

Knowledge Construction in Engineering Education Research – Assessing the Role of Journals, Books, Conferences, and Other Products of Research

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Abstract—This panel will discuss the role of different knowledge artifacts in creating, maintaining, and circulating knowledge within the engineering education community. The past decade has seen a significant increase in the venues available for sharing engineering education research and as the field grows and builds more knowledge, it is equally important to also take stock of prior work and of strategies to create novelty. Within this context, what is the role of different knowledge encapsulating artifacts and why do those who engage with creating these artifacts do so? In this panel we touch upon these issues while taking stock of the knowledge base in the field. We will also discuss what the future of knowledge creation in the field might look like given the move towards open access online publications as the primary form of knowledge circulation. Finally, in the post-COVID context, what will and should be the role of in-person events in this process. In terms of equity of participation, what potential avenues are available?

Keywords—engineering education research, knowledge construction, research publications

I. INTRODUCTION

As the field of engineering education has matured, a range of venues are now available for members to share their ideas and empirical results. In recent years we have seen a, relative, proliferation of journal outlets that are publishing engineering education research and several journals that have been started specifically for the field. Many existing journals are receiving a higher number of submissions than before and in terms of both authorship and content, there is increased diversity. Furthermore, although during COVID many face-to-face, in-person, conferences were on a hiatus, there has been almost an explosion in the number of online or virtual events related to engineering education that are being hosted and attended by participants across the world. Recent years have also seen

increased community-building around engineering education across the world leading to more formal organizations and their events. In a nutshell, for those engaged in engineering education research, more ways of participation are available than previously [1]-[4].

A consequence of this expansion is that both newcomers to the field as well as established researchers have to make strategic decisions about participation with implications for both immediate and long-term impact not only for their careers but also the growth and vibrancy of the field itself. This issue is further complicated by the very different backgrounds, careers, and incentive structures for researchers and practitioners across institutions in a given country and a lot more across different geographical areas. Whereas in the one field conference publications may play a significant role in the academic discussion, in the other field journal publications may still have the pole position. An increasing number of publication venues and also an accelerated turnaround time for knowledge development in the area of educational technology make the landscape even more difficult to navigate, in particular for younger and new scholars. Even in terms of areas of research focuses and methodologies, there are variations across the globe with implications for how and what knowledge is shared with others and how engineering education practices are impacted.

As we look towards a mature field with meaningful impact and the increasing integration of engineering, it is critical to assess and discuss the field's development [5]-[7]. For any academic field it is important to be vibrant, but it is equally important to have common ground so that future work actually builds on what has come before. This also requires emphasis not only on certain content areas and research methodologies but a discussion of issues related to data sharing practices, open access to publications and datasets, and other approaches that can help

build a foundation for a more inclusive field. Many efforts are being taken in the field such as mentoring for new authors and reviewers, regular workshops to provide insights into research and best practices for teaching, and increased participation of members of the field in activities such as journal reviewing, conference and seminar hosting, and where applicable review of research proposals. Many members have also started sharing knowledge through blogs or other venues that are not yet widely used in the academic community.

Through this panel, we want to start a conversation around where the field stands in relation to all these efforts that are engaged with knowledge construction, sharing, and maintenance in some respect. We want to engage with the question – what does the future of knowledge construction and sharing look like in engineering education – what is our next frontier? In this panel session we will target this overarching questions and topics pertaining to the construction of knowledge within the field of engineering education research and related areas by addressing the following questions:

- What constitutes a contribution to the field of engineering education research?
- What counts as knowledge?
- How does the community translate new knowledge based on engineering education research to actual practice of improving education?
- What are the ways and venues in which one can contribute, depending on the specific research context, the addressed community, and career goals?
- What role do different knowledge sources play in the field and what might future sources look like?
- How can the different avenues for publishing position themselves to advance the careers of individuals as well as the research field?
- Finally, what are the tensions inherent in this enterprise and how does gatekeeping shape the field and futures of individuals?

The panel consists of experts who have experience and expertise with different aspects of the knowledge construction process. Through their viewpoint they will illuminate the advantages and disadvantages, as well as the opportunities that are available to members of the community to contribute to knowledge construction.

We anticipate that this panel will be of interest to a broad range of community members and all FIE participants. Our goal is to present different viewpoints on the topic including those from journal and book editors, conference organizers, etc. We have a mix of scholars from both North America and Europe in the panel (and will add others as participation becomes clear). We will tailor our discussion so that it speaks to the needs to newcomers to the field – illuminating different options and pros and cons of each approach – and to those who are looking to increase their contributions through editorial positions or journal special issue opportunities.

II. KNOWLEDGE AND KNOWING IN ENGINEERING EDUCATION

A. *The Growth of Engineering Education Research*

Over the past decade, the engineering education research (EER) community has seen significant growth in terms of participation from ever more number of scholars, practitioners, and institutions. Akin to any maturing academic entity, the community is morphing from a relatively close-knit community of practice (CoP) into what can be seen as a network of practice (NoP) [8]-[9]. With this maturation comes the challenge of creating a common foundation for the field to grow into the future, one that builds on what has come before but also one that points to novel work that can be accomplished in the future.

Starting in the early 2000s, in the United States, a few seminal works have shaped how the field has progressed in terms of the issues that field has addressed including the National Academies reports “Engineering of 2020” and “Educating the Engineer of 2020”, “Rising Above the Gathering Storm,” special issues of the *Journal of Engineering Education* published in 2005, 2008, and 2011, efforts such as the research colloquies and innovating change workshops, and the *Cambridge Handbook of Engineering Education Research* (CHEER) [10]-[18]. New entrants to any academic discipline are the cornerstone of its future success and the training, including the foundational knowledge, newcomers build on determines to a large extent the trajectory of the field. Later contributions also describe the development in Europe, often noting the contrast to the US-based EER [5] [19]-[21].

B. *Knowledge Construction in Engineering Education Research (EER)*

The panel will discuss the questions listed earlier with focus on three larger aims that support knowledge building and knowledge sharing.

1) *Creating of Body of Knowledge* – First and foremost, panels will discuss the ways in which knowledge is produced – from inception of research to its final knowledge product and how these contribute to the field. The panel will discuss the pros and cons of different artifacts, the development of new forms of artifacts, and the legitimacy of different ways of sharing knowledge. In addition to the practicalities of publishing, for tenure and promotion for instance, we also want to reflect on the actual goal of knowledge production i.e., to change practices [22].

2) *Mapping of Scholarship* – Second, through our panel discussion we will roughly map the boundaries of knowledge and scholarship in engineering education research. This mapping will help establish boundaries of core EER as well as allied fields. We also investigate the deeper implications of boundary setting in a highly interdisciplinary field like EER. We will discuss what can make work become recognised as valuable contributions to the field, for instance regarding the research topics addressed or the research methodologies adopted. By extension, such boundaries can also affect who is seen as a legitimate member of the community [23]-[26].

3) *Creation of Epistemic Networks* – Finally, the panel will discuss ways to meaningfully engage newcomers to the field

and also extend the network to scholars who have traditionally not been represented in EER. The panel will focus on how to catalyze new scholarly collaborations and strengthen the network of practice (NoP) of EER by bringing together participants from different academic sub-communities, institutions, and nations in small teams to produce knowledge that fully and honestly reflects the state of engineering education research with the goal to impact engineering education practice [24].

III. PANELISTS AND CONTRIBUTIONS

A. Aditya Johri

Aditya Johri is Professor of Information Sciences & Technology at George Mason University, USA, and co-editor of the Cambridge Handbook of Engineering Education Research (CHEER). He is currently working on an international handbook of engineering education research under contract with Routledge and to be published in 2023. He has edited multiple journal special issues including for *Journal of Engineering Education*, *Advances in Engineering Education*, and *Engineering Studies*. He has also contributed to several reports and white papers that have been published by the American Society of Engineering Education (ASEE), U.S. National Science Foundation (NSF), and the National Academy of Engineering (NAE).

B. Kristina Edström

Kristina Edström is Associate Professor in Engineering Education Development at KTH Royal Institute of Technology, Stockholm, Sweden. Since 2018 she is the Editor-in-Chief of the *European Journal of Engineering Education*, published by SEFI. She is also active in the SEFI working group for Engineering Education Research. Kristina has since 2001 been involved in developing and disseminating the CDIO approach for engineering education reform.

C. Xiangyun Du

Xiangyun Du, Ph.D., is a professor at Aalborg Centre for PBL in Engineering Science and Sustainability, Aalborg University, Denmark. In addition to her substantial number of publications, Xiangyun has also (co)edited over 20 books and conference proceedings, and multiple special issues contributing to journals including *International Journal of Engineering Education*, etc. In addition, she is also (co)editing a book series for Palgrave and RIVER publishers and serves as an editor of engineering education section for *Eurasia Journal of Mathematics, Science and Technology Education*.

D. John Mitchell

John E. Mitchell is Professor of Communications Systems Engineering, and Co-Director, of the UCL Centre for Engineering Education. He is Editor-in-Chief of *IEEE Transactions on Education*. He led the team that introduced the Integration Engineering Programme (IEP) at UCL, a major revision of the curriculum across the engineering faculty which was awarded the HEA Collaborative Award for Teaching Excellence (CATE). He has published widely on curriculum development, active learning and issues of diversity within engineering education. Professor Mitchell is a Chartered Engineer, Fellow of the Institution of Engineering and

Technology (IET) a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), Former Member of the Board of Directors of the European Society for Engineering Education and Principle Fellow of the Higher Education Academy (PFHEA).

E. Domink May

Dr. May is an Assistant Professor in the Engineering Education Transformations Institute at the University of Georgia, Athens, GA, USA. His primary research focus is the development, introduction, practical use, and educational value of online laboratories (remote, virtual, and cross-reality) and online experimentation in engineering instruction. Dr. May is Vice President of the International Association of Online Engineering (IAOE) and serves as Editor-in-Chief for the *International Journal of Emerging Technologies in Learning (iJET)*. He is currently program co-chair and international program committee member for the annual International Conference on Remote Engineering and Virtual Instrumentation (REV) and is co-editing two journal special issues on online laboratories, one with the *Journal of Computing in Higher Education* and one with the *European Journal of Engineering Education*.

IV. ANTICIPATED OUTCOMES

The primary goal of this panel is to engage in a discussion with the EER community about the knowledge sources in the field, their past, present, and future state. Depending on the nature of discussion as well as engagement from the audience we see a possibility of a joint editorial or even a special issue around this topic. This panel will bring together EER scholars from around the world and across the range of all the work that is going on in the field to discuss the role of knowledge creation. This panel will advance the current scholarship on engineering education in three main ways. First, a new, global agenda will be defined to inform researchers, and other key stakeholders in decisions about future research on engineering education and knowledge creation in the field. Second, the development of a community of researchers, employers, and educators represents an important opportunity for exploring how research findings on engineering practice can be used to bring engineering education and professional engineering work in closer alignment.

The work proposed in this project is timely as after years of strong growth the EER field is slowly turning into a mature field and attracting a higher number of new entrants – students and learners – across the world. It is very timely to start a discussion across those globally spread areas and communities of engineering education research scholars. The global community will be able to benefit from a discussion across those communities in terms of learning from each other, learning with each other, and, potentially most important, prevent any silos of knowledge in the same field of research [Jesiek, Borrego and Beddoes, 2008].

Overall, there is also an increase in numbers of researchers engaged with engineering education and the impact of research outcomes on educational practices. Most prior offerings have been designed around in person participation and their direct gains have been limited since participation in them has been

constrained due to space and budget limitations. These programs have also not focused specifically on engineering education practices related to research i.e., how a research project or program is actually carried out from inception all the way through outcomes, usually a published article or another form of dissemination. This aspect of scholarship is especially beneficial for those who don't have access to communities of practice readily to learn these skills. The different ways in which people undertake research is also important from a disciplinary and interdisciplinary perspective.

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