Transitioning from faculty-centered to student-centered communication

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***Abstract*—Preconference workshop: Research shows that effective faculty-student communication can help alleviate students' fear of engineering and other STEM courses and improve student persistence within these courses. However, we as faculty are not always expert at the interpersonal communication skills necessary to communicate effectively with today's students. The goal of this workshop is to increase participants' knowledge and understanding of effective student-centered communication strategies that promote student resilience and persistence in engineering and computer science and prepare students with 21st century science and engineering skills such as complex communication, self management, and problem solving. This workshop will facilitate interactions and discussions around strategies for improving how faculty effectively communicate with students. Specifically, strategies for centering the student in course communication, what instructors should be communicating to the students beyond basic course information to help them succeed, and strategies for encouraging student resilience through growth mindset and anxiety management. This repertoire of strategies will allow instructors to improve student engagement within their courses and promote students' overall success in STEM.**

***Index Terms*—Communication, Student-Faculty Interactions, Growth Mindset.**

I. Introduction

Engineering and computer science courses are some of the most difficult and feared courses offered at institutions of higher education. In addition, students often enter these courses without the resilience necessary to succeed, believing that they simply do not have the talent nor the intelligence necessary to understand the STEM content [1, 3, 4, 5, 11]. This fixed mindset belief puts students at risk of dropping or withdrawing from engineering and computer science courses at their first challenge and/or failing to engage with the material as needed to succeed. Reducing DFW rates are a key step in broadening participation in engineering and computer science education. In this workshop, we will cover two communication approaches to improve the success of post-secondary engineering and computer science students. The first approach focuses on improving the way faculty and students communicate by centering students within the communication. The second approach focuses on improving students' resilience and persistence in STEM by incorporating instruction on growth mindset and anxiety management.

A. Strategies for improving how faculty communicate with students

We as faculty are experts in engineering fields and some of us are even experts at engineering and computer science communication. However, we are not always expert at the interpersonal communication skills necessary to communicate effectively with our students. Traditionally, faculty utilize a variation of a faculty-centered communication model, where students must come to them and must learn how to communicate with them. Couple this with the belief that a professor's time is more valuable than a student's and this presents a huge stumbling block for many students who would rather drop or withdraw from the class than seek out the help they desperately want and need. An alternative communication model is a student-centered communication model, which focuses on faculty reaching out to students and using communication to connect with students and help them to not only learn the course content but also thrive in the college environment. This model of communication requires faculty to become cognizant of the students' needs and difficulties both with the content and in their personal lives. In activities 1 and 2, the workshop will explore centering students in communication between faculty and students. Participants will learn about and practice these skills in groups.

B. Strategies for communicating growth mindset and anxiety management

Solving the problem of a lack of student persistence in engineering and other STEM courses is not an easy task, but research suggests that student resilience may be the key. Yeager and Dweck (2012) define resilience as behavioral or emotional responses to challenges that are positive and beneficial for development [11]. Examples of student resilient behaviors include searching for alternative strategies, having high self-expectations, putting forth greater effort, and setting goals. Growth mindset is a necessary and related part of student resilience [11]. Growth mindset is defined as a belief that construes intelligence as malleable and improvable. Despite current science on growth mindset and neuroplasticity [2, 10], a fixed mindset culture still predominates. In addition, despite recognizing the importance of resilience and growth mindset

for STEM education, STEM instructors often do not have access to a repertoire of practices to develop resilient learners [5, 11]. In activities 3 and 4, this workshop will focus on how instructors can encourage students' growth mindset through proper written and verbal communication, as well as through intentional and timely use of growth mindset supporting course activities and course materials [6]. Participants will learn about and practice these skills in groups.

II. Workshop Goals

The goal of this workshop is to increase participants' knowledge and understanding of effective student-centered communication strategies to promote student resilience and persistence in engineering and computer science. This aligns with the FIE goal of convergence by training current and future engineering educators in modern student-centered communication strategies and skills. This repertoire of communication skills are needed to promote convergent, 21st century scientific skills in engineering classrooms that will prepare students for the STEM workforce such as problem solving, complex communication skills, and self-management [3, 7, 8, 9].

TABLE I
Workshop agenda and timeline

15 minutes	Icebreaker activity and Participant Introductions
60 minutes	Student Centered Communication Activity 1: Guidelines for faculty-student communication in college courses (small working groups). Activity 2: Importance of Student Validation.
10 minutes	Report back in Full Group
10 minutes	Break
60 minutes	Exploring Growth Mindset Activity 3: Growth mindset and anxiety management as tools for promoting STEM student success. Activity 4: Role playing of tough student conversations.
10 minutes	Report back in Full Group
15 minutes	Closing Remarks

III. Workshop Audience

This workshop is primarily aimed at engineering and computer science instructors, but all educators are welcome. The workshop will focus on best practices for working with students taking undergraduate engineering and computer science coursework. Max participation: 30.

IV. Expected outcomes and participant takeaways

At the end of the workshop participants will leave the workshop with a better understanding of:

1) Transitioning into a student-centered communication model;
2) New methods for communicating difficult content;
3) Sending unintended messages in participants' classrooms;
4) Importance of supporting students through validation;
5) Resilience and growth mindset and the important role they play in engineering and other STEM learning;
6) Improved skills at recognizing when students are/are not using growth mindset and when students' anxiety is playing a negative role in student behaviors;
7) Ways to improve communication with students to build student resilience.

V. Workshop Details

Activity 1: Guidelines for Communication in STEM College Courses. This activity includes a discussion of examples of successful and unsuccessful communication from organizers' and participants' experiences teaching STEM courses. Participants will work in small teams to develop guidelines for more successful communications.

Activity 2: Importance of Student Validation. In this activity participants will be introduced to students' need for validation. Participants will work in small teams to respond to several "real world" student/ faculty interactions.

Activity 3: Growth Mindset and Anxiety Management. This activity focuses on introducing and exploring growth mindset. A brief introduction on growth mindset and resilience will be presented by the workshop leaders. Then participants will share and discuss in small groups their personal experiences of positive mindset and fixed mindsets and the impacts these had on teaching or learning.

Activity 4: Role Playing of Tough Conversations. We will have a few real world scenarios which lead to difficult or important student-faculty conversations. Participants will take turns role playing the characters in their scenario. Participants will then discuss how the interaction played out, ways to improve the interaction, and ways for the instructor to communicate a growth mindset stance and/or promote resilience through improved communication.

VI. Post-workshop evaluation and follow-up

After the workshop, workshop directors will provide a short workshop evaluation survey to participants. The survey specifically collects participant feedback on the value of the different workshop pieces and participants' overall assessment of the workshop's effect on their understanding of communication, growth mindset, and resilience.

In addition, workshop participants will be encouraged to continue networking and engaging with each other and the workshop leaders post workshop. A shared email list of participants - who wish to be included - will be available to participants post workshop. Google Docs will be used to collect any shared information from participants about strategies and practices they used or did in their classes following the workshop and wish to share back to the group.

VII. Conclusion: Timeliness & Relevance of this Workshop

While moving at risk students to successful students is a well-known problem within engineering, computer science and other STEM fields, it has been exacerbated this year due to the unprecedented Covid-19 pandemic and the move to online instruction. Coupling this with the extreme stress experienced by both the faculty and students, it is more important than ever to improve communication between instructors and students and promote growth mindset and resilience. This workshop presents possible communication solutions to reduce higher

than average DFW rates for post-secondary engineering, computer science and other STEM courses and promote student success not only in these courses, but also in life.

VIII. Workshop Leaders

Dr. Rebecca Lindell is an interdisciplinary STEM education researcher with over 25-years of experience. She specializes in Physics and Astronomy Education Research but has participated in STEM Education projects within the fields of Engineering Education, Chemical Education, and Biology Education research to name just a few. Her experience with engineering education began by becoming an STEM education research coach to the Department of Physics and Astronomy at her alma mater, Purdue University. As a STEM Education research coach, she met regularly with the Physics and Astronomy Department Head to discuss the department's upcoming education efforts specifically related to Purdue's Engineering Education Curriculum. Beginning in 2011, she relocated to the Purdue area to work more closely on this project with both Purdue's Department of Physics and Astronomy and the School of Engineering Education. In addition to her coaching work, Dr. Lindell's research focuses on both effective STEM curriculum design as well as the development and methodologies surrounding STEM concept inventories. Dr. Lindell is an award-winning curriculum developer who has received national and international recognition for her innovative astronomy instructional materials and methods.

Dr. Rebecca Rosenblatt is a discipline-based STEM education researcher with an interdisciplinary focus on physics and engineering education research. Dr. Rosenblatt has worked on several projects in materials science and engineering education, specifically developing the Material Science Concept Evaluation (MSCE) and designing a set of tutorials for use in the introductory materials science course at The Ohio State University. Dr. Rosenblatt has extensive experience in curriculum design and best practices in evaluation and assessment. Dr. Rosenblatt is also interested in secondary physics teacher preparation, undergraduate student mentorship, and increasing participation and achievement in STEM. She is currently an AAAS-STP Fellow at NSF/EHR/DUE and has organized a variety of workshops and professional development events.

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