

Practical Utilization of Photovoice in a Multi-disciplinary Engineering Program

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Motivation, Background, and Theoretical Frameworks

Photovoice is a participatory action research methodology that uses participant-driven interviews [1] to reframe marginalized voices, with the goal of challenging structures to bring about change [2]. Photovoice engages participants as knowledge co-creators, providing a platform for participant researchers to engage in the data collection and analysis process through the discussions of photographs they have chosen to share that reflect their experience [3]. Originating as a photo elicitation technique within the health sciences [3], it has been expanded and applied to engineering contexts [e.g., 4,5]. The authors utilized photovoice to explore the experiences of multiple cohorts of students participating in a multidisciplinary engineering professional development program who face academic disruption due to the COVID-19 pandemic. Undergraduate and graduate student scholars in either automotive or mechanical engineering programs engage in professional development and community building activities to further develop future engineers equipped to address complex challenges. The student cohort is located at multiple campuses across the state and are at many different stages of their academic career, making photovoice a useful methodology as students are not sharing the same experiences with engineering nor with the program.

The program is designed to spark interest and support workforce development and retention of mechanical and automotive engineers across the state. The theories that will be used to underpin the stories brought to the surface by photovoice include the hidden curriculum [6] and social capital and engineering identity [7]. Hidden curriculum is the understanding that there are critical parts of a system that are often hidden to those entering it. Often this information is only learned from someone else who has been within the system for some time, which could mean that the student who is new could be learning the critical information after it would be most useful. The second theory that will be utilized is social capital with engineering identity. This theory outlines the understanding that having a network within your field provides structure and support through the development of professional identity. This work describes how photovoice was implemented in this context and how the stories shared by our participants describe the multitude of experiences of future engineers.

Methods

This program utilizes photovoice interview methodology to provide in-depth, student-driven data collection. Due to the individualized experiences of the participants within this program, photovoice methodology provides a way to curate the interview to the participants' experiences within the semester. In this method, students are asked to take a specific number of photographs that are representative of their experience that semester as an engineering student within this program. All students within the program were asked to take photographs and complete a photovoice interview. At the interview, they are asked to select a subset of those photographs and talk about each of these photographs during the interview. Example photographs are shown in Appendix A. Within the 2024-2025 academic year the students were asked to collect at least ten photographs prior to their interview that they thought would be representative of their experience that semester. The students were asked to narrow the ten photos down to five that

they wanted to talk about at the interview. For the five photos they were then asked to describe their photographs, how the photo is reflective of their life, and then how the photographs provide insight into how to improve life and society.

Phase 1 was based on the photovoice methodology and captured students' descriptions, reflections, and insights to their chosen photos. Phase 2 was a more traditional semi-structured interview focused on evaluating the program's effectiveness and student motivation. The interview protocol underwent revisions based on the first two semesters of interviews of the fellows. While wanting to maintain the ability to have the fellows actively participate in data collection through photovoice, the research team decided to expand upon the semi-structured questions within the interview protocol for the 2025-2026 academic year. This was done to balance the student driven nature of photovoice with the critical program evaluation that only the fellows could provide. Data collection for this project included the photos that the participants took as well as the two-phase interview transcript. The interviews for both the 2024-2025 and 2025-2026 academic years were audio recorded, transcribed, and the transcripts were reviewed to correct errors in the automated transcription process. Data was analyzed through MAXQDA, utilizing thematic qualitative coding methods. Each semester, each transcript was coded individually using first a cycle of applying descriptive codes. The transcripts were open coded for emergent themes. During the second cycle, the codes were organized thematically and recurrent codes or themes were noted [8]. The first author discussed coding frameworks and findings with the second author, who provided critical input on codes and thematic groupings before the final analysis was completed. This work was reviewed and determined to be exempt by Clemson's IRB (IRB2022-0546).

Results

In the first cohort, there were a total six students with three undergraduates and three graduate students. The table below describes the students within each cohort.

	Graduate Student	Undergraduate Student
Cohort 1	3	3
Cohort 2	4	3

Table 1: The number of students within each cohort. The three undergraduate students that were in Cohort 1 continued into Cohort 2. Two of the graduate students within Cohort 1 continued into Cohort 2 and third graduated; two of the graduate students in Cohort 2 were new to the program

Three overarching themes emerged from the Fall 2025 interviews: Financial Stability as a Catalyst, Structure vs. Agency, and The Hybrid Paradox. Financial Stability as a Catalyst shows how the scholarship doesn't just pay bills; it buys time for students to engage in high-impact practices that are critical to the development of an automotive and mechanical engineering professional identity or future professional pursuits (e.g., racing clubs or research). Students highlighted the ability to feel less stressed and participate in opportunities because they can as a result of the financial support. This is shown in Photo three, four, and five in Appendix A. These are all photos of extracurricular events that students participated in throughout the semester. Jerry states below how the scholarship provided by this program reduces stress: “...*lifting the financial burden, to some extent of school has lowered my stress level overall.*” - Jerry, Fall

2025. Ruffles elaborate on this idea by stating that the opportunity to be a part of an extracurricular engineering team is because he can afford to go to this institution, which is supported through this program. He says: *"I would say this would show that I've, due to what has been provided, I've been able to work with the team more effectively from a few of the things I've attended, but also I've been able to do something like this because I could afford to go here."* - Ruffles, Fall 2025

Structure vs. Agency describes how students appreciate the "nudge" of the program to do things they "wouldn't do otherwise" (like the photovoice interviews or professional development events). Many of the students realize these events are available to them outside of the program, but that the individual development plan and the program itself broadly provide structure to bring some of these events and skills to the forefront of their minds and plans over the course of the semester. Many also acknowledge that if they hadn't been in this program they wouldn't have attended professional development events that provided knowledge to them that they probably wouldn't have gained elsewhere. The program exposes the hidden curriculum that is present in automotive and mechanical engineering and encourages students to engage in professional development to build and develop skills. David King felt as though he was stalled in the research process due to the COVID-19 pandemic. He outlines below how the individual development plan provided the structure to jumpstart that process again with achievable goals: *"It [the program] really picked up on the fact one of the things that has impacted me is that COVID really, really put a hard break on all the work I was doing, and I'm having a hard time getting back into it, so this association is, really helping me with that, getting back into gear...to overcome the stall from COVID. Yes, it's been quite the catalyst to go get the wheels a-rolling again back on to a slightly stalled process."* - David King, Fall 2025. David King later talks about how they conducted informational and informal interviews of people who are currently working in careers that they would want to work in. He says: *"I definitely would not have even thought about this. I'd heard the term before, but I'd never thought about it as a tool for refining the process and the activities I need to be doing to get into a position that meshes with my personality. Yes, to use the informational reviews as an example, really helped me focus on what I know, or where the opportunities are, or what I need to know, and where the opportunities are."* - David King, Fall 2025. Purple offers a different perspective by saying *"I mean, there's nothing stopping me from doing it before but having that structure and that sort of impetus to engage with them [professional development]. It has been a big help. Because it's easy to not engage with it when there's, you know, so much else to do and to keep up with."* - Purple, Fall 2025. This quote highlights how this program adds the structure that is lacking otherwise within the students' life.

The Hybrid Paradox shows how students love the flexibility of virtual meetings, but they feel a "disheartening" lack of connection when digital prompts go unanswered. Many students who have variable schedules due to family obligations or work outside of school emphasize the ease of the hybrid modality, but many also expressed the excitement over the immersion day which will be the first time that program participants will meet in person. Additionally, most students felt like there was more of a community within the program this semester, however wished that the online group chats were more active despite realizing that they wanted to be more active themselves in the next semester. David King outlines the benefit of having a virtual community in the quote below: *"The virtual nature, really helps, again, with the spread-out nature of the [program name], cohorts, but as well as my unpredictable life, and I don't know, vacation scheduling of the wife means I can still connect virtually"* - David King, Fall 2025. These three

themes highlight the overarching ideas that span across the experiences that mechanical and automotive engineering students have had within the program.

Significance and Broader Impact

The significance of this work can extend beyond this program. Examining students' realizations of the "unwritten rules" of STEM and the lack of clarity or structure regarding developing the skills, knowledge, and networks to navigate it points to the hidden curriculum in the academic world as well as industry. The professional development events as well as the individual development plan prove to be places where students were able to find structure for navigating the hidden curriculum. This program is a translator of this hidden curriculum and a catalyst for navigating what has been illuminated. Not only were the professional development sessions helpful for navigating hidden curriculum, but they provided a scaffold for students to develop their social capital. This was shown when students performed informational interviews with faculty members as well as making connections through professional development events. This supports students' social capital within their engineering field. This social capital aids students throughout their academic and professional careers. These results provide insight into how this program is supporting engineering students. Looking towards the future, we aim to continue to shine a light on and provide a bridge over the hidden curriculum within STEM through professional development and the individual development plan. In addition, the program aims to continue to create additional professional connections to support students' social capital. The program is planning an immersion day where all students will meet in person and participate in professional development. This will support their social capital going forward. Overall, students have reported benefiting from the efforts and this program will continue to strive to support students within engineering spaces.

Future Work

Data collection continues through Spring 2026 with the current cohort, enabling cross-semester and cross-cohort thematic comparisons with additional interview data. These comparisons will allow the research team to examine the consistency and transferability of the three themes identified in the Fall 2025 interviews, i.e., Financial Stability as a Catalyst, Structure vs. Agency, and The Hybrid Paradox, and to determine when data reaches saturation. The program's upcoming in-person immersion day offers a natural point to study how community-building and social capital development shift when students meet face-to-face for the first time; photovoice will be part of capturing that experience. Finally, while the current analysis centers on participants' verbal reflections, future work will examine whether recurring visual patterns exist across the photographs themselves, such as shared objects, settings, or visual motifs, as these may surface aspects of students' experiences that spoken reflection alone does not capture. Acknowledgments to NSF EPSCoR RII-BEC for funding this work.

References

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Appendix A:

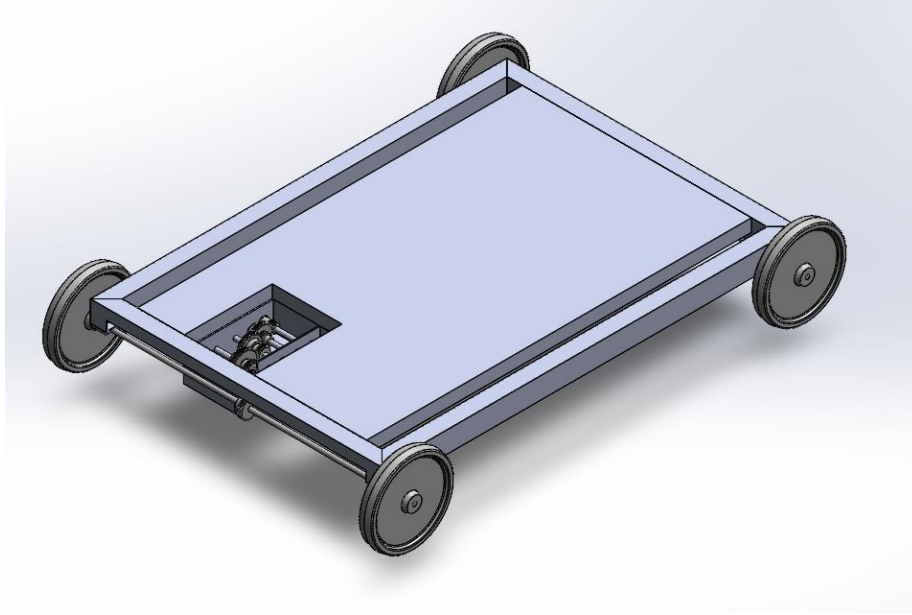


Photo Example 1 from Photovoice Interviews: This photograph shows a project that a participant was working on that semester.



Photo Example 2 from Photovoice Interviews: This photograph shows a 3D printer project that a participant was working on that semester.

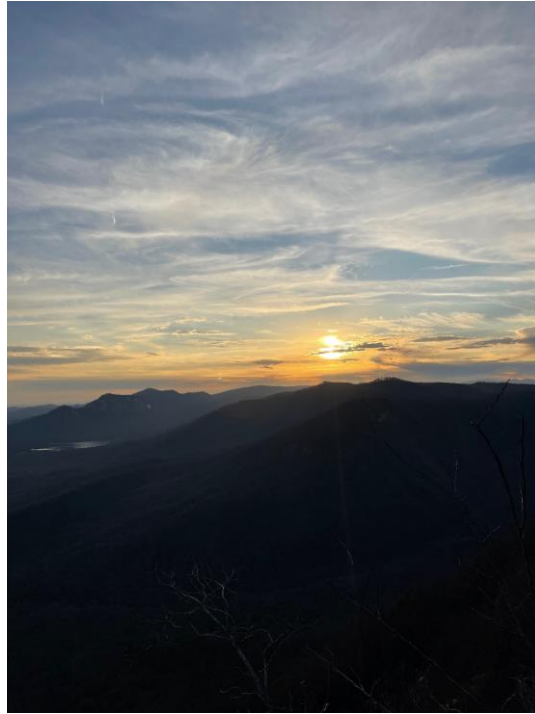


Photo Example 3 from Photovoice Interviews: This photograph shows a hike that a student did in that semester as an example of time they were taking away from academics.



Photo Example 4 from Photovoice Interviews: This photograph shows a car club, extracurricular to their academics, that the participant was a part of that semester.

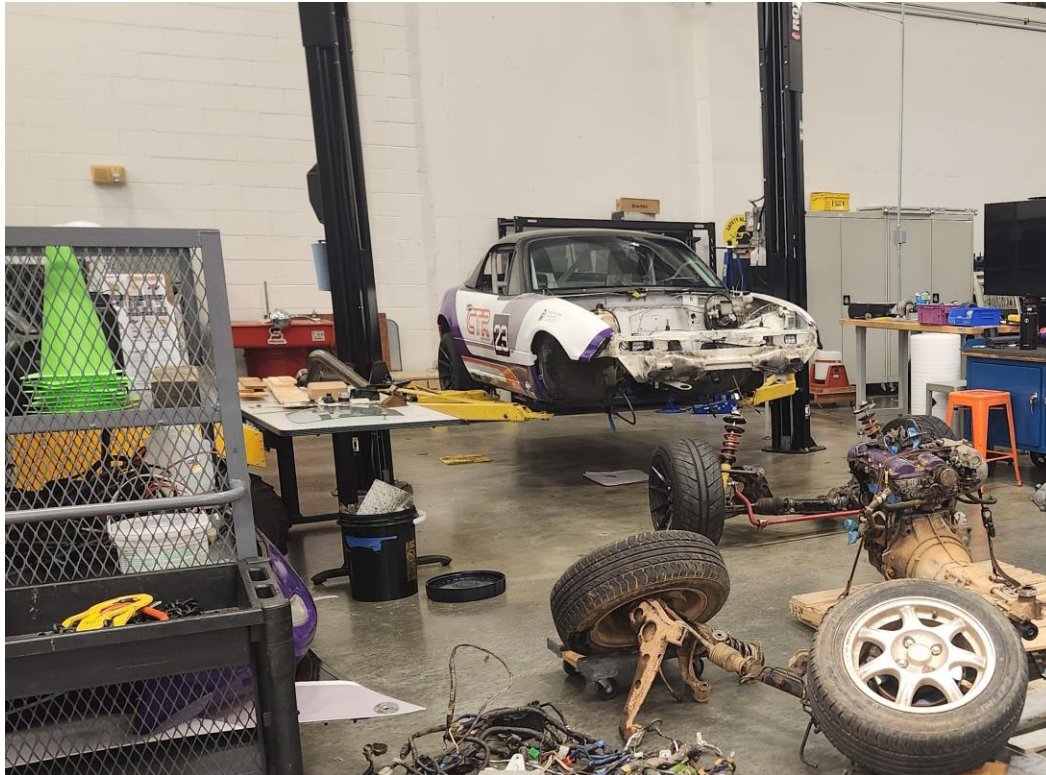


Photo Example 5 from Photovoice Interviews: This photograph shows a car that the participant was working on within one of their courses that semester.