

Research Practice Partnerships: Faculty, Teachers and Secondary Students in Informal Engineering Education

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Extended Abstract

For many years, an informal engineering day camp has been hosted by engineering and education faculty at a regional university in the Midwest. The camp has been evaluated positively by those who participate and their families, as well as state and federal funders. Each summer (not including 2020 due to COVID restrictions) up to 24 secondary students come to participate in hands on/minds on engineering projects, coupled with lectures and lab time learning skills of electrical and computer engineering, aspects of professional engineering and collaboration and critical thinking skills, among others. The experience is designed to make engineering as a profession a possibility and choice for future university students. In addition to the informal engineering day camp the faculty hosts, there is also a federally funded teacher research experience (RET) engineering faculty provide in collaboration with a local community STEM outreach organization. This year, the day camp and RET experiences were combined to address problems of practice identified by the teachers, while providing engineering experiences to the day camp students. Often, in a research practice partnership, faculty work with k-12 teachers on a problem of practice the teachers identify. There is not always the opportunity to collaborate with the faculty, teachers and students in real time. The authors share partial initial data from the RET and day camp experience suggesting an overall benefit for all participants.

Data was collected using design-based feedback protocols specifically related to student and teacher experiences. Questions included what worked, what they would change, and any inquiries students and teachers may have had. In addition to a pre- and post- test, students were asked daily about whether people like them could be engineers and if they were likely to consider engineering in their future education and career choices. Teachers were also asked about if their formal teaching would be improved related to planning, participation and/or teaching the camp students during RET. Responses from teachers include: “I need to establish a mission involving the drones rather than free flight”, “I feel more comfortable...because I know what to expect and the students gave really smart responses I didn’t even think about”, and “It was extremely helpful to work with the kids to see what worked, what could be improved.” Of the 18 students who were selected from applications to attend the camp, there were representatives from public, private and home school communities. Students represented a variety of social and cultural backgrounds. Of the 10 teachers in the RET program, all

participants were from public institutions and represented a variety of experience levels, social and cultural backgrounds. Preliminary data suggests that the two days that students worked with RET teachers on four centers that included programming, flying drones and 3D printing, their responses for considering engineering in their future and people like them could be engineers were the highest of the week. Excerpts of data are included in Fig 1.

Fig 1. Student responses to engineering identity questions



The research practice partnership with real time opportunity including faculty, teachers and students proved to be of value for all involved. Although there were other experiences on the days students worked with teachers, the two days of RET center work were influential. There may also be a cumulative effect on building skills and experiences prior to working with the RET teachers. In the future, the successful day camp experiences will continue and funding will be sought to actively include the RET with the day camp. This expands on the idea of a research practice partnership, and the authors hope to continue to provide experiences that increase the likelihood that engineering will be taught by k-12 educators as well as providing opportunities for k-12 students see themselves becoming engineers.

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