested an increased significance of the importance of extracurriculars to participants' daily lives compared with our team's expectations. Findings also included repeated participant uncertainty regarding the differences between stress, anxiety, and depression, as well as clinical versus symptomatic anxiety and depression, consistent with our team's previous findings [6]. For example, some participants had no confusion in our mental health items, while others believed that depression should not be grouped with stress and anxiety, as it was "too severe." Both our cognitive interview and prior interview results suggest that engineering students have trouble describing the differences between and definitions of stress, anxiety, and depression, in addition to understanding when any of those phenomena are symptomatic or clinical.

In response to the cognitive interview results, the survey was adjusted to include more consistent language. For example, the survey prompted participants to agree with statements, participants for whom English was a second language often were confused when reading items which began with "It is," as formal (e.g., textbook) English questions (not statements) often begin with "Is it," Additionally, questions were reworded to explicitly state "engineering professors," "engineering students," "engineering college/department" etc. throughout the protocol. Items consistently

considered confusing or irrelevant to participants were deleted, such as “Professors in my engineering department are stressed out,” which many participants felt they could not answer. Finally, some questions were divided into two new items, such as the TA and professor questions mentioned above. As a result of these changes, the newly developed survey consists of 81 items (with an additional 15 demographic questions).

Future Work

Future work will leverage a pilot survey of undergraduate engineering students using our newly developed engineering culture survey. The data collected from the pilot study will be analyzed using exploratory factor analysis to identify latent factors and refine survey items [11]. The newly developed survey items will be combined with existing measures of mental health (stress, anxiety, and depression) [13], retention [14], and perceptions of inclusion [15]. Survey data will be collected longitudinally over four years. To compare with student findings, additional interviews will be conducted with faculty, staff, and administrators to understand perceived culture and challenges for student mental health and wellness. The results of the proposed study will provide insight into the social factors and “hidden curriculum” [16] that influence student perceptions of engineering and ultimately the engineering student experience. Moreover, the results of the proposed research will illuminate institutional or programmatic factors that develop perceptions of high stress in engineering and contribute to unspoken hazing. Overall, enhancing student well-being in undergraduate engineering programs will improve the public’s perception of engineering careers, attract and retain talented students, and will support broadening participation efforts.

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