

Special Session: Emotions in Engineering Education – A Roadmap to Possibilities in Research and Practice

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Abstract—This special session invites scholarly educators and engineering education researchers to learn about nascent research and innovative practice possibilities related to emotions in engineering education. Through an interactive session, facilitators will guide participants into developing their own thinking in relation to how emotions can shed novel insight on innovative teaching solutions and educational research. We have designed the special session to catalyze community around this topical interest for both education researchers and scholarly educators.

Keywords—*emotion, engineering education research, research agenda, interactive training*

I. OVERALL DESCRIPTION

Emotions are ubiquitous in social and learning processes in engineering education. For example, they might bolster or inhibit the cognitive engagement of a student who is learning to perform nodal analysis in a circuits course. Emotions are also at the center of an interaction where a student might feel marginalized in a project team, motivating the behaviors of both the student who is marginalized and the students who are marginalizing. More generally, although emotional constructs undergird many focal points of engineering education research (e.g., identity [1-3], marginalization [4-5], conceptual blocks [6]), they are—with some exception [7-12]—rarely examined as a central focus in investigations.

In the special session, we will guide participants through research opportunities and innovative learning strategies that lie at the intersection of engineering formation and emotional

experience. This session is primarily designed for an audience of both education researchers with emerging or established interests in pursuing research on emotions and scholarly educators who are interested in how emotions shape the learning environments of their contexts.

This special session is informed by ongoing work that aims to develop a research agenda for emotions in engineering education [13]. With the guidance of our facilitator team, participants will dialogue this ongoing work. In terms of concrete outcomes, participants will be sensitized to emotional concepts in order to actively construct their own goals connected to emotions in engineering education research and teaching practice. Finally, participants will be able to find community and potential collaborators among engineering education researchers and innovative, scholarly educators with allied interests in emotions within engineering domains. We particularly aim to foster dialogue between these two groups of participants in order to strengthen both practice-informed research and research-informed practice [14].

II. JUSTIFICATION FOR NOVELTY OF SPECIAL SESSION

The proposed special session builds on the generative outcomes a well-attended workshop on emotions in engineering education research that was conducted at the 2019 ASEE conference and a 2020 international symposium that has served to formalize a research agenda on this topic of inquiry [13]. While the focus of these prior meetings served to organize a widespread interest in developing structured research agendas related to emotions, the special session will serve to leverage the outcomes of these prior workshops in order to support both engineering education researchers and scholarly educators in articulating how they could contribute to further research on emotions in engineering contexts.

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III. FORMAT OF SPECIAL SESSION

The special session will be highly interactive but also provide participants the opportunity to learn new content. In addition to brief talks from Drs. Huff and Lönngren, each facilitator will provide a one-page handout of their emergent work on emotions in engineering education and practice, which will document practical guidance related to educational practice. As detailed in the itinerary, the first portion of the special session will begin by facilitators providing brief overviews of their perspectives on emotions in engineering as informed by their active investigations. These presentations will lead the way into semi-structured activities that enable participants to contribute to discussion related to a variety of relevant topics related to emotions in engineering contexts.

IV. ITINERARY

The following schedule reflects the itinerary for the 80-minute special session:

- 0 – 5 min: Welcome and brief overview of the session's purpose and itinerary. Introductions of facilitators and participants.
- 5 – 15 min: Overview of emotions research in engineering education, drawing on frameworks generated from previous workshops.
- 15 – 25 min: Interactive panel with two facilitators. The following perspectives will be represented:
 - *Emotion as related to identity: Perspectives from a study on shame in engineering* (Dr. James L. Huff)
 - *Emotion as related to sustainability education: Perspectives from a study on how emotions are expressed in discussions about wicked problems* (Dr. Johanna Lönngren)
- 25 – 35 min: Concept-mapping activity. Participants will work in virtual breakout rooms to map the space of what draws participants to explore emotions in engineering education and practice (e.g., What perspectives do participants bring into the research space? What are the topics of emotions research that they want to pursue in their own research or apply to their teaching practices?). Facilitators will be scattered across various virtual breakout rooms to support the activity.
- 35 – 45 min: Report out from various groups
- 45 – 65 min: Each group of participants will prototype the beginning stages of research or education plans related to emotional phenomena in engineering education. Groups will be guided by facilitators on thinking between alignment of relevant theories, methods, and practice-oriented contexts.
- 65 – 80 min: Concluding remarks from facilitators. Discussion of opportunities for formulating projects and publications.

V. EXPECTED OUTCOMES

As a minimal outcome, participants of the special session will gain an understanding of how existing research on emotions

in engineering education is organized and also identify opportunities for further exploration of research in this domain. The participants will also be able to dialogue with a nascent research agenda on emotions in engineering education, based on the authentic perspectives that they represent (e.g., those focused on innovating teaching and learning; those focused on fostering educational research). Based on the outcomes of prior workshops, we anticipate that the special session will provide a needed space to catalyze collaborations and partnerships that will support investigations and scholarly interventions that are related to emotional phenomena in engineering education domains.

VI. ABOUT THE PRESENTERS

This special session is facilitated by a well-rounded international group of educators with expertise on emotions in engineering education, from teaching and research perspectives.

Dr. James Huff is an Associate Professor of Engineering Education at Harding University, USA. He leads the research group Beyond Professional Identity (BPI), which broadly investigates lived experience of identity within individuals in the interest of advancing holistic identity development and psychological health in engineering domains. Relevant to the special session, Dr. Huff is currently the principal investigator on an NSF-funded project to investigate shame in the context of engineering education (NSF EEC 1752897) [8].

Dr. Johanna Lönngren is a Postdoctoral Scholar in Science and Engineering Education at Umeå University, Sweden. Her research focuses on sustainability and ethics in engineering education and the role of emotions in such education. She leads a project that aims to investigate how engineering students talk about emotions in discussions about wicked sustainability problems. Through the lens of positioning theory, the project explores how students negotiate rights and duties to express emotions and to take emotions into consideration in developing solutions to wicked problems [12-13].

Dr. Tom Adawi is a Professor of Engineering Education Research at Chalmers University of Technology. His research interests include problem-solving, technology-enhanced learning, authentic learning environments, and identity development. He is currently involved in a project exploring the role of emotions when learning to deal with wicked sustainability problems in engineering education.

Dr. Nadia Kellam is an Associate Professor and Engineering Education Systems and Design Graduate Program Chair in The Polytechnic School at Arizona State University, USA. In her research related to emotions, she employs narrative methods to understand the role of emotions in student learning. Her other research involves exploring the role of power and privilege in engineering education systems as experienced by students and faculty. Dr. Kellam served as principal investigator on an NSF-funded project to unpack the role of emotions in student learning (NSF EEC 1160350) [9].

Dr. Idalis Villanueva is an Associate Professor of Engineering Education at the University of Florida. She has applied motivational theories of cognition and emotion using biological and physiological techniques in several engineering activities (e.g., design, exams). Relevant to the present special

session, Dr. Villanueva serves as the principal investigator on a collaborative NSF-funded project to investigate motivation and performance in engineering education (NSF EHR CORE 1661100/1661117) [6, 10].

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