Co-Designing for Graduate Student Mental Health: An Example of Participatory Research Methods in PER

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In this work we present an example of participatory research methodologies: a co-design session. The session was an early stage of the development of a broader study of graduate student mental health, and it provided critical insights that helped shape the study design. This paper first motivates studying graduate student mental health and then describes our co-design process in detail. We discuss the particular activities performed and the motivations for each activity, foregrounding our design choices and how these choices attended to participant psychological safety. We finally describe participants' evaluation of the session as well as themes from the session that shaped the subsequent study design. This work highlights the value of meaningfully including members of a study population in the design and interpretation of physics education research studies.

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I. INTRODUCTION

In physics education research (PER), a typical subject of study is people, including students, teachers, department stakeholders, and practitioners of physics. Thus it is critical to choose research methodologies that not only are appropriate for the research questions at hand but also attend with care to the people being studied.

This work presents an example of participatory research (PR) [1], a set of methodologies in which the "researcher-participant binary" [2] is broken in favor of deeper involvement of research participants in the design, interpretation, and utilization of the study. PR methodologies can help alleviate research subjects' frustration with researchers who study them with little sociocultural context or knowledge about them; PR can also help build the commitment and the broad and diverse collaborations needed to successfully translate knowledge into action.

The example of PR described in this paper (inspired by another recent work [3]) is a co-design session [4], in which members of the group being studied are invited to participate as a group in activities (developed by the researchers) in which they meaningfully contribute to some phase of the research (e.g. study design, data analysis, interpretation of results). Our co-design session was performed as an early step in the design of a broad study of physics and astronomy (P/A) graduate student mental health. We briefly describe the aims of this broad study and then introduce co-design sessions more thoroughly. Then we describe the participants in our session and how we recruited them. We then discuss the activities we conducted, detailing the choices we made in developing the session, and we describe participant evaluation of the session. We finally discuss how the session shaped the subsequent development of the broader mental health study. Thus we provide a concrete example of the use and the epistemic value of PR methodologies in PER.

II. BACKGROUND AND CONTEXT

In studies of mental health, it has been found that academics suffer worse mental health than the general population [5–8]. This phenomenon has been studied in STEM graduate students in the biological sciences [9–11], chemistry [12], computer science [13], data science [14], and engineering [15–18]. However, no equivalent formal conversation exists in physics and astronomy. Among specific mental health concerns of interest, local surveys given at the University of Maryland (UMD) [19–22] identified anxiety, depression, and especially impostor phenomenon (IP, defined below) [23–26] as prevalent among UMD P/A graduate students. In designing our quantitative survey study, we sought not only to describe the state of mental health among the broader population of P/A graduate students, but also to relate mental health concerns in this population to other aspects of the graduate student experience, including identity (e.g. gender), personal life (e.g. social support or isolation), and professional life (e.g. support from research advisor).

To narrow our survey to topics most relevant to P/A graduate students, we sought opinions from graduate students themselves by performing participatory research (PR). PR is an approach to research in which the population under study becomes part of the study design process [1, 27–32]. PR generally emphasizes empowerment of the group being studied, social justice, and translating knowledge into action, values that are aligned with our broader mental health study. Some kinds of PR have been used in PER [2], such as participatory action research (PAR) [33, 34], which combines the participatory element of PR with an intentional balancing of research and action to ameliorate an issue. Our particular choice of PR method, the co-design session, has rarely been used in academic studies.

In a co-design session [4, 35], several members of the group being studied are invited to come together with the researchers to participate meaningfully in the design of the research study (or other phases of the research, such as data analysis and interpretation) through a series of discussions and activities developed and guided by the researchers. The activities of a co-design session may be either convergent or divergent [35]. Divergent activities are those aimed at exploring topics and generating ideas, while convergent activities involve the group attempting to reach a consensus or a collective decision about a question of interest to the researchers. For instance, researchers may ask a group to consider their professional lives and generate ideas about aspects of their work that affect their mental health (divergent), or researchers may ask a group to collectively choose one or two mental health interventions, among many, that they would try if given the resources (convergent). After a co-design session, the researchers use notes and materials produced during the session to analyze the generated ideas and make decisions about the research study. With our co-design session, we aim to learn from graduate students (members of the population under study) how they believe their graduate student experiences relate to their mental health; in analysis of the generated materials, we found common themes which became focal topics on our survey.

III. PARTICIPANT RECRUITMENT AND CHARACTERISTICS

For our co-design session, we selected participants from our personal and professional networks (also known as convenience sampling [36–38]). When researchers are inviting members of a population they do not know, sometimes pre-interviews or pre-surveys will be used to assess whether potential participants fit certain requirements. In our case, we used personal knowledge to select potential participants who we believed (1) would be open to frank and honest discussions about their experiences in graduate school, and (2) had a diverse set of backgrounds, identities, and professional experiences before and during graduate school. Based on these criteria, we invited several people; our email invitations included a two-page description of the broader project and what we were asking of potential participants. Since we personally knew those we invited, we were able to quickly answer any questions and receive responses to our invitations. We invited students until we received eight affirmative responses; two students declined our invitation due to time constraints. The eight students that participated were: four men and four women (and none outside the gender binary); four domestic and four international students; 4 White, 1 Black, and 3 Asian, with two identifying as Hispanic; two first-years, two sixth-years, and four in their third to fifth years; one full-time teaching assistant and several others who had been teaching assistants; five experimentalists and three theorists; and two students who worked primarily off the main campus. Two graduate student researchers (who are co-authors on this paper) facilitated the co-design session.

IV. CO-DESIGN SESSION PROMPTS AND ACTIVITIES

Our co-design session, which lasted two hours, consisted of several divergent guided activities that sought to generate ideas about aspects of the graduate student experience and about impostor phenomenon [23–26]. We did not record the session in any way, nor do we share specific quotes from participants. Rather, in this work we describe the activities we performed, foregrounding our design choices for the session and how these choices attended to participant psychological safety.

We began with introductions and ice-breakers shared with the whole group: ("If you could be an animal for a day, what would you be and why?" "Complete the sentence: I'm happiest when..."). We then spent a few minutes to set norms and expectations for discussions, as shown in the left panel of Fig. 1. Then we discussed an ice-breaker prompt in pairs: "What's something that has surprised you about your time in grad school?" Responses were shared with the whole group. Through these initial prompts, we aimed to establish participants' comfort talking both with the person next to them and with the whole group.

Following these ice-breakers, we gave the participants a brief explanation of the session's purpose by describing the aims of the larger research study, and we explicitly stated their role ("Your work here will ultimately help us determine what topics should be included in our survey."). We positioned the participants as experts in their graduate school experiences with statements like "You all bring diverse experiences that [the researchers] alone don't have," and emphasized the value of their time with statements like "Your stories, experiences, insights, and work here will be extremely valuable to us and to the physics community as a whole."

With this setup, aimed at psychological safety and explicit goal-setting for the session, we began a series of four activities. The first activity focused on participants' graduate student experiences by considering the following prompt: "Imagine you're writing an autobiography in which you tell the story of your time in grad school so far. **What would you write about? How would you tell the story?**" (emphasis in the original prompt). We provided "possibly helpful" guiding prompts and a fictional example story which included themes of pride in having passed a qualifying exam, challenges with social integration, support from a research advisor, and joy in teaching. After letting participants consider the prompt on their own, participants paired up with the person next to them to tell their stories. We asked that the listener of the pair only speak to repeat emotion or feeling words used by the storyteller; the goal was not only to elicit the important aspects of each student's experience but also to focus on the emotional and psychological effects of those experiences. At the same time, listeners were asked to take notes in a Google Document; after the storytelling time, we gave participants a few minutes to edit the notes of their own story for accuracy and clarity. These documentation strategies encouraged attentive listening among the participants and yielded important records for subsequent analysis.

The second and third activities focused on mental health. We provided a definition of mental health: "Mental health is a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community." (This one is similar to the World Health Organization's definition [39].) We split the eight participants into two groups (which we selected in advance), and we asked the groups to imagine a fictional scenario about moon tourism, with tourists visiting lunar cities for the first time. One group discussed a tourist whose luggage was stolen (full story in the right panel of Fig. 1), and one group discussed a tourist whose vehicle broke down during a lunar safari. We asked participants to "think about how [the tourists'] mental health affects how they interact with the world around them" via discussion prompts (like those shown in the right panel of Fig. 1) that emphasized the bidirectional nature of the relationship between mental health and the environment. The two groups discussed and then shared their scenario and how they felt their tourist's mental health might affect them. This activity was designed to give participants some experience with the definition of mental health we provided and also to generate ideas about their understandings of the concept of "mental health." These ideas translated into the third activity: we returned to the graduate school stories told earlier in the session and asked participants to pick out parts of their study that had a particular effect on their mental health. Students shared these parts of their stories and the effects on their mental health by writing on virtual sticky notes on the co-design session slides, which we gave participants access to edit. Participants wrote on a range of issues, from visa difficulties to harassment, finances to loneliness, difficulties getting into graduate school to interactions with research advisors (both positive and negative). Finally, we invited students to share one of their sticky notes out loud (but did not require anyone to share).

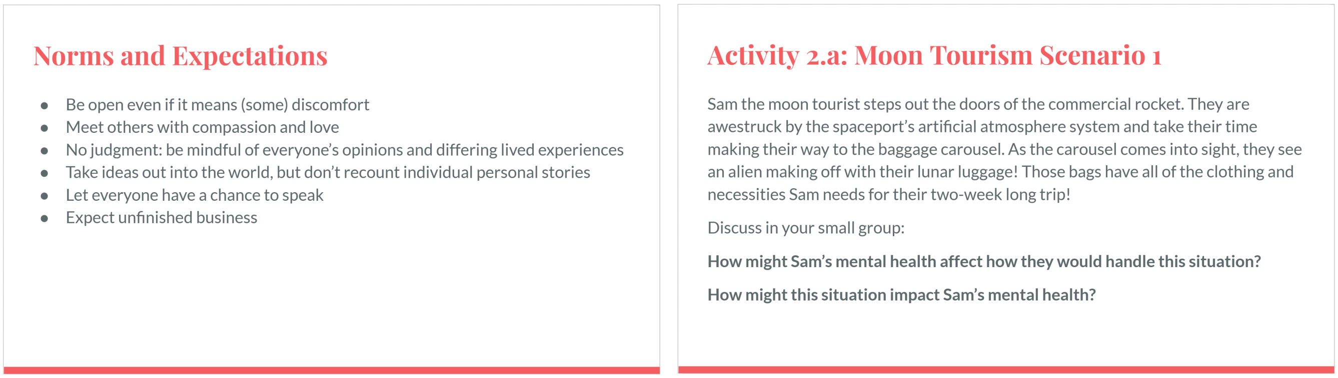

FIG. 1. Two slides from the slide deck used during the co-design session. Left: the norms and expectations used at the beginning of the co-design session. We encouraged participants to be open and be without judgment, preserve anonymity after the session, and expect that we would not have time to explore all of the topics in as much depth as we might like. Right: one of the two moon tourism scenarios used to help participants explore their conceptions of "mental health." The discussion prompts emphasized that the relationship between mental health and one's actions is bidirectional.

For our final activity, we focused on impostor phenomenon (IP). IP is a feeling of intellectual fraudulence, a belief that you have somehow "tricked" those around you into thinking you are smarter, more capable, or more competent than you "really" are [23–26]; we took a particular interest in IP after local surveys showed it to be highly prevalent in samples of P/A graduate students. Though we began this activity by saying that local surveys had shown IP to be prevalent at our institution, we did not explicitly define IP for participants during the session. We presented the participants with a ten-question instrument (the CIPS-10 [40]) meant to measure feelings of IP. We asked participants to think carefully about how they interpreted the questions in the context of their graduate education as well as describe their thought processes in selecting answers to the questions. We specifically provided the following four discussion prompts: (1) "Did the questions [of the CIPS-10] and experiences [described in the questions] feel relevant for you as a graduate student?" (2) "How did you interpret the questions?" (3) "What factors make you choose the answers you did?" and (4) "Are there specific grad school experiences you've had that strongly relate to any of the answers you gave?" After a few minutes to consider the questions on their own, we asked the participants to form two groups, and each of the two researchers joined one group to take notes and facilitate discussion.

We ended the session by reserving five minutes for additional comments and discussions on any of the activities we had done. We then thanked the participants for their time and reiterated the value of their efforts for the broader study. We also informed participants that we would be sending short follow-up materials, including the evaluation survey described next.

V. EVALUATION METHODS AND RESULTS

After the session, we asked participants to fill out an anonymous and voluntary evaluation form in order to solicit feedback along multiple dimensions, including participants' perceptions of psychological safety, whether their contributions were valued, benefits of participation, and session organization. The form included ten rating questions with possible responses Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree; one overall rating question on a scale from 1 to 10; and five open-response questions. Five of the eight participants responded to the form.

First, attending to participants' psychological safety was critical to the session's success. All respondents agreed or strongly agreed that "I felt comfortable sharing during discussion in pairs and groups," "I felt comfortable sharing during whole-group discussion," and "The researchers valued my psychological safety during the session."

Second, we wanted to position participants as experts in their own experiences and identify their "expertise" as valuable to our study. All five respondents also agreed or strongly agreed that "I feel that my contributions were heard and valued" and "The researchers valued my insights and contributions during the session."

Third, we wanted to assess how well the session flowed and whether it appeared well-organized and well-motivated. All five respondents agreed or strongly agreed that "Overall, the session was well-planned" and "The session was well-organized and flowed smoothly," while one respondent was neutral to the statement "The session's activities and discussions were well-motivated" (with the other four agreeing or strongly agreeing).

Finally, all five respondents agreed or strongly agreed that "I would say I benefited from the session in some way" and that "Overall, the session was fun." When asked to rate the session on a scale from 1 to 10, the participants rated it with an average of 8.8/10, with no participant rating it less than 8/10. All of this indicates that we successfully designed a space for the participants to meaningfully reflect about their experience in graduate school.

The above paragraphs discuss all of the rating-style questions we asked; in addition, we asked several open-response questions. We asked

1. Which part of the session did you enjoy the most? Why?
2. Which part of the session did you enjoy the least? Why?
3. Would you make any suggestions to improve the session?
4. Is there anything you wanted to say during the session that you were unable or unwilling to say during the session, whether due to time constraints or to discomfort sharing with the group, that you would like to share with us here?
5. Is there anything else you would like to tell us about the session, in terms of content, feedback, or anything else?

There were a few themes across responses to these questions.

First, several responses regarded the perceived intimacy and vulnerability of one-on-one discussions. One person commented that the small group activities felt easier than the one-on-one discussions "since it felt less intimate," while another person perceived the one-on-one discussions in the first activity as helping to "establish the safety of the meeting" but needing more closure before moving on to other activities.

Second, several participants mentioned the session's use of time. One person said the session took up a lot of the afternoon, while another person wondered if the session could be effective if split into two one-hour parts over two days. But participants expressed wanting more time to do particular activities, specifically the small group activities (the moon tourism and CIPS discussions).

One person noted something that the researchers were attuned to: the room we chose was a conference room, with no room for pairs or small groups to spread out. This made it hard for some participants to hear their partners. The physical space used for the session is an important part of its success.

Finally, several respondents mentioned enjoying having dedicated time to reflect on their graduate school experiences. Two noted that these reflections particularly benefited from the insights of their one-on-one or small group discussion partners.

VI. CONCLUSION

The information gathered during our co-design session meaningfully and substantially impacted the course of our survey development. First, based on thematic analysis of notes from the session, we found a pair of themes across student experiences that we had not previously considered: (1) feelings of isolation or loneliness during the graduate program, and (2) students' sense of "progress," which included how progress was defined in the research group and in the program, what milestones or structures were provided by the program to indicate progress, and how to develop professional goals to which a student could align professional progress. We included both of these themes on our survey. We also gained additional insights and context for the effects of advisors on graduate student mental health, which shaped the items about this topic on our survey. In other words, diversifying the set of voices contributing to the project by partnering with members of the population under study attuned the researchers to important aspects of the graduate student experience and inspired new research directions, which were ultimately included in our broader cross-institutional survey study.

By writing about the design and implementation of this co-design session, we hope to offer the community a concrete view into a rich (but well-bounded) example of participatory research methods in PER. Such methods have the potential to give researchers deep insight into the community under study while also empowering participants to contribute to research about their community. Broader adoption of and experimentation with such methodologies could be a rich direction for future PER work.

In addition to shaping the course of our broader quantitative survey study, several of the co-design session participants expressed appreciation at having dedicated time to reflect on their graduate school experiences as well as activities to guide those reflections. We believe that our activities could be adapted into standalone community-building activities for graduate students, which could be facilitated by student groups or other members of graduate programs. Indeed, loneliness proved a prominent theme in our co-design session; community-building activities could help create a buffer against loneliness for graduate students. These activities could also provide graduate students with a space to reflect on their experiences in the program, with discussions helping to generate new ideas to improve those experiences. Adapting our activities for community engagement purposes would give us an additional way to contribute back to the graduate student community, in the spirit of participatory research methodologies.

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