Board 54: How a Civic Internship Impacts Student Professional Discernment

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Abstract:

Researchers at UNIVERSITY developed, piloted, and examined a community-engaged STEM learning environment at a university in Indiana. This summer, the MODEL developed from this pilot was adapted and replicated at two other universities. Over 50 students (high school and college) participated in the three regions in the Midwest in a community engaged internship experience during the summer of 2022. Students worked on project teams of 4-6 students on a community-identified project for 8 weeks. Local high school teachers managed projects and community partners served as technical mentors as students completed their paid internship, which culminated with a formal presentation and product to their community partner. The larger research effort uses mixed-methods data collection, including surveys and interviews, to examine a variety of outcomes, including dispositional changes in STEM self-efficacy and identity.

Students completed surveys and reflections at multiple points throughout their internship, including a retrospective pre/post survey capturing dispositional shifts during the experience. The results of the internship experience on student intern participants educational and professional plans at the 3 sites are evaluated in this paper. Results show significant gains on items related to professional discernment (desire to work in a STEM field, use technical skills, on open ended problems for the betterment of society) for participants at all sites. Additionally, there are differences by gender.

Overview

Beginning in 2015, the College of Engineering researchers and staff at UNIVERSITY developed, piloted, and examined a community-engaged STEM learning environment in a deindustrialized city in Indiana. Drawing on principles from academic engaged learning and innovation ecosystems [1-5], the pilot integrated partners across a diversity of higher education institutions, high schools, local government, and community organizations to develop community-identified, authentic projects and tailored programming to implement internships that support STEM attraction and retention for underrepresented groups in engineering and science as well as improving the quality of life in these communities. As such, it applied what we understand about persistence in STEM [6-8] by providing opportunities for early research and active learning in the community. The original pilot received awards from both the Indiana Department of Education and the Indiana Chamber of Commerce in the first 4 years. Building from this success, the MODEL developed from this pilot was adapted and replicated at two other Midwestern universities this summer [9-13]. Over fifty students (high school and college) participated in a community engaged internship across the three regions.

Delivery of the MODEL internship begins with training modules in the first week, which includes project management, leadership, team building, design-thinking, and diversity training across all teams. This training, in part, helps interns to understand common frictions in teamwork as they engage in problem-solving for community issues. Depending on the project needs and the team skillsets, specialized training, such as Geographic Information Systems, is also provided. Following initial training, teams develop an approach to addressing a community-identified challenge – working through roles and tasking internally. By the final and eighth week, interns provide the deliverables to the community partner and participate in presentations to the community.

In general, projects are scoped within issue areas (e.g., sustainability, health equity, community development, workforce) that were selected with regional partners. Community partner organizations help to scope the projects in more detail to ensure deliverables that will be useful to their work. For example, the Renewable Energy Comparisons project sought to conduct research that would help small scale growers understand energy demands for powering fans and small tools in the hoop house and provide cost effective solutions to reduce fossil fuel use. As a counterpoint, the C-EEEM site staff ensure that project scoping is open enough for team ownership. Throughout the internship, mentors guide intern teams through different aspects of the projects; some projects may include faculty as well as community mentors. This first year of replication, interns tackled a broad variety of projects across the three sites (see Table 1).

Table 1 Projects by C-EEEM site

Site	Project Title
SB/Elkhart	Downtown Vibrancy Initiative
SB/Elkhart	Internship Accessibility
SB/Elkhart	Renewable Energy Comparisons
SB/Elkhart	Advanced Manufacturing
SB/Elkhart	Affordable Housing
SB/Elkhart	Design-Thinking Camp
SB/Elkhart	Food Information Network (FINs)
SB/Elkhart	Lead Service Lines
SB/Elkhart	Michiana Community Health Coalition
SB/Elkhart	SB Public Works Complete Streets
Louisville	Beargrass Creek
Louisville	Food Justice
Louisville	Empathic Design for Pedestrians
Youngstown	Neighborhood Development
Youngstown	SIMUN (Street Information Mapping Unit).

Together, the elements of this internship experience were expected to show positive impacts on factors related to career discernment, among other outcomes. For example, with mentorship, findings have shown that for students working with an academic leader such as a professor or

advisor, doing activities and projects were influential in helping engineering students in major selection [14]. Furthermore, professional development programs, such as internships, have been shown as an effective approach to promote students' awareness and intentions towards future careers [15]. Several of the elements of the internship – mentoring, research, and community-based projects – have shown to be predictors of continuing in STEM after graduation [16].

Methodology

Researchers at the UNIVERSITY pilot site began with collection protocols from the original pilot [10, 17, 18]; they modified them as needed in collaboration with UNIVERSITIES. Using a digital platform (Qualtrics), researchers at UNIVERSITY also coordinated and managed all data collection from interns; in doing so, researchers aimed to collect data at similar stages and times of the internship implementation at each of the sites. The Institutional Review Board (IRB) at UNIVERSITY provided review across all three sites and approved the research protocols.

Data collection protocols from the original pilot included weekly check-in surveys for program feedback, reflection prompts, interviews at replication sites, and the primary final post-internship survey instruments. For the final survey, the pilot included a retrospective pre/post survey informed by our understanding of attraction and retention in STEM and formation of STEM identity [7, 19-23] and place attachment [24-27]. This was modified slightly to ensure sufficient representation of the constructs of Self Determination Theory (SDT) [28-30] for collaborators interested in exploring these concepts. The final survey provided a measure of dispositional shifts across these constructs using Likert scaling, as well as open-ended questions regarding the career intentions, the region in which the internship is located, and suggested improvements for the internship. Quantitative data for this paper were analyzed using Microsoft Excel and STATA.

Participants

Across the 3 sites, there were 53 participants from the summer of 2022. There were 41 College students, 12 high school students. There were 24 men and 29 women. There were 5 students that declined to participate in the study and are not included in the subsequent analysis / discussion. Table 2 outlines the summary of participants and Figure 1 describes the racial identification of participants.

Table 2. Summary of Participants

	High School	College	Male	Female
Louisville	2	7	6	3
Youngstown	0	7	6	1
South Bend / Elkhart	9	27	12	25
Total	12	41	24	29

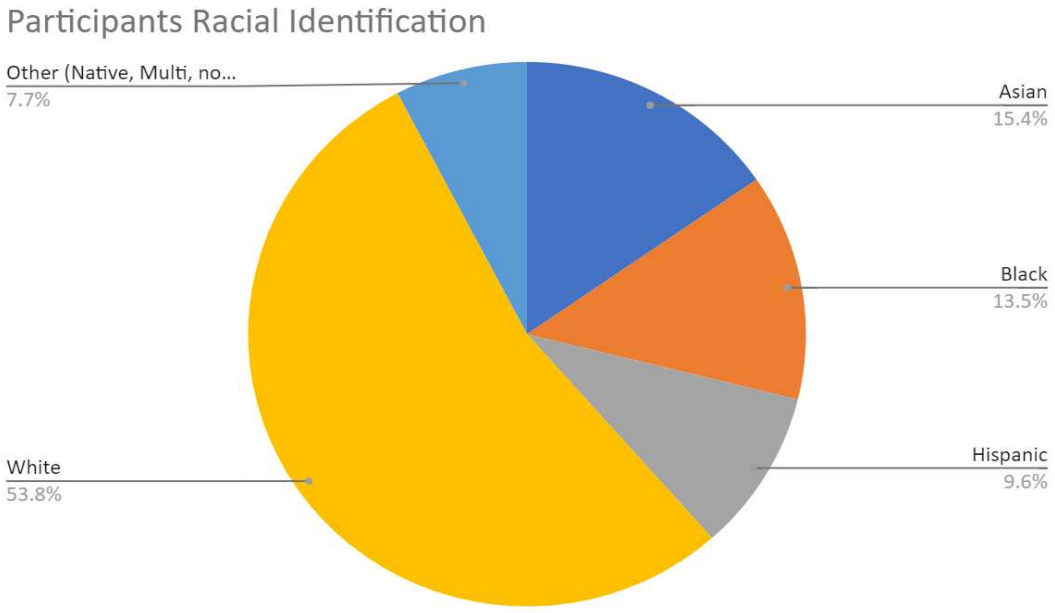

Figure 1. Racial Identity of Study Participants

Results / Discussion

The key survey questions related to discernment were as evaluated using paired t-tests for all 53 participants, with results summarized in Table 3. All 5 questions were statistically significant at 95%, $p<0.05$ including interest in using technical skills, making a contribution to society, solving engineering problems, and a desire to work in a STEM profession. There were no statistically significant differences in survey responses between sites.

Table 3. Summary of Pre-Post Discernment Questions

Question	Difference Mean Post Respone-Pre Response	Difference Standard Deviation Post Respone-Pre Response	ttest
I am interested in a career that uses technical skills.	5.04	14.75	2.49*
I would do well in a field that uses technical skills.	5.79	14.70	2.87**
I can make meaningful contributions to society through STEM skills.	9.21	21.80	3.07***
I enjoy solving open-ended problems that do not have a single solution.	7.85	13.68	4.18***
I know that I want to be in a science, engineering, or math-based field/profession.	3.68	13.07	2.05*

* denotes $p<0.05$, ** $p<0.01$, ***$p<0.001$

It is positive that there was increased interest in STEM fields and using technical skills after the internship experience; but critically important to the recruitment and retention of women and minorities is the recognition of the societal contributions which has been recognized in many other studies [15]. Based on the numbers, Hispanic, Black, Asian, Native American, and muti racial were grouped together as minorities "non-white." There were no statistically significant differences between white and non-white participants in the survey responses. Future work should aggregate data over multiple years so that more in depth analysis can be conducted for different racial groups.

These questions were evaluated for differences between male and female program participants. Three of the five questions were statistically different for male and female participants. For both male and female participants, they indicated an interest in a career using technical skills, but male participants made larger gains between the pre and post experiences. Similarly, male students had larger gains in recognition they can make a meaningful contribution through STEM skills. Finally, male students were initially more certain that they wanted to pursue a career in a

STEM field, and both gained certainty throughout their experience but there is still a significant difference by gender.

Table 4. Differences between Male and Female Program Participants

Question	Pre-Response (Mean)		ttest	Post-Response (Mean)		ttest
	Male	Female		Male	Female	
I am interested in a career that uses technical skills.	79.0	66.7	1.71	85.0	70.4	2.24*
I can make meaningful contributions to society through STEM skills.	74.6	65.5	1.10	82.0	71.5	2.91**
I know that I want to be in a science, engineering, or math-based field/profession.	84.6	46.4	3.73***	86.8	52.5	3.39***

* denotes $p<0.05$, ** $p<0.01$, ***$p<0.001$

Responses to these same questions were considered for the difference in gains for high school versus college students but the only difference was in the response to "I enjoy solving open-ended problems that do not have a single solution." While the reason for the difference is unclear, college students in STEM fields may have a lot of exposure to solving open ended problems; this experience may make them more comfortable with these types of problems.

Students were asked about personal outcomes based on this internship experience and Figure 2 shows the responses ("As a result of this internship, I am considering…"). The majority of students indicated they are planning to stay in their current field of study (40%) – which may or may not be STEM based, but many were also open to a broader range of locations (30%), being open to adding a course in a new field (17%) or changing fields (13%).

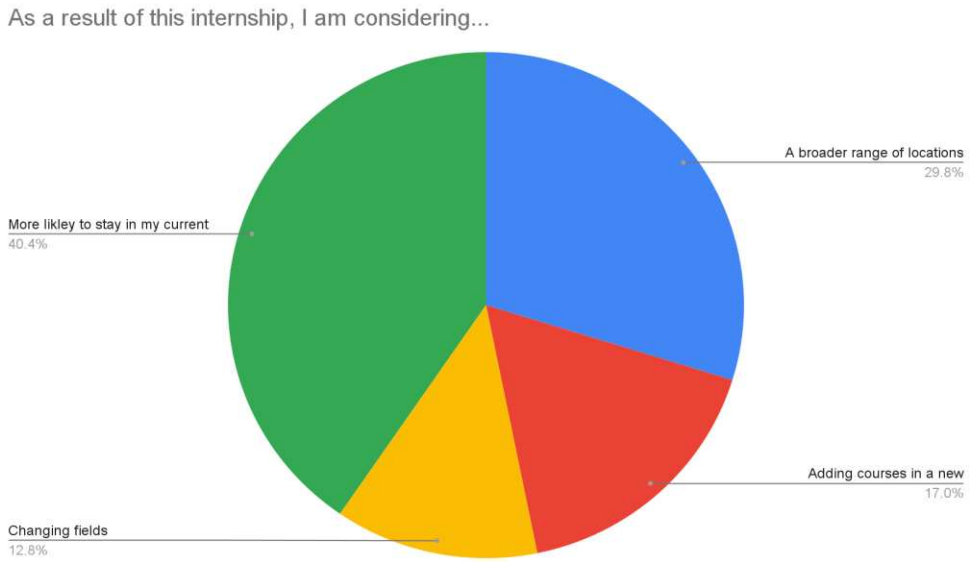

Figure 2. Internship Outcomes

More specifically, students reported on their future career plans in Figure 3. The majority of students indicated they feel more certain about their career path (50%), although students indicated that as a result of this experience they were considering other options. A quarter of the participants were considering either changing career pathways or felt less certain about their career plans which indicates healthy exploration / discernment [31, 32]. The exploration and selection of a field of study when based on experiences has been found to be "polarizing," either affirming a student's plans for study or dissuading them [33].

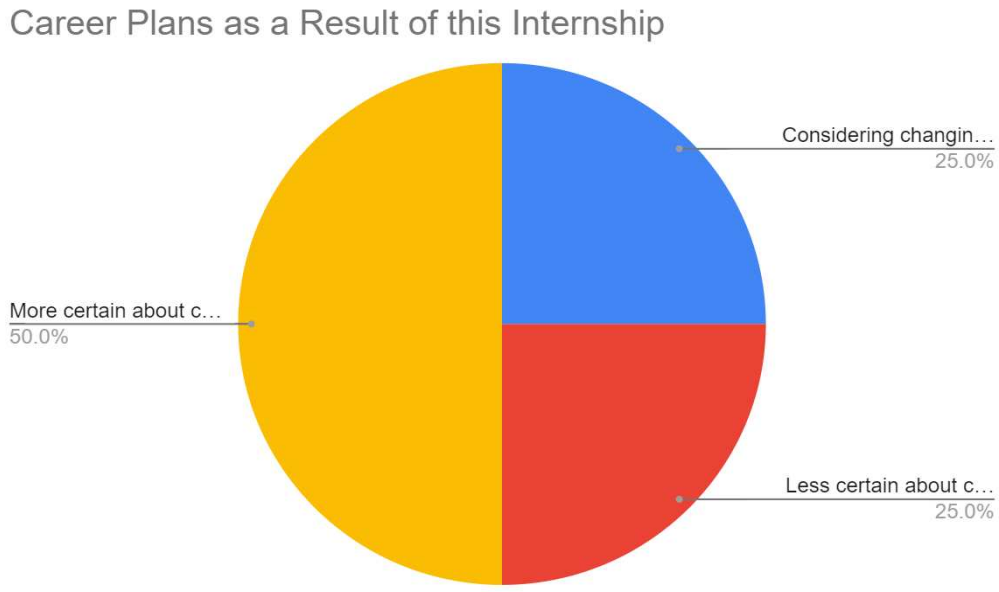

Figure 3. Future Career Plans

Conclusions

Overall, this study shows the benefits of a community-based project experience on high school and college students towards professional discernment. There were significant gains across all 5 questions relating to desire to work in a STEM field, using technical skills, on open-ended problems for the betterment of society. There were no differences between the site that originated the program and the two expansion sites. The only differences between college and high school students related to solving open ended problems, which is a focus in higher education as opposed to K-12. There were no differences between white and non-white students for this inaugural year. If data were aggregated across years, however, then further analysis could be conducted by different racial groups. The biggest differences were for male and female students, male students were higher than their female counterparts on measures of careers that use technical skills, societal impact, and an intent to work in a STEM profession after college. Both made gains; however, male students started out higher and both made gains through the internship experience. In previous studies of the pilot, females made greater gains than males in nearly all areas [10]. It is well documented in the literature that for women and underrepresented groups that demonstrated societal impact is a meaningful motivator for engineering and STEM fields, so this will be an area of future examination. Another potential area related to career discernment for future efforts includes co-researchers exploring the implications of this programming on self-determination and its relationship to other outcomes (e.g., place attachment, career discernment).

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