i.e.: inquiry in education

Volume 13 | Issue 2 Article 10

2021

"I Am Not Alone": Impact of Participating in a Group-Level Assessment for Undergraduate Women Engineering Students

Batsheva R. Guy
University of Cincinnati, batsheva.guy@gmail.com

Brittany Arthur
University of Cincinnati, arthurby@ucmail.uc.edu

"I Am Not Alone":

The Impact of Participating in a Group-Level Assessment for Undergraduate Women Engineering Students

Batsheva R. Guy
University of Cincinnati

Brittany Arthur
University of Cincinnati

Abstract

Group level assessment (GLA) allows participants or co-researchers the opportunity to voice their opinions on a specific topic while also developing action strategies for change. The purpose of the method is to empower participants and provide them an outlet for sharing their experiences in addition to developing a salient action plan. In this article, we describe how the process of participating in a GLA impacted the undergraduate women engineering students who participated. We conclude that merely facilitating a GLA positively impacted participants, aside from the action steps. Women who participated in the GLA felt supported, thought that their voice was heard, and developed a heightened awareness of other women's experiences.

Introduction

Women continue to lag in enrollment in engineering majors, despite efforts to increase the numbers of women in undergraduate science, technology, engineering, and mathematics (STEM) majors. The National Science Foundation (2018) has reported an overall decrease in engineering major enrollment. The engineering workforce is made up of only 10% women (Bureau of Labor Statistics, 2011). Due to this low enrollment and retention, undergraduate women in engineering (WiE) tend to feel lonely, unsupported, and tokenized (Haas et al., 2016). Faulkner (2009) notes that women engineers often live within a paradox in the engineering field, being highly visible as women but "invisible" as engineers.

Although organizations such as the National Research Council (2007) continue to stress the importance of strengthening the science and technology fields to ensure economic and social prosperity, the numbers belie these efforts. Furthermore, although WiE has been a topic of research for decades now, we have made little progress in the recruitment and retention of women. As

Bernold et al. (2007) note, “In spite of considerable research about the poor retention rate of undergraduate engineering students, we still have an inadequate understanding of the factors that affect students’ decisions to remain in engineering programs” (p. 26). Researchers typically have used traditional quantitative or qualitative methods to study undergraduate research programming and its connection to women in STEM, with a majority being quantitative. The experiences of women in STEM are normally studied using quantitative and/or mixed-methods survey data, or traditional qualitative methods, such as interviews (Adedokun et al., 2013; Espinosa, 2011; Jones et al., 2010; Kardash, 2000; Rosenthal et al., 2011; Wilson & Kittleson, 2013). There is a marked absence of participatory research methods in the examination of these topics. A distinct need for the use of participatory methods in this field of study stems from a lack of marginalized voices represented in the study of undergraduate research and the potential benefits participatory research could have for women in engineering.

Consequently, additional research approaches should be utilized to better understand the experiences of women in engineering in hopes of facilitating the development of effective recruitment and retention strategies. We suggest the implementation of participatory methods, namely, Group-Level Assessment, as a critical tool for evaluation and assessment (Vaughn & Lohmueller, 2014), as well as a method to empower WiE.

Low self-esteem has been identified as an issue for the success of women in STEM, while high self-efficacy is a success factor (Cole & Espinoza, 2011; Heilbronner, 2012; Saucerman & Vasquez, 2014; Thoman et al., 2014). Participatory research can address these issues not only through asking women what their experiences are like surrounding strengths and barriers to inform programming but also through involving them in the process. By doing so, participatory research can help empower these women, aiding with self-efficacy and self-esteem issues and providing them with research experience that could help them grow as future scientists. Participatory research can shed new light on this topic and provide a novel perspective on the problem at hand directly from the women themselves while at the same time empowering participants throughout the research process.

Although participatory research is infrequently used with undergraduate women in STEM, successful studies that have used participatory research with university students and with women provide a platform for the current project (Goodhart et al., 2006; Gordon & Edwards, 2012; McIntyre, 2003; Williams & Lykes, 2003). Furthermore, engaging in participatory research leads to knowledge acquisition and relationship development in addition to empowering participants (Goodhart et al., 2006; Gordon & Edwards, 2012; Lazarus et al., 2014; Martin et al., 2016; McIntyre, 2003; Richardson et al., 2017; Vaughn et al., 2017; Williams & Lykes, 2003). Thus, the current project aims to understand women’s experiences as undergraduates in engineering as well as to improve their experiences and empower them as a result of participating in Group-Level Assessments.

Methods

Group-Level Assessment (GLA) is a qualitative, large-group participatory methodology that allows participants to anonymously share their opinions on a specific topic and also challenges participants to develop themes and action items as a group. GLA has been utilized within higher education with STEM students and faculty to improve programming within their respective contexts (Arthur & Guy, 2020; Guy, 2017, 2020; Guy & Boards, 2019). The overall purpose of GLA is not simply to answer a research question but to use the answers to research questions to develop relevant action plans that are meant to be carried out in a timely fashion. The GLA process, as a participatory method, empowers participants, valuing their voices and input as expert stakeholders, and is therefore particularly salient when working with historically marginalized groups (Vaughn & DeJonckheere, 2019; Vaughn & Lohmueller, 2014). We followed the GLA process Vaughn and Lohmueller (2014) define it, aside from a minor modification in Step 2 that assists with ensuring anonymity during the process. Below are the steps that we carried out during each GLA session:

1. **Climate Setting**: We began by introducing ourselves and GLA as a whole, then conducted an icebreaker activity. Climate setting is an essential first step to ease participants into the process and facilitate their comfort with the facilitators and group of fellow stakeholders.

2. **Generating**: During the generating phase, a series of prompts were posted around the room on the walls using sticky note poster board paper. To add another layer of anonymity, we modified the traditional GLA process and asked participants to reply to the prompts on small sticky notes as opposed to writing directly on the poster boards. Participants were given time to respond to the prompts using words and phrases, and then they posted their answers on the corresponding poster.

3. **Appreciating**: The appreciating step involved participants reading everyone's prompt responses while at the same time indicating which responses they agreed with through marking them with checks (✓) or asterisks (*).

4. **Reflecting**: The GLA participants spent a few minutes reflecting on the prompt responses as a whole and were encouraged to jot down their initial reactions.

5. **Understanding**: The GLA participants were divided into small groups and assigned a series of prompts to consider. Participants were instructed to identify three to five common themes across their assigned prompts (see Figure 1).

6. **Selection**: After reconvening as a large group, the small groups shared their themes, and the large group consolidated these and selected three to five overarching themes through facilitated discussion.

7. **Action**: The final step of GLA is utilizing the final themes to create action items. Facilitators worked with the large group to identify salient and realistic action items that could be carried out in the future.

Figure 1. GLA Understanding Phase

Study Context

To understand the experiences of WiE at our institution, we facilitated three GLAs. Over the span of the three GLAs, 79 undergraduate WiE participated. These three GLAs took place over three academic semesters, with 31, 39, and 9 participants attending the spring, summer, and fall sessions, respectively.

The GLA prompts were developed to allow us to look holistically at the experiences of WiE at the university. The prompts varied, with a balance of positive and critical as well as serious and lighthearted. The prompts strategically asked questions around their experience in courses, on co-op, and within the culture of engineering. The hope was that the diversity of prompts would allow us to understand the diverse experiences of WiE. Below are a few examples of the prompts we utilized.

- *Advice I would give a freshman female engineering student at [institution name] would be...*
- *If the culture of engineering were a movie, it would be titled …*
- *Things I enjoy about the engineering program at [institution name] are …*
- *If I could change one thing about engineering at [institution name] it would be …*
- *My professors in engineering are …*
- *Being in a professional engineering environment [co-op] makes me feel …*
- *The culture of engineering at [institution name] is …*

We conducted these GLAs to investigate the experiences of WiE as well as understand the impact of the GLA process on participants. In this paper, we focus on the latter. To assess the impact of the GLA process on participants, at the end of each of the facilitated GLAs we provided the women with a quick questionnaire that asked the following questions in the form of an open-ended survey:

1. How did participating in the GLA change your perspective?
2. What did you enjoy about this process, or what would you change?
3. Is there anything else that we didn't cover that you'd like to add?

These questionnaires allowed us the opportunity to analyze how the experience of participating in a GLA impacted the participants while also gleaning insight into how to improve our practice moving forward.

Data Analysis: Findings

During the "understanding" phase of each of the GLAs, the participants conducted a preliminary analysis of the prompt responses. After the three GLAs, we combined the data from each individual GLA, including the developed themes and action items, into overall themes and action items. Then, the research team, a collaborative group of co-researchers including the authors and our undergraduate co-researchers, thematically analyzed the data using Jackson's (2008) group

analysis method. Additionally, we utilized Braun and Clarke's (2006) method of conducting thematic analysis to analyze the questionnaire responses and allow us to identify common themes.

The analysis of the questionnaire results indicates that participating in the GLA made participants feel supported and less alone. Also, participants stated that they enjoyed the GLA as an engaging and interactive process. The women also highlighted that they enjoyed the opportunity to learn from the perspectives of the other participants. The GLA provided WiE an opportunity to voice their opinions and concerns in a safe environment, which, as expressed in the GLA, is very different from their typical experiences in engineering. WiE shared their voices and experiences with the group in an anonymous and safe way, were empowered to think critically about the themes developed and suggest action items, and were provided the authority to make suggestions for change. Key themes that arose from the questionnaire analysis were (1) Awareness, (2) Connection, and (3) Voice. A fourth theme indicated that some participants' perspectives remained unchanged following the GLA.

Awareness

Through participating in the GLA, participants gained a heightened awareness of the experiences of WiE through encountering multiple perspectives and hearing others' voices, which some women indicated allowed them to gain new perspectives. Many respondents wrote that they enjoyed hearing other women's perspectives, with one woman sharing that it was "good to hear from other women." Another participant shared, "I liked seeing everyone's perspective." Hearing others' stories and perspectives also led to learning and gaining new perspectives as a result. As a participant explained, "[The GLA] helped me see how other females perceive their experiences in engineering." Another woman shared that "[the GLA] allowed me to think about the challenges that are never actually spoken." Comments such as "I think I have learned a lot about other women's experiences" and "it made me a lot more aware of what others feel" were common. Becoming more aware of their own experiences and others' as a result of shared experiences and understanding was a common thread throughout the reflections.

Connection

The GLA process also provided connection for the participants. Participating in the GLA led many of the participants to feel "not alone" but, rather, supported, which led to feelings of confidence. Several participants shared the phrase "I am not alone" in their reflection responses. In fact, nine respondents shared that participating in the GLA made them feel as if they were "not alone" in their thoughts, feelings, and experiences as WiE. As one woman stated, "[Participating in the GLA] opened my eyes to how I am not alone on this path to becoming an engineer." Another participant indicated that engaging in the GLA helped her realize, "I'm not the only one who feels the way I do." Furthermore, the women felt supported throughout the process, as the GLA as a whole was a "very supportive environment." As a result of feeling not alone but supported in the process, many participants "left feeling more confident." Ultimately, being a part of the GLA's participatory process led to decreasing feelings of loneliness and increasing connection with others and internal confidence.

Voice

The third core theme that arose was that of "voice." Participants sensed that their voices were heard and felt validated as a result. Many women made comments such as "I feel like my voice is being heard." Another participant wrote, "It was fun to know that someone genuinely cares about my opinion." Feeling heard led to feelings of validation, with one woman responding that the GLA process "showed me that my concerns have validation." Another participant shared that participating in the GLA "made me feel that my experience isn't just me being too sensitive about these things." Many participants responded that they felt validated in their feelings because they could see that so many other women in engineering felt the same way or had similar experiences. Furthermore, the women felt engaged throughout the process as a result of feeling heard. Feeling their voice was heard and validated made the process feel "engaging" and "interactive." Participating in the GLA as a whole led to the women feeling not only heard but also validated in a process that they found engaging.

Unchanged

While many participants felt heightened awareness, connection, and engagement from the GLA, several women indicated that their perspectives remained unchanged and that they did not gain anything significant from participating in the GLA. Although most women responded that they were impacted in some way by the GLA, some of the responses to the question, "*How did participating in the GLA change your perspective?*" were, "It didn't." One woman responded "N/A," and another stated, "Not very influenced." Ultimately, although most of the women felt they were impacted by the GLA, a vocal few did not feel they gained much from the GLA in terms of perspective, connection, or engagement.

Discussion

Engineering continues to be noted as the "last gender-equitable" profession—that is, the last to *become* gender equitable—in the United States (Pierrakos et al., 2009). In the engineering field, women tend to feel isolated and unsupported (Cech, 2015), particularly in higher education settings (Tonso, 2006). Given this context, the utilization of participatory methods such as GLA gives researchers the opportunity to both study the problem at hand and empower and encourage WiE participants. The current study demonstrates that the GLA experience provides WiE with a platform for sharing their experiences, engaging with other like-minded women, and feeling supported and valued.

Participants felt empowered to be change agents through the process of the GLA. Implementing future participatory methods with this population could continue to empower women to address the issues in their own communities while also raising awareness about WiE experiences overall. Conducting participatory research with marginalized groups has been found to be empowering for

participants and effective in producing measurable outcomes that improve the experiences of these groups (Goodhart et al., 2006; Gordon & Edwards, 2012; Lazarus et al., 2014; Martin et al., 2016; McIntyre, 2003; Richardson et al., 2017; Vaughn et al., 2017; Williams & Lykes, 2003). The current study not only addresses the experiences of WiE but also utilizes GLA as a process to begin to improve these experiences. For example, while WiE typically feel isolated, participating in the GLA helped combat these feelings and made several participants feel "not alone" and that their voice was heard.

Some participants shared that their perspective had not been altered by participating in the GLA process, which is not surprising given what is known about the culture of engineering. The engineering culture deems topics such as gender equality as off limits, as this falls within the realm of the social and subjective, which go against engineering's commitment to individualism and empirical science (Seron et al., 2016). Creating an environment in which individuals do not challenge or discuss inequalities within the profession is central to engineering culture. Due to the culture creating a taboo of raising concerns about gender equality, we find women becoming enculturated to not raise questions, as discussing these types of issues goes against what it means to be an engineer.

To summarize, the GLA process aided several participants in terms of empowerment, awareness, and connection. However, some women indicated their perspectives and feelings remained unchanged, which could be explained by the culture of engineering itself as an obstacle. Future participatory research could address this through exploring the culture of engineering itself. This could be accomplished by engaging multiple stakeholders, such as administrators, faculty, staff, and undergraduate engineering students, through participatory research processes.

Dr. Batsheva (Sheva) Guy is a diversity, equity, and inclusion professional; participatory action researcher; and program developer. She is the current Program Director of Strategic Initiatives for the Office of Inclusive Excellence and Community Engagement in the College of Engineering and Applied Sciences at the University of Cincinnati. Dr. Guy's professional interests revolve around utilizing participatory and community-based methods to engage and support racially and ethnically diverse groups and women in the workplace. Her research interests include equity and inclusion in higher education, particularly using feminist participatory methods to promote the retention of women students and faculty in STEM fields through program development.

Dr. Brittany Arthur currently serves as an associate professor at the University of Cincinnati in the Division of Experience-Based Learning and Career Education, where she oversees cooperative education (co-op) experiences for engineering students. Dr. Arthur prides herself on being a participatory action researcher, specifically using a feminist approach to ensure the voices of the marginalized are heard. Her research focuses on exploring co-op experiences of women engineering students using feminist participatory action research. Dr. Arthur is passionate about participatory methods, more specifically utilizing these approaches to strengthen the conversation around equity and inclusion.

References

Adedokun, O. A., Bessenbacher, A. B., Parker, L. C., Kirkham, L. L., & Burgess, W. D. (2013). Research skills and STEM undergraduate research students' aspirations for research careers: Mediating effects of research self-efficacy. *Journal of Research in Science Teaching, 50*(8), 940–951.

Arthur, B., & Guy, B. (2020). "No, I'm not the secretary": Using participatory methods to explore women engineering students' experiences on co-op. *International Journal of Work-Integrated Learning*, *21*(3), 211.

Bernold, L. E., Spurlin, J. E., & Anson, C. M. (2007). Understanding our students: A longitudinal-study of success and failure in engineering with implications for increased retention. *Journal of Engineering Education*, *96*(3), 263–274.

Bureau of Labor Statistics (BLS). (2011). *Labor Force Statistics from the Current Population Survey*.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Cech, E. (2015). Engineers and engineeresses? Self-conceptions and the development of gendered professional identities. *Sociological Perspectives*, *58*(1), 56–77.

Cole, D., & Espinoza, A. (2011). The postbaccalaureate goals of college women in STEM. *New Directions for Institutional Research*, *2011*(152), 51–58.

Espinosa, L. L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review, 81*(2), 209–240, 388.

Faulkner, W. (2009). Doing gender in engineering workplace cultures. II. Gender in/authenticity and the in/visibility paradox. *Engineering Studies*, *1*(3), 169–189.

Goodhart, F. W., Hsu, J., Baek, J. H., Coleman, A. L., Maresca, F. M., & Miller, M. B. (2006). A view through a different lens: Photovoice as a tool for student advocacy. *Journal of American College Health*, *55*(1), 53–56.

Gordon, S. M., & Edwards, J. L. (2012). Enhancing student research through a virtual participatory action research project: Student benefits and administrative challenges. *Action Research*, 1476750312439900.

Guy, B. R. (2017). Movers, shakers, & everyone in between: Faculty personas surrounding active learning in the undergraduate STEM classroom. *i.e.: inquiry in education*, *9*(2), 6.

Guy, B. (2020). "Participatory approach to program evaluation: Learning from students and faculty to improve training in biomedical informatics." *i.e.: inquiry in education* (in press).

Guy, B., & Boards, A. (2019). A seat at the table: Exploring the experiences of underrepresented minority women in STEM graduate programs. *Journal of Prevention & Intervention in the Community*, 1–12.

Haas, M., Koeszegi, S. T., and Zedlacher, E. (2016). Breaking patterns? How female scientists negotiate their token role in their life stories. *Gender, Work, and Organization, 23*(4), 397–413.

Heilbronner, N. N. (2012). The STEM pathway for women: What has changed? *Gifted Child Quarterly, 57*(1), 39–53.

Jackson, S. F. (2008). A participatory group process to analyze qualitative data. *Progress in Community Health Partnerships: Research, Education, and Action*, *2*(2), 161–170.

Jones, M. T., Barlow, A. E. L., & Villarejo, M. (2010). Importance of undergraduate research for minority persistence and achievement in biology. *The Journal of Higher Education, 81*(1), 82–115.

Kardash, C. M. (2000). Evaluation of undergraduate research experience: Perceptions of undergraduate interns and their faculty mentors. *Journal of Educational Psychology*, *92*(1), 191.

Lazarus, L., Shaw, A., LeBlanc, S., Martin, A., Marshall, Z., Weersink, K., Lin, D., Mandryk, K., & Tyndall, M. W. (2014). Establishing a community-based participatory research partnership among people who use drugs in Ottawa: The PROUD cohort study. *Harm Reduction Journal*, *11*(1), 26.

Martin, R. E., Turner, R., Howett, L., Howard, T., Hanberg, D., Buxton, J. A., Moravan, V., & Oliffe, J. L. (2016). Twelve committed men: The feasibility of a community-based participatory HIV-prevention intervention within a Canadian men's correctional facility. *Global Health Promotion*, 1757975916659045.

McIntyre, A. (2003). Through the eyes of women: Photovoice and participatory research as tools for reimagining place. *Gender, Place and Culture: A Journal of Feminist Geography*, *10*(1), 47–66.

National Research Council. (2007). *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, DC: The National Academies Press.

National Science Foundation. (2018). Science & engineering labor force. In *Science & engineering indicators 2018*.

Pierrakos, O., Beam, T. K., Constantz, J., Johri, A., & Anderson, R. (2009). On the development of a professional identity: Engineering persisters vs engineering switchers. In *39th IEEE Frontiers in Education Conference* (pp. 1–6). IEEE.

Richardson, C. G., Buxton, J. A., Pellatt, K., Mitchell, K., Durante, S. E., & Mathias, S. (2017). Naloxone and the Inner City Youth Experience (NICYE): A community-based participatory research study examining young people's perceptions of the BC take home naloxone program. *Harm Reduction Journal*, *14*(1), 34.

Rosenthal, L., London, B., Levy, S. R., & Lobel, M. (2011). The roles of perceived identity compatibility and social support for women in a single-sex STEM program at a co-educational university. *Sex Roles*, *65*(9–10), 725–736.

Saucerman, J., & Vasquez, K. (2014). Psychological barriers to STEM participation for women over the course of development. *Adultspan Journal*, *13*(1), 46–64.

Seron, C., Silbey, S. S., Cech, E., & Rubineau, B. (2016). Persistence is cultural: Professional socialization and the reproduction of sex segregation. *Work & Occupations, 43*(2), 178–214.

Thoman, D. B., Arizaga, J. A., Smith, J. L., Story, T. S., & Soncuya, G. (2014). The grass is greener in non-science, technology, engineering, and math classes: Examining the role of competing belonging to undergraduate women's vulnerability to being pulled away from science. *Psychology of Women Quarterly*, *38*(2), 246–258.

Tonso, K.L. (2006) Student engineers and engineer identity: Campus engineer identities as figured world. *Cultural Studies of Science Education, 1*(2), 273–307.

Vaughn, L. M., & DeJonckheere, M. (2019). Methodological progress note: Group level assessment. *Journal of Hospital Medicine*, *14*, E1–E3.

Vaughn, L. M., Jacquez, F., Zhen-Duan, J., Graham, C., Marschner, D., Peralta, J., Garcia, H., Recino, M., Maya, M., Maya, E., Cabrera, M., & Ley, I. (2017). Latinos unidos por la salud: The process of developing an immigrant community research team. *Collaborations: A Journal of Community-Based Research and Practice*, *1*(1), 2.

Vaughn, L. M., & Lohmueller, M. (2014). Calling all stakeholders: Group-level assessment (GLA)—A qualitative and participatory method for large groups. *Evaluation Review*, *38*(4), 336–355.

Williams, J., & Lykes, M. B. (2003). Bridging theory and practice: Using reflexive cycles in feminist participatory action research. *Feminism & Psychology*, *13*(3), 287–294.

Wilson, R. E., & Kittleson J. (2013). Science as a classed and gendered endeavor: Persistence of two white female first-generation college students within an undergraduate science context. *Journal of Research in Science Teaching*, *50*(7), 802–825.