BOARD # 62: Leverageing Relationships with Community Organizations to Target Audiences

Emily Wonnacott-Stanley, Southern Illinois University Edwardsville

Emily earned a bachelor of science in biology from Southern Illinois University Edwardsville and a Master of Science in zoology from Southern Illinois University Carbondale. She is currently working on her second Master of Education through SIUE's innovative Diversity and Equity in Education (DEQ) program. She has 20 years of experience in informal education and most recently was responsible for the STEM initiative and robotics programs for Girl Scouts in southern Illinois. At the SIUE STEM Center, Emily focuses on building collaboration with community groups to create awareness and interest in STEM for all audiences.

Leveraging Relationships with Community Organizations to Target Audiences

Leveraging community partnerships is a powerful strategy to increase diversity in STEM (Science, Technology, Engineering and Math) education opportunities, as it allows for the pooling of resources, expertise, and networks to create more inclusive programs. By working together with community organizations and businesses, higher education institutions can expand access to underrepresented groups in STEM, such as women, minorities, and economically disadvantaged students. One key benefit of these partnerships is that they enable the creation of programs that are tailored to the specific needs of a community or research project. In the case of the subject institution, we were able to use our partnership with a regional girl serving organization and their well-established extension and outreach efforts to offer our engineering curriculum specifically to Black Indigenous People of Color (BIPOC) girls in areas with low performing schools and high poverty rates.

Our partner was able to secure community-based funding to provide materials and staff for a four-week series on careers in engineering for girls in the two local school districts in southern Illinois. Their staff are not trained on offering STEM curriculum and creating assessments. The staff at the university were able to develop an in-class series of activities highlighting careers in engineering for girls in k-7th grade.

The outreach program made a significant impact on nearly 900 girls in low-income school districts, providing hands-on exposure to engineering careers and helping to demystify STEM fields. By introducing students to different aspects of engineering each week, the program built confidence, curiosity, and critical thinking skills. Girls walked away with practical knowledge about technologies they encounter daily and an understanding of how engineering shapes the world around them.

Moreover, the program fostered empathy in engineering, encouraging students to consider how designs and technologies meet human needs. This emphasis on empathy empowered students to see themselves as problem-solvers capable of making a difference in their communities.

For many, the program was their first introduction to engineering, sparking new career aspirations and showing them that STEM is not only accessible but also an exciting avenue for creativity and innovation.

A Brief Outline of the Activities

Week 1: Electrical Circuits and Electrical Engineering

Activity: Students built simple circuits using batteries, wires, and light bulbs.

Purpose: This activity introduced the basics of electricity and the role of electrical engineers in designing the systems that power our modern lives. It helped students understand concepts like conductivity and energy flow, while showcasing the importance of problem-solving and precision in engineering.

Week 2: Sound and Acoustics

Activity: Students experimented with sound waves using tuning forks, cups, and string telephones. Students used sound meters to test what materials dampened sound.

Purpose: These demonstrations helped explain how sound travels and the science behind acoustics. The week highlighted careers in sound engineering, including designing concert halls, improving hearing aids, and creating recording technologies.

Week 3: Light, Aerospace Design, and UV Safety

Activity: Students explored light refraction and UV protection by creating sun-safe designs for pilots and passengers.

Purpose: This activity introduced students to different concepts in aerospace engineering with a focus on safety and innovation. They learned how engineers protect people from environmental challenges like UV radiation while considering visibility and functionality.

Week 4: Robotics, Programming, and Automation

Activity: Students programmed basic robotics kits to perform simple tasks.

Purpose: This hands-on activity demystified coding and introduced automation as a growing field. Students gained insight into the teamwork and creativity involved in designing systems that improve efficiency and solve real-world challenges.

Implementation Strategy

The organization we partnered with has a long running program that happens during the school day for some schools and after school for others. This was an important trait that helps with retention of the girls in the program, since they are already at school and transportation is already planned for by their adult. Adapting to their existing schedule and module meant the girls were in a mindset for learning and being with their peers.

We implemented with the grade levels kindergarten through 7th grade which is an important factor in the STEM career/degree pipeline, as underrepresentation starts early (Finn et al 2023, Fry et al. 2021). Many universities focus outreach and engagement on high school students to increase enrollment potential and do not address the need in their target communities for engagement at a younger level. Our operational model is a "program on demand" style, with planned outreach experiences open to the public each semester. With our general outreach experiences, we often see students who are children of faculty and staff at our university. By partnering with an existing organization that specifically serves girls and adapting to their existing program model in lower income school districts we were able to target our programming efforts to an audience who is currently underrepresented in our engineering degree enrollment numbers.

Future plans for this curriculum include refinement and creating kits for the organization's staff to utilize in other schools. In the long term, our center would like to incorporate more University student groups to lead activities and talk to students. We have also developed a training for the staff at this organization, however due to frequent turnover it has not been as successful as we would have wanted.

In addition to addressing access issues, community partnerships can enhance the quality and relevance of STEM education by incorporating real-world applications and mentorship from professionals in the field. Partnerships with universities and research institutions can expose students to advanced STEM topics and cutting-edge technologies, helping to bridge the gap between K-12 education and higher education. These experiences are particularly important for students from underrepresented groups, as they may not have as much exposure to STEM careers in their personal networks. Seeing professionals from similar backgrounds succeed in STEM can have a profound impact on students' aspirations and sense of belonging in the field.

In our program, it meant bringing graduate and undergraduate students in engineering into the classrooms with our outreach staff to talk about what they studied in elementary school, what they were interested in and what they want to do with their engineering degree.

Preliminary Survey Results

This partnership serves as a pilot to additional research and future data collecting opportunities. The partner organization collected survey data based on their instrument developed by their national headquarters. It is a survey that measures STEM interest, STEM Confidence, STEM Competence and STEM Value. While we participated in data collection for this project in collaboration with the community organization, we are unable to use the data in this paper due to the absence of IRB approval. However, as our collaborator is not subject to the same IRB requirements, they can utilize the data within their scope of work. They plan to apply for additional funding to support their STEM outreach programming in inner-city schools.

The goals for future programming include developing a tool to assess core competencies gained but participants including problem solving and critical thinking, systems thinking and scientific inquiry and experimentation.

Future Plans

Community partnerships between universities and youth organizations can lead to sustainable and long-term initiatives that continually support diversity in STEM. For example, university partners can provide enrichment beyond the traditional classroom setting by supporting existing afterschool programs, summer camps, and mentorship networks. These programs help students develop the critical thinking, problem-solving, and collaboration skills necessary for success in STEM fields. Additionally, many community organizations can secure funding and resources that schools alone might not be able to access, such as grants from private foundations or corporate sponsorships. This additional funding allows for the development of high-quality programs that are both scalable and sustainable.

In the long term, we hope that our community partnerships can play an advocacy role, promoting policies and practices that foster greater inclusion in STEM education. Through joint efforts, partners can advocate for systemic changes, such as curriculum reform, teacher professional development, and the implementation of culturally responsive teaching practices. These changes can make STEM education more equitable and accessible to all students. Leveraging community partnerships is a crucial strategy for increasing diversity in STEM education for higher education institutions. By combining resources and expertise, these partnerships can address both the structural and cultural barriers that prevent underrepresented students from pursuing STEM, creating more equitable and engaging opportunities for all.

References

Girl Scouts of the USA. (2022). The impact of Girl Scout STEM programming: Full report. Girl Scout Research Institute. Retrieved from https://www.girlscouts.org/content/dam/gsusa/forms-and-documents/about/research/GSUSA_GSRI_2022_The-Impact-of-Girl-Scout-STEM-Programming-Full-Report.pdf

NSTA, "STEM Education Outreach: School-Industry-University Partnerships," *Connected Science Learning*, vol. 2023, no. May-June, May 2023. [Online]. Available: https://www.nsta.org/connected-science-learning/connected-science-learning-may-june-2023/stem-education-outreach?utm_source=chatgpt.com. [Accessed: 14-Jan-2025].

L. E. Quarles, B. C. Monks, and L. M. DeAngelis, "First-Year STEM Persistence: The Role of Learning Environments and Early Academic Success," *CBE—Life Sciences Education*, vol. 23, no. 4, pp. 1–12, Dec. 2023. [Online]. Available: https://www.lifescied.org/doi/pdf/10.1187/cbe.23-04-0059. [Accessed: 14-Jan-2025].

S. S. Raza, A. M. Ibrahim, and C. M. Williams, "The Role of Informal Science Education in Shaping Science Identity: A Case Study of an Out-of-School Astronomy Program," *arXiv preprint arXiv:2306.06014*, Jun. 2023. [Online]. Available: https://arxiv.org/abs/2306.06014. [Accessed: 14-Jan-2025].

R. Fry, B. Kennedy, and C. Funk, "STEM Jobs See Uneven Progress in Increasing Gender, Racial and Ethnic Diversity," *Pew Research Center*, Washington, DC, USA, Apr. 2021. [Online]. Available: https://www.pewresearch.org/science/wp-content/uploads/sites/16/2021/03/PS_2021.04.01_diversity-in-STEM_REPORT.pdf. [Accessed: 14-Jan-2025].