Board 222: CAREER: Engineering in Youth-led Technology-rich Settings: Promoting Belonging and Preventing Harm

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Introduction

Technology-rich environments have been on the rise in educational settings for the past several decades. Access has been improved because low-cost cutting-edge technologies and technology adoption in public schools and libraries has increased. However, youth from underserved communities are not as comfortable being in these spaces as their more privileged peers. These youth are less likely to feel a sense of belonging and ownership in engineering spaces. One way to increase belonging in engineering and technology-rich environments is to provide pathways of ownership and leadership within the space. In the past, preventing harm to communities and the environment has not been central in engineering educational settings. The engineers of today and tomorrow need to reduce the harm caused by engineering and technology proactively and that mindset can start in the earliest stages of engineering education. Additionally, harm reduction offers real-world applications to engineering problems and can help youth address problems in their own communities.

This paper will discuss the preliminary findings from two middle school afterschool STEM clubs that are implementing youth-led design workshops into their program. Along with the research team and afterschool coordinators, youth leaders design and develop engineering workshops that promote belonging in engineering and center preventing harm (in engineering). In these design and development meetings, youth leaders learn about technologies that are new to them, identify problems in their communities, and work with the team to design each session of the workshop. In sharing ownership of the project, we hope to further the sense of belonging and solve community-based issues. In the poster-presentation, we will report on the early findings and lessons learned during the implementation of this program.

Goals of the project

This project has two primary goals: Goal 1: To support youth in leading explorations of how technology use and creation can support a sense of belonging in engineering. Goal 2: To develop a framework along with youth that centers preventing harm to people and the environment when engineering. Our poster will be focused on findings related to the first goal.

Current work

Relationship Building with Partner School

As we are in the first year of this grant, we are in the preliminary stages of developing a relationship of trust with our partner schools' teachers and students, especially those who attend the afterschool STEM club which is the primary site for the research. In the first several months of the partnership, the research team met with the afterschool coordinators of the STEM club to introduce the teachers to the project, ideate about potential activities, and identify youth leaders. At least one member of the research team was also present at the weekly after school club meetings, helping the teachers and students after approval from both the university and school IRB boards. The teachers and the research team worked together to identify students who showed leadership potential but also had room to grow their sense of belonging in STEM fields. We selected 5 youth leaders at each of our two sites.

School district and youth leaders

Half of the school district that we are working with is considered socioeconomically disadvantaged, 40% of the system's high school students identify as non-white, more than 25% have an individualized education plan, and English language learners consist of 18%. While working with the teachers, we appointed youth leaders who were representative of the student body and displayed patience, curiosity and camaraderie with others. Youth leaders will be re-elected each year and students in lower grades have already expressed interest in participating. Below is a breakdown of the youth leader demographics.

School	**School A**	**School B**
% not male	60%	80%
% not White	80%	40%
Languages spoken	English and Spanish	English, Albanian, Spanish, Nepali

Starting in February 2024, the youth leaders, teachers and researchers have begun to meet to prepare the programming for the club following a Youth Participatory Action Research (YPAR) approach.

Findings and Discussion

In this poster we will share analysis from initial interviews with youth leaders and teachers aimed at understanding their perceptions of engineering, engineering and harm, and if and how they feel a sense of belonging in STEM. We will also share findings from our weekly YPAR meetings with the youth where we use conjecture mapping and related activities to unpack everyone's (youth, teachers, research team) conceptions of belonging and equity, and how we plan on using tools, materials and mediating processes to achieve these outcomes. Additionally, we will share outcomes from the afterschool program which will be co-lead with the youth leaders following February vacation (after the submission of the initial draft of this paper, since this is an ongoing project).

So far we have learned that a majority of our youth leaders have had almost no prior experience with engineering other than a few students being in a PLTW class currently. Several of them are new to the afterschool club since this project has enabled the schools to recruit more students with additional funding for materials and stipends. It is interesting to note that even with no prior experience in engineering, all leaders see how humans impact what is engineered and how it is used. Some also make a distinction between science, technology and engineering - to some engineering is a serious activity since "what engineers build cannot break". When asked about what qualities they think they have or would like to develop to be a leader, almost all responded with socioemotional skills like patience, listening, and being helpful, as opposed to technical skills. Most leaders feel that they belong in science but are unsure about their belonging in engineering. Since an important aspect of our study is a sense of belonging, we started our equity conjectures framing by discussing where we feel like we most belong most and what makes us feel this way - we will share these findings and aligned program design elements in the poster.