Article

Volume 19 (2026), pp. 219-216
American Journal of STEM Education: Issues and Perspectives
eISSN 30.3-1190| Print ISSN: 3069-0072
https://doi.org/10.32674/ew3wcy76

Shifting STEM Pedagogy Through Student Voice: Faculty Reflections on Focus Group Data

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ABSTRACT

Improving undergraduate STEM education requires sustained attention to students' lived experiences and the ways faculty respond to them. This qualitative study examines how faculty in computer science and mathematics engaged with anonymized student focus group data from students in an NSF S-STEM program. We took the opportunity to reflect on and adjust our teaching, mentoring, and advising practices. The focus group data revealed themes related to academic pacing, mentoring relationships, peer support, and the perceived disconnect of general education requirements, which faculty explored through structured, collaborative reflection. Findings illustrate how centering student voice can prompt meaningful pedagogical and programmatic shifts, highlighting a reflective, interdisciplinary, and reproducible model for fostering more responsive and inclusive STEM learning environments.

Keywords: computer science, focus groups, mathematics, pedagogy, STEM education

INTRODUCTION

Improving undergraduate STEM education requires more than revising syllabi or adopting new technologies—it demands a deeper understanding of students' lived experiences. In this study, we explore how STEM faculty at a regional university engaged with student focus group data to reflect on and improve their teaching and mentoring practices. The project was part of a broader NSF-funded S-STEM initiative aimed at supporting underrepresented students in computer science and mathematics.

Our S-STEM included structured supports to improve retention among underrepresented STEM students, a need indicated by Moreno and Muller (1999). Similarly, undergraduate STEM students learn study habits from each other (Alcock et al., 2020), and research pointing to students' experiences in STEM programs (e.g., Jett, 2019; Adiredja, 2019) supports our motivation to create a space for students to unpack their learning experiences in structured ways. We employed the use of focus groups (Liamputtong, 2011), where undergraduates in our program met in-person with an educational researcher outside the STEM disciplines, creating space for open and honest dialogue. As a support for students, this allowed them to exchange experiences and share opportunities and challenges to move successfully through the program. Students discussed their academic transitions, mentoring relationships, and classroom and overall college experiences.

LITERATURE REVIEW

This approach was grounded in a growing body of literature emphasizing the importance of student voice in educational reform. While student feedback is often collected through course evaluations, these tools rarely capture the complexity of students' academic and social journeys. Cook-Sather (2006) argues that authentic student voice can reshape institutional practices, and Brownell & Tanner (2012) highlight the barriers STEM faculty face in adopting student-centered pedagogies.

Our project builds on these insights, offering a model for interdisciplinary collaboration and reflective practice.

Our project continues to explore pathways of success for marginalized student populations within STEM education, similar to Ouedraogo-Thomas & Miles's (2026) focus on culturally relevant pedagogy and BlackCrit at the secondary STEM level and Jackson, Revelle, & Maiden's (2026) work in describing STEM mental health at an urban Historically Black College/University (HBCU). Balancing these perspectives on pedagogies for underrepresented student populations, our work also draws on the student-centered approaches found in Golegou, Wallace, & Peppas (2026) work.

RESEARCH METHOD

The methodology was qualitative and exploratory, designed to foster faculty reflection rather than test a specific hypothesis. Participants included faculty from mathematics and computer science, all of whom were involved in mentoring S-STEM scholars. After reviewing the anonymized transcripts, faculty engaged in structured reflection activities, both individually and in small groups. These reflections focused on identifying areas of alignment and dissonance between student experiences and faculty intentions. Beyond supporting students' particular growth, our project team considered how the focus group data (recorded conversations that were then transcribed and anonymized) could lead to innovations for faculty teaching in the program. We began with a simple but powerful question: What impacts on STEM teaching and learning occur when faculty reflect on student experiences? The anonymized focus group data were shared with STEM faculty who had completed ethics training in social science research, and as a team, we followed a careful protocol to reflect on this data to draw conclusions impacting our teaching.

Over the course of the project, approximately 15 computer science and mathematics majors participated in recurring focus group sessions held once or twice per semester. These meetings provided a longitudinal view of students' evolving experiences and challenges. After the transcripts were anonymized, faculty engaged with the data through structured reflection prompts and collaborative discussions. This process allowed faculty to consider student perspectives in a way that was both ethical and deeply personal.

RESULTS

Several key themes emerged from the student data. Students described feeling overwhelmed by assignment pacing, particularly during high-stress periods like finals week. They expressed a desire for more consistent mentoring and clearer communication about expectations. Many valued instructors made intentional

efforts to connect with them personally, beyond delivering content. Students also voiced frustration with general education requirements, often perceiving them as disconnected from their major coursework.

This feedback prompted faculty to reconsider how they advise students and how they frame the purpose of general education in STEM pathways. For example, one faculty member revised the timing of major assignments to better align with students' capacity during peak stress periods. Another initiated department-wide conversations about advisement practices and the importance of soliciting student feedback more frequently. These shifts reflect a broader move toward student-centered teaching and leadership in STEM. Another recurring theme was the importance of peer support. Students frequently mentioned the value of learning from classmates who had previously taken the same courses. They appreciated alternative explanations and informal guidance, which sometimes felt more accessible than faculty instruction. This insight led faculty to explore ways to foster peer-to-peer learning, such as discussion boards, group work, course assistants, and structured mentoring among scholars.

DISCUSSION & CONCLUSION

To further illuminate the transformational change that occurs when STEM faculty engage with focus group data, the co-authors—STEM faculty who engaged directly with the anonymized student focus transcriptions—now provide personal reflections on how the experience influenced their teaching and leadership practices. These reflections offer insight into the kinds of shifts that can occur when faculty take time to listen, reflect, and respond to student voice in meaningful ways. Some of these reflections point to an unfortunate event that occurred during finals week of the first semester for these students. The scholarship program placed the majority of students into a living-learning community, meaning their dormitory rooms were located together on one floor of one building. In the middle of finals week, a fire took place overnight in their dormitory, and all students were evacuated and lost sleep. Some had final exams the very next morning, while others sustained longer outcomes given the smoke damage to personal living spaces that occurred.

Brian Kronenthal – Mathematics Faculty and Department Chair Reflection

Reading the student focus group data made me reflect on the idea that, despite the visibility and accessibility of faculty to our scholars, they don't always see faculty as a resource in moments of crisis. Indeed, I reached out to offer support after the dormitory fire, but received very few responses. This has prompted me to consider how we might build stronger connections with students beyond advising. For example, we could formalize faculty mentorship roles or create structured peer

mentorship among scholars, rather than relying on organic relationships. I also think we need to be more proactive in reminding students about tutoring resources and helping them select general education courses that align with their major goals. Finally, the housing situation may need reevaluation, especially if proximity doesn't translate to meaningful engagement. These reflections have challenged me to think more intentionally about how we support students both academically and personally.

Yun Lu – Mathematics Faculty Reflection

Reading the student focus group data gave me new insight into the cohort's experiences beyond the classroom. The dormitory fire during finals week made me recognize more fully how external events can significantly affect student performance, reinforcing for me the importance of being attentive and responsive as an instructor. I also learned how much students value peer support, not just for academic help but for navigating course expectations and sharing strategies. This has encouraged me to think more intentionally about building peer connections in my courses. I also noticed students' confusion around general education requirements and their desire for more consistency in course design. As a result, I've begun aligning my course materials, assignments, and assessments more closely and have added opportunities for peer interaction through discussion boards and group work. I'm also making a more consistent effort to encourage students to use office hours and tutoring services, recognizing that repeated engagement often leads to better outcomes.

Lisa Frye – Computer Science Faculty and Department Chair Reflection

The student focus group data revealed several unexpected insights about our cohort. I was surprised by how some students blamed faculty for needing to retake courses and how unpopular the living-learning community (LLC) seemed to be. I had assumed these students would be more proactive and mature in their academic habits, but the data showed they often struggled with time management and understanding the shift from high school to college expectations. These reflections have prompted me to consider changes in both program structure and my own teaching. For example, I now space out assignments more intentionally and avoid scheduling major projects alongside final exams. I also believe the program could better support students through required advisor meetings, more frequent check-ins, and peer mentoring. Helping students understand the purpose of general education courses and how they connect to their major could also improve engagement and course selection. This last reflection led me to create a list of potential General Education courses for students to consider that better align with the computer science programs.

These reflections underscore the transformative potential of student voice when paired with faculty willingness to listen and adapt. The interdisciplinary nature of the project, bringing together STEM faculty and an education researcher, was key to its success. It created a space where faculty could engage with student perspectives in a structured, ethical, and supportive environment. While the study was limited to a single institution and a small group of faculty, its implications are broad. It suggests that even modest efforts to center student voice can lead to meaningful changes in teaching and mentoring. Future research might explore how similar models can be scaled across institutions or integrated into faculty development programs. Additionally, more longitudinal data could help track how faculty changes impact student outcomes over time.

In conclusion, this research brief highlights the value of reflective practice informed by student experience. By listening to students and engaging with their feedback via focus groups, STEM faculty can create more inclusive, responsive, and effective learning environments. The process is not always comfortable, but it is essential for continuous improvement in STEM education.

Acknowledgments

This project was supported by NSF Grant Award #029357. The authors thank the student participants and institutional partners for their contributions.

AI Tools Statement

The authors used generative AI tools (CoPilot) to assist with language editing and formatting during the manuscript preparation process. These tools were partially used to strengthen clarity and consistency throughout the manuscript. All ideas, interpretations, and findings are the original work of the authors.

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