Helping newcomers feel "at home": Reflections on the start of careers in engineering education research and implications for broadening participation

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Abstract— **Broadening participation of students and faculty is a goal of many engineering programs. In order for participation to be broadened, newcomers who are outsiders must be welcomed into an existing community and it is vital to welcome these new members. But little is known about behaviors that help newcomers feel at home. This study shares insights gained from the reflections of now-established members of the engineering education research (EER) community as they look back at the beginning of their EER career. The data comes from semi-structured interviews with participants of a series of NSF-funded summer workshops held in the mid-2000s designed to introduce participants to the emerging field of engineering education research. The interviews were conducted 10 – 11 years after they participated in the workshops and sought to capture their career and research trajectories since the workshops. Looking back at the start of their EER career trajectory, participants stressed the importance of the relationships that they formed with other participants, workshop facilitators, and other EER members. Thematic analysis of the transcripts revealed three themes which we are calling contributor, approachable, and sharing. The paper details specific, meaningful actions that resulted in the newcomers feeling welcome and provides recommendations for those interested in broadening participation.**

Keywords— broadening participation, belonging, community of practice

I. INTRODUCTION

Diversifying the field of engineering remains a persistent and often unmet goal. In order to recruit and retain diverse faculty and students, the engineering community must welcome newcomers, who often come from groups that do not automatically see themselves as 'belonging' in engineering. Although the need for feeling welcomed and "at home" in a community is a goal that is frequently mentioned, less commonly discussed are actions that may foster a feeling of welcome within the newcomers. As members of a highly social species, human beings crave a sense of belonging. Theoretical frameworks, such as Self-Determination Theory (SDT) [1] highlight belonging as an essential element for motivation. Of the three core elements of SDT: competency, autonomy, and relatedness we would posit that *relatedness* is a synonym for *belonging*. The importance of belongingness has also been correlated with engagement [2] as well as speculation that belongingness might be crucial for conceptual change [3].

The main questions driving this paper are "what does it feel like to have a sense of belonging?" and "how does one foster this sense of belongingness?"

The data we used to answer these questions comes from the retrospective reflections of participants in a workshop which took place over 15 years ago. This workshop was designed to form a Community of Practice (CoP), and interviews conducted a few years after the workshop suggest that a CoP was indeed formed [4]. In that workshop, participants were introduced to tenants of engineering education research (EER) at a time before any departments of engineering education had formed [blinded for review] so participants were newcomers to the field - as indeed almost everyone was in the mid-2000s.

Community of practice provides a framework to interpret the actions of the EER community that fostered a feeling of welcome and understand the process by which newcomers develop a sense of belonging or feeling "at home." The acknowledgement of the importance of social connections and a welcoming community existed long before Lave and Wenger's [5] introduction of CoP as a framework. In fact, the value of belonging and the adverse effects that its absence can have on others have been discussed in psychology and sociology for decades [6]–[8]. Nevertheless, Lave and Wenger [5], then Wenger [9] and colleagues [10], played a critical role in popularizing the examination of organizational social structures with their introduction and development of CoP as a theory.

One of the tenets of design of the EER CoP was the opportunity for large-group interaction as well as one-on-one relationship building engagements. This was in keeping with Lave and

Wenger's [5] recommendation that newcomers need to be more than "observational lookouts" (p. 95). Instead, the interaction should be designed such that the potential members of the community are engrossed in the type of participation that creates the opportunity for them to be absorbed in the culture of practice. In another study, we found that meaningful interactions of newcomers with existing expert community members added value to and catered to the newcomer's interests or reasons for joining. These intentional types of interaction further helped to formulate valuable community relationships [4]. These non-superficial connections allowed newcomers to legitimize their membership and enabled their sense of belonging and their feeling "at home".

As will be detailed in the methods section, the current paper is based on interviews with participants that were conducted 10-11 years after the workshop when the participants were established members of the EER community. They were asked to reflect on their experience and discuss where they were at the time of the workshop, where they were when they were interviewed, and what they hoped for the future. Other studies have discussed the specifics of the methodology used to collect that data [blinded for review] but there is richness in the interviews that had not been tapped.

II. METHOD

A. Study Design

This paper is drawn from a larger follow study that seeks to highlight the long-term impacts of a series of summer workshops on participants' journey into engineering education research. In 2005, when the field of engineering education research was formally being established, the National Science Foundation funded several projects aimed at building the community of emerging scholars who would learn what types of questions engineering education researchers would seek to answer, how to apply educational and social science research methodologies and theoretical frameworks in their research designs, and for some how to conduct qualitative research. The workshops were designed using the guiding principles of communities of practice. Through the workshops the participants were exposed to various disciplinary experts along with the workshop conveners and encouraged to start building their collaborative research networks. The longitudinal data collected by the follow up study presents a unique opportunity for engineering education researchers to capture how critical interventions can have lasting impacts on career trajectories.

B. Participants

Our participants were past attendees of the workshops who at the time were junior faculty, research assistants/associates or postdoctoral scholars. Using the participants names at the time of the workshops, a directory of the attendees was created by a graduate researcher. This directory included the year they attended the workshop, their roles and place of employment at the time of their participation, as well as their current roles and place of employment at the time of the follow up study. More than ten years after their attendance to the workshop, using the directory, all 146 participants were invited to participate in this follow up study of which 30 agreed to participate.

C. Interviews

All 30 interviews were conducted, audio recorded and transcribed by one of the authors. The interviews ranged from 45 to 60 minutes and were conducted using a semi-structured protocol. Some of the questions the participants were asked were:

1. Can you speak to the influence of persons, experiences, circumstances that contributed to your understanding of EER or development of an EER identity?
2. Could you share an example of a situation in which you had to translate an EER concept into something someone not familiar with EER could use or understand?
3. Looking back on what you've shared today, what advice would you give to others interested in entering engineering education research? How would this be similar or different if the advice was for other engineering faculty?
4. Looking back on your experience in the RREE was there anything you learned/experienced during that program that was particularly useful in helping you navigate any of these hurdles (conceptual, community, identity)?

Participating in this study was completely voluntary and no compensation was given. For the purposes of this paper, we selected five interviews. There were two selection criteria for inclusion in this study: (1) participants from various faculty ranks (at the time of the workshops and when the data were collected for the follow up study) and (2) participants who provided rich data in their interviews.

Participant	Rank at time of workshop	Rank at time of follow up interview
Caroline	Associate Professor	Professor, Admin
Catherine	Professor	Professor, Admin
Chloe	Assistant Professor	Associate Professor
Cooper	Associate Professor	Associate Professor, Admin
Charlotte	Associate Research Scientist	Associate Professor, Admin

D. Data Analysis

A thematic analysis approach, based on the work of Braun and Clarke [11] was used to explore common themes across the five interviews chosen for this study. Thematic analysis is used when the goal of the research is to identify and highlight common and shared experiences across a group of participants. Further, thematic analysis "is a way of identifying what is common to the way a topic is talked or written about and of making sense of those commonalities" (p. 57). In keeping with

the six steps involved in performing a thematic analysis, the authors independently read through the selected transcripts (step 1), generated their own individual descriptive codes (step 2), search for and name themes that captured the breadth of the codes (step 3), met to discuss and review the potential themes (step 4), defined and named the final set of themes (step 5), and collectively produced the results for this paper (step 6).

Below we provide some preliminary findings and discussion based on the five interview transcripts that were analyzed. The identified themes are defined and discussed using illustrative quotes from our participants. Future work will include further development of our themes and a holistic analysis of all the interview transcripts.

III. PRELIMINARY FINDINGS

Based on the preliminary thematic analysis of the data, we identified the importance of forming relationships with established members of the community as the main theme across all the participants. This broad theme was broken down into three sub-themes that we are calling: contributor, approachable, and sharing.

Contributor

This theme was seen across all participants and deals with how they believe they were perceived by the members of the community. The contributor theme captured instances when the participants discussed how the members of the community saw them as individuals who had something that could benefit the community. For example, some of the participants discussed how they were already curious about engineering education focused work and were determined to conduct research in this space before they attended the workshops. Other participants described how they felt their professional experiences, up to the time of the workshops, had been positioned to add to the types of questions the community was seeking to answer. Consequently, by the time they attended the workshops it was not hard to find other researchers to collaborate with and this collaboration led to a broader network for their careers. Below we share some quotes from the transcripts (all names are pseudonyms assigned by the researchers):

Ok so I think definitely the workshop that I attended was pivotal for me again because it was the first real exposure that I had had to people who were doing this well and who were promoting this as a true field of research and I started to see the possibilities for me and started to see things that I would really be passionate about doing. - Chloe

I feel like there's just lots of pieces that did come together that I wouldn't have necessarily been able to predict, I think often we look back and we try to make a linear path to our story, the reality of what it is. I think that you know a lot of pieces that I have already described sort of the hunger for a larger community, the desire to make things better, make it more fair, the sense that there's something that's not quite right with what we have, it could be better and that there are people who have insights into how it can be better. - Caroline

In this theme we saw also evidence of how the participants progressed from being merely attendees to the workshops to finding community at the annual engineering education conference.

When I go to a place like [conference] meetings I definitely feel like I am home with colleagues, people who understand what I am doing or interested in what I am doing, people I can talk to about what I am doing and what they're doing, and find collaboration of things to do - Cooper

Approachable

We found evidence of this theme across all our participants. The approachable theme speaks to how supported the participants felt by the experts in the community in that even though they were established researchers or "known" by everyone the participants felt they could reach out to them at conferences or through email to get feedback on their projects or access their networks to connect with other researchers.

I think it was the community, although starting with the community of researchers with whom I got connected at the RREE program so Person 1 and Person 2 and Person 3 and the people that absolutely ran that program sort of served as the experts that provided the information about how to use the tools to gain but I think even more importantly was the building of communities that from going there I met people who were doing similar things, established relationships with them then even more it was furthering those networks that other opportunities like the ERM division of ASEE where I really was able to find a home and connect with people who included the people I met at the RREE but who also branched out beyond that and it included a much more inclusive community as well – Charlotte

I think one thing I learn names of people who were successful and be able to kind of follow them throughout their careers and kind of see what they were doing and how they were creating things and when I had the opportunity to go to their presentations and, chiefly in [conference] because a lot of people that would pop up in [conference] and I always made sure I went to see them so I could learn more from what they were doing so I think it was the, it was the people more than anything. - Chloe

In some cases, participants discussed how being able to connect with experts in the engineering education community was very different from their technical disciplines. In the quote from Caroline below we see an example of this:

People like Person 2 who is the you know huge, one of the most important people who would talked [sic] to me whereas in the technical community unless you were up at a certain level nobody would even talk to you so it seemed like a much nicer and group and I am very grateful that I can still do the going to

conferences and have intellectual discussions and having a community of colleagues working on things that is beyond our local network. I am really glad that exist and certainly that the RREE workshop was one of the things that helped with that because several people that I knew that went to that but I didn't know very well and after going it kind of increased the level of interaction that we had and other things - Caroline

On the other hand, some participants described the type of mentoring relationship that blossomed with engineering education experts through their attendance to the workshops and subsequent conferences:

Yeah absolutely, so there were two things, one is the workshop, so the workshop itself. I think one of the key things about that workshop was that we got a little mini-grant to do research and I did something with that and then I would say Person 1 in particular has been a real mentor along the way in a couple different ways. When I got the, my results, like it was this quantitative study they were strange, Person 1 said well, if you do a little qualitative thing you can find out what's going on so I did and that got me interested in qualitative research this is where I am going to start getting into people knowing who I am. - Cooper

I also learn from my colleagues and we were sort of learning together how to conduct the research that we were doing in a really strong way, none of us are engineering, sorry none of us were education researchers so we all were learning the information that we needed together and which was really helpful for us to just be there for each other and support each other as we went through the process. - Charlotte

In one particular instance, a participant discussed how they did not immediately find ways to approach or connect with the members of the community but they were still able to take some valuable lessons from being there into her future career.

No but then like I said I was very, very, very new and I was kind of like chicken to talk to anybody so I think I just sat there probably literally looking like…I don't think I literally said anything so no I didn't actually collaborate with anybody but it made me see the value of doing so, I collaborate with a lot of people now but it's not, it didn't start there at all - Chloe

Sharing

Through our analysis we found that a key component to the relationship that the participants were able to form with each other and established members of the community was anchored by the bi-directional sharing of resources, knowledge and networks. This sharing sub-theme captured the participants' discussion of how they were able to engage in the generation of knowledge with the established members that could benefit other newcomers to the community as well as how their involvement could further influence engineering practice more broadly.

Person 4 was a Co-PI with me on that and so I was fortunate because I had sort of a built in peer and mentor in him because he was so much more adaptive, knowing how all the NSF things worked and had handled a larger project and his knowledge of the literature was much deeper than mine and he had, his PhD had ended up being an essentially in engineering education whereas mine had been purely technical so he had been in the space for a lot longer and could point me to things and Person 4 is absolutely amazing at developing relationships and making sure to connect things and whether that was relationship among people or relationships among ideas so I was really lucky in that regard to sort of have a built in person and not have to go outside so much. It was nice having a community at ASEE and FIE where you know the folks from NETI such as Person 2 and Person 1 and other folks that you could talk to and bounce things off of and so was certainly a helpful piece there and being able to come a present thing as you were going - Caroline.

Now I am deeply embedded in it [the community], this is a signpost that has guidance, assistance, advice, support, help that's what I am doing now with my research team, doing all of that, intimately involved in helping them in all those areas and being pulled like the sign shows to do support, to do assistance, to guide, to help and to advice on the projects that we are working on and my last one which is what I see in five years for me maybe ten or five years down is sort of, it looks like a Buddhist monk or something that's sitting on a high seat and people are around him, his followers or something are around him or her watching and I guess you could say listening to what is going on and I see myself in five years as not intimately involved in the day to day activity of research in this area but someone who can guide those who are in it from a far, not like I am doing now where I am intimately involved but from a far and hopefully be a sage type of guide to give someone advice on directions they can take with their work - Catherine

IV. Discussion

We first want to unpack what we feel are the deeper implications of the findings, and then discuss what these themes mean with regards to broader participation.

The contributor theme: an important element of feeling at home was that the newcomers were made to feel that they had something to contribute to the EER community. They were not approaching a new community that would "take them in" solely for the purpose of adding to the number of members in the community. The newcomers had perspective, experience, ideas, and/or shared values that added to the EER community. Members of the existing community made it clear to the newcomers that they were contributing to the community.

The approachable theme: established members of the community (even "big names" who were seen as influencers, or leaders) were friendly and interested in the newcomers. They were easy to meet and talk to. There were no status barriers between established members and newcomers.

The sharing theme: established members of the community were willing, perhaps even eager, to share the knowledge they held with everyone. Community members did not guard their knowledge as the newcomers had experienced in other settings. This provided a sense that the knowledge held by the EER community was open to the newcomers.

The three themes, taken as a whole, are represented in Figure 1. A sense of belonging (which we are calling the "belonging zone") is facilitated when boundaries between the newcomers and the established community overlap (seen where the circles connect). Newcomers are made to feel they have something to contribute. And established members are approachable and willing to share their knowledge with all. When newcomers feel they can contribute, and old-timers are approachable, and sharing, newcomers can experience a sense of belonging [the belonging zone] that makes them more likely to join the community.

What are the implications of our findings for broadening participation? We propose that all three elements (contributor, approachable, and sharing) might be needed for belonging to be fostered. For newcomers to feel like contributors, they need to be seen, heard, and welcomed. Old-timers need to be interested in new members, to learn their names, and a bit about their backgrounds, interests, and values. Therefore, time needs to be set aside to get to know the newcomers.

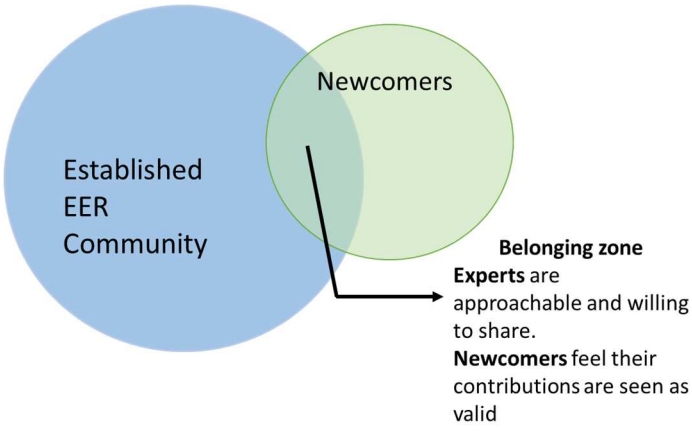

Figure 1 – integrating newcomers into an existing community

The newcomers need to be introduced to others, their opinions or experience needs to be solicited and recognized in conversations and discussions. Established members of the community need to be mindful of being approachable, and to go out of their way to meet newcomers or be gracious when newcomers are introduced to them. There is always a temptation for established members of a community to become cliquish and want only to meet with their friends and colleagues. If one is truly trying to broaden participation, this tendency toward cliques should be consciously counteracted. And finally, established community members need to freely share knowledge and resources with newcomers. This could be accomplished through informative conference presentations or more informally through ad hoc conversations. We recommend that those interested in diversifying communities remember the three themes of helping newcomers see their contribution, of being approachable, and sharing knowledge. We suggest that incorporating these behaviors into the community's culture could promote broadening participation.

V. Conclusion and Future Directions

In this paper we presented a thematic analysis of five interviews. Our goal is to refine our analysis approach and continue to analyze the remaining 25 interviews. While our findings and discussions are fairly preliminary, we anticipated that, with the rest of our data analyzed, we will be able to tell a more complete story about the NSF program that initiated these newcomers into the burgeoning engineering education community. As the community continues to expand its reach to new and emerging scholars, our findings have and will continue to have implications for those interested in broadening participation in their own communities, departments, or disciplines. For example, our results suggest that members of an existing community need to be genuinely interested in newcomers and should create opportunities for newcomers to introduce themselves and contribute to ongoing discussions around issues being studied by the community. We also suggest that being able to connect and share in the joint enterprise of knowledge generation and dissemination could be key to helping newcomers feel as though their voices are heard and welcomed.

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References

[1] E. L. Deci and R. M. Ryan, "Self-Determination Theory," 2022.

[2] D. Wilson *et al.*, "Belonging and Academic Engagement Among Undergraduate STEM Students: A Multi-institutional Study," *Res. High. Educ.*, vol. 56, no. 7, pp. 750–776, 2015, doi: 10.1007/s11162-015-9367-x.

[3] R. Adams *et al.*, "A model for building and sustaining communities of engineering education research scholars," *Am. Soc. Eng. Educ.*, 2006.

[4] N. Pitterson, C. Allendoerfer, R. Streveler, J. Ortega-Alvarez,

and K. Smith, “The importance of community in fostering change: A qualitative case study of the Rigorous Research in Engineering Education (RREE) Program,” *Stud. Eng. Educ.*, vol. 1, no. 1, 2020.

[5] J. Lave and E. Wenger, *Situated learning: Legitimate peripheral participation*. Cambridge university press, 1991.

[6] A. W. Chickering and L. Reisser, *Education and Identity. The Jossey-Bass Higher and Adult Education Series.* ERIC, 1993.

[7] M. Seeman, “On the meaning of alienation,” *Am. Sociol. Rev.*, pp. 783–791, 1959.

[8] V. Tinto, “Dropout from higher education: A theoretical synthesis of recent research,” *Rev. Educ. Res.*, vol. 45, no. 1, pp. 89–125, 1975.

[9] E. Wenger, “Communities of practice and social learning systems,” *Organization*, vol. 7, no. 2, pp. 225–246, 1999, doi: 0803973233.

[10] E. Wenger, R. A. McDermott, and W. Snyder, *Cultivating communities of practice: A guide to managing knowledge*. Harvard business press, 2002.

[11] V. Braun and V. Clarke, “Using thematic analysis in psychology Using thematic analysis in psychology,” *Qual. Res. Psychol.*, vol. 3, pp. 77–101, 2006, doi: 10.1191/1478088706qp063oa.