Board 153: An Immersive Summer Camp Designed for Underrepresented Populations and Its Effectiveness on Increasing Pre-College Awareness and Broadening Participation in Engineering (Evaluation)

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An Immersive Summer Camp for Underrepresented Populations and its Effectiveness on Increasing Pre-College Awareness and Broadening Participation in Engineering (Evaluation)

Introduction

The new E.S. Witchger School of Engineering at Marian University launched its inaugural residential INnovation Through Engineering summer camp for summer 2022. Marian University is a private Catholic university situated just north of downtown Indianapolis, Indiana. Due to its location and mission, Marian University is well known within the community for uplifting those that are disadvantaged by working closely with local public schools and through strong relationships with Catholic high schools. Continuing with the university's mission, a 5-night, 6-day event was designed to grow exposure and interest in engineering amongst minority, first generation, and other traditionally underrepresented rising sophomores, juniors, and seniors in high school with the long-term goal of increasing participation in the engineering profession.

In recent years, summer programs have emerged to help increase access to STEM (Science, Technology, Engineering and Math) and to serve as a pipeline for those who are underrepresented and underserved. It has been shown that increasing access to STEM has a direct impact on increasing the matriculation among minority and underserved groups, positively influencing graduation rates, and increasing the likelihood of underrepresented students graduating with a STEM degree from college [1], [2]. Despite continued growth, there still exists a hesitancy among certain populations of students to pursue areas of STEM such as Blacks/African Americans, Hispanics, and those who are female [2], [3], [4]. This hesitation can be attributed to many reasons from lacking aspirational goals to low self-efficacy or even the existence of negative stereotypes can shape this [5], [6]. Additionally, there are challenges in accessibility for underrepresented populations such as access to application materials, transportation, or even cost [7], [8]. Establishing environments where underrepresented students feel supported and feel as though they belong will have a positive impact on increasing the participation in STEM of those who are minorities [6], [9].

Although there has been a shift for higher education to focus on increasing equity and inclusion in areas of STEM, findings indicate that more work needs to be done as representation, accessibility, and participation remain of concern. To address these challenges, the INnovation Through Engineering summer camp was designed as a residential event with intent to maximize the experience for those who are underrepresented and underserved. This report offers evidence that through careful consideration of barriers, such as the above-mentioned concerns, an inclusive camp for underrepresented high school students can be created while offering increased awareness and broadening the participation in engineering.

Positionality Statement

Both the director and the assistant camp director are first generation, females in engineering who are also university faculty teaching difficult STEM subjects such as physics, biophysics, programming, and linear circuits analysis. Each had hurdles to overcome to be where they are, and these hardships helped the directors to shape the organization and planning of the camp. The

director (first author) understands the challenges faced by many of the camp participants because she herself was raised in a low-income family within a rural community where resources and opportunities were lacking. Through hard work and dedication, she financed her own college education as both an undergraduate student and a graduate student. While pursuing her degrees (BS and MS), she had to attend many engineering courses as the only female in the class. As if this was not difficult enough, before attending college she had developed an anxiety and panic disorder that she has now battled for over two decades. Through her journey, the director has developed the capacity to recognize when others may feel/be uncomfortable in situations and can empathize. In response, she has cultivated an ability to easily connect with others and uses this ability to create inclusive supportive environments for those pursuing STEM. The assistant director (second author) frames her practices around diversity related experiences. As an international woman issues of diversity and inequality are deeply important to her both personally and professionally. She grew up in Sri Lanka, a developing country with a multi-cultural environment. She finished her high school and college education in Sri Lanka and then moved to the United States to pursue multiple higher education degrees (MS and PhD). After she started her graduate studies on foreign soil, her awareness and appreciation of cross-cultural understanding continually grew. Her native language is Sinhala which means she had to learn English as a second language to succeed in the United States. She understands the challenges, as well as the benefits of diversity, that many of the camp participants have experienced, and she uses this understanding in her work.

Camp Recruitment/Enrollment

To recruit the desired demographics and to negate any hinderance of access to application materials, camp directors and the dean of engineering worked directly with the Minority Engineering Program of Indianapolis (MEPI) and Starfish Initiative to connect with prospective campers from underrepresented minority groups. Additionally, the university worked with the president of the Center for Leadership Development (CLD), a non-profit Indianapolis organization focused on preparing African American youth for academic, college, and career success. Furthermore, camp directors also worked with the executive director and CEO of the Diversity & Innovation Institute (DNOVA, formerly Health & Science Innovations), to reach out to high school students seeking STEM career paths. Due to the camp's targeted demographic, it was important that enrollment costs were kept low. In response, a total enrollment cost of $500.00 per camp participant included room and board, three meals a day, all transportation costs while attending the camp, and admission to any event. Financial help was also available to those who found it necessary. Through the generous offerings of industry partners and secured grants, the INnovation Through Engineering summer camp offered half of the camp participants scholarships to attend. With the combined efforts of these items, accessibility was improved, and a diverse population of attendees were enrolled in the camp’s first iteration.

The target enrollment for the inaugural INnovation Through Engineering summer camp was 40 students. For its first year, approximately 45 students applied, and 40 were accepted to the camp. Thirty-eight students confirmed attendance and submitted deposits for the summer program. Unfortunately, due to last-minute cancellations and COVID illness, at the start of the camp, the final number of attendees was 31 students. Several last-minute cancellations were from African American and Hispanic students.

Table 1. *Demographics of camp attendees*

Category	Number (Percentage)	
Sex		
*Male**	18	(58.1%)
Female	13	(41.9%)
Race		
Black/African American	4	(12.9%)
Asian/Pacific Islander	4	(12.9%)
*Caucasian**	17	(54.8%)
Hispanic/Latinx	6	(19.5%)

** Caucasian Males made up 29% of camp attendees*

As evidenced in Table 1 above, of the 31 camp attendees, more than 40% were female, 19% Hispanic, 13% Black/African American, and 13% Asian. The combination of underrepresented cohorts involved in the inaugural camp was encouraging, but there is room for improvement.

Camp Faculty/Staff

A factor in increasing participation in those who are in minority, low-income, and female population is representation. Providing role models campers can connect with will promote an inclusive environment for camp participants to explore engineering. For the first iteration of the INnovation Through Engineering summer camp, sixty percent of faculty and staff were female, and more than half combined were either Hispanic or Asian/Pacific Islander. Table 2 below depicts a breakdown of the camp faculty and camp staff demographics.

Table 2. *Demographics of camp faculty and staff*

Category	Number (Percentage)	
Sex		
*Male**	6	(40.0%)
Female	9	(60.0%)
Race		
Asian/Pacific Islander	4	(26.7%)
*Caucasian**	7	(46.7%)
Hispanic/Latinx	4	(26.7%)

** Caucasian Males made up 20% of camp faculty and staff*

For the directors to be the inspirational and aspirational authority figures they are known to be, it was crucial that they connected with campers. Creating an inclusive environment for all, camp

directors learned the names of each camper before arrival and greeted families accordingly. Camp directors enjoyed breakfast and lunch with camp participants and spent most of the daytime programming interacting and participating with the campers. This not only provided representation to many, but the interactions with directors set the tone that each camper mattered and that they belonged.

In addition to providing representation between the camp directors, the camp counselors were of diverse backgrounds contributing to the creation of an environment where minority and underrepresented groups could see themselves in other roles. It should also be noted that all eleven counselors were students at Marian University. More than 72% of counselors were students pursuing engineering degrees, 38% of those counselors were females in engineering, and a combined 38% of counselors were of Asian/Pacific Islander and Hispanic ethnicities. To gain trust in their assigned campers, upon participant arrival, counselors provided questionnaires inquiring about preferred names, preferred pronouns, and any anxiety/depression/or other mental health struggle campers may be experiencing and were willing to share. This allowed for counselors to understand campers on a deeper level and helped to form connections early. Counselors also had to guide campers through their packed schedules and were responsible for communicating to camp participants expectations for each event or activity. Through leading by example and offering guidance to camp participants, camp counselors played a pivotal role in establishing a sense of belonging and offering the necessary representation.

Academic Programming

Each camp day started with either keynote talks, or faculty-led technical lectures followed by workshops, design projects, and off-site industry visits. To further enforce to participants that there is a place for them and that they belong, a diverse mix of speakers and lecturers were secured including Hispanics, African Americans, and females who are all practicing engineers. Keynote talks allowed campers to learn about civil engineering, structural engineering, and geotechnical engineering. Campers learned some of the ins and outs of these disciplines and were enlightened on why or how to pursue these avenues. In addition to learning about specific disciplines, campers attended a keynote talk specifically about Diversity and Success in Engineering to further show participants that there is a space for them if they choose to pursue it. The presentation was given by a successful female engineer and whose race is African American. She delivered a message that was aspirational and inspirational telling campers to reframe their thoughts with the phrases “I can’t do it, YET.” and “HOW will I do it.”

Technical lectures were provided by university faculty and by industry leaders. Topics covered included fundamentals of engineering, RC car design, an introduction to Python programming and engineering graphics, a look at biomechanics, and lectures on additive manufacturing, as well as learning computer aided design (CAD). Throughout the week, campers worked in teams to design cardboard chairs, wrote computer programs to draw engineering graphics using Python, and built robotic arms to study biomechanics. The industry partner who led the robotic arm activity was a Hispanic female working as a biomedical engineer for a world-renowned pharmaceutical company. She is alumni of the dual degree engineering program at Marian University who earned 3 degrees in STEM in a non-native language: a B.S. in Mathematics from Marian and a B.S. in Biomedical Engineering from a partnering university, and a M.S. in

Mechanical Engineering from Purdue University. As a lecturer, she provided an additional opportunity for representation.

Campers also constructed model structures and tested the structural integrity and stability with a shaker table which worked to mimic earthquakes or windy conditions. Camp participants were challenged to build and program Arduino-controlled RC cars, and were exposed to fabrication using 3D printers, laser cutters, and CNC machines. Through these keynote talks, lectures, and hands-on activities, students were exposed to the engineering field conceptually, learned engineering design and theory concepts, and applied those concepts to develop solutions to engineering challenges all while being immersed in supportive and inclusive environments.

Industry Visits

A vital component in the planning and implementation of the INnovation Through Engineering summer camp is the close partnership between the E.S. Witchger School of Engineering and industries within the Indianapolis area. Working closely with these partners, summer camp participants made several visits to leading companies. The breadth of companies and organizations involved spanned biomedical, chemical, civil, construction, environmental, mechanical, manufacturing, and computer engineering disciplines. While in-class speakers, lectures, and design projects are extremely effective in engaging students with inspirational interactions in conjunction with learning about engineering, witnessing engineering in action offers prospective engineering students an opportunity to see others who look, act, or even speak similarly to themselves. This helps camp participants to visualize themselves as practicing engineers solving real-world problems. Additionally, site visits provide differing aspects of engineering including management, sales, research and development, manufacturing, etc. thus opening a world of new possibilities campers may not have considered.

Entertainment/Cultural Programming

Viewing the community through their own lens and witnessing inclusive, supportive environments is necessary in gaining the participation of underrepresented populations in STEM. Therefore, a third aspect of the engineering summer camp was to expose students to diverse cultural experiences available on a college campus and in the surrounding community. Last year, these experiences included attending a local minor league baseball game and taking part in a scavenger hunt through the university's acres of natural habitat including wetlands, prairies, and forests. Through participating in these activities, campers created community and worked together to achieve a common goal outside academics.

To further reinforce an environment in which campers would feel as though they belong and to provide inspiration, directors coordinated a visit to the Indiana State Museum specifically to experience the Marshall “Major” Taylor exhibit. As described in the museum’s exhibit, Marshall Taylor was an athletic powerhouse in the sport of cycling during the late 1800s and early 1900s. Due to his ethnicity, he was faced with racism and prejudice and decided it best to leave his hometown. His relocation provided him with the necessary sense of belonging to break through racial barriers so he could achieve athletic greatness. In 1899, Marshall “Major” Taylor become one of the first African Americans to win a world championship among many other wins and

titles. Following the museum visit, campers attended a cycling event at the Major Taylor Velodrome, an outdoor velodrome named after the 1899 cycling world champion. Campers offered support to a camp counselor as he raced in the event, continuing the theme of creating supportive environments. Students also had recreation time on the Marian University campus, including sand volleyball, kickball, movie night, game night, and a camp talent show (final night). These fun events helped to boost camaraderie, team building, and community.

Survey Design

In addition to designing the camp to maximize the experience of diverse, underserved, underrepresented students, the INnovation Through Engineering summer camp was created to increase awareness and interest in engineering career pathways in these populations. To achieve this, the camp program had three key camp goals:

1. Campers will have opportunities to experience and explore different engineering disciplines in academics and industry.
2. Campers will actively participate and collaborate with others to work towards shared goals through different engineering designs and hands-on tasks.
3. Campers will participate in activities designed to help them feel a sense of belonging in STEM-related academic settings.

The use of Likert-scales in STEM related camps has been cited by others [10], [11], [12], [13] and thus was adopted for the INnovation Through Engineering camp survey. The camp directors and dean of engineering worked directly with the university's Institutional Review Board chair to develop a series of survey questions used to assess camp goals. These questions were evaluated using a 5-point Likert-scale of 'Strongly Agree' to 'Strongly Disagree' and 'Definitely Aware' to 'Definitely Unaware'. To make a direct comparison of pre-camp knowledge with post-camp knowledge, the same questions were asked pre- and post- camp. Table 3 offers a look at these questions.

Table 3. *Survey Questions – Pre/Post-Camp*

Question Number	Question
1	I am knowledgeable about modern engineering design concepts
2	I am knowledgeable about modern engineering design tools
3	I am interested in pursuing biomedical engineering as a career
4	I am interested in pursuing civil engineering as a career
5	I am interested in pursuing computer engineering as a career
6	I am interested in pursuing chemical engineering as a career
7	I am interested in pursuing mechanical engineering as a career
8	I am aware that I can major in biomedical engineering.
9	I am aware that I can major in civil engineering.
10	I am aware that I can major in computer engineering at college.

11	I am aware that I can major in chemical engineering.
12	I am aware that I can major in mechanical engineering.
13	I am aware of many of the jobs available for a biomedical engineer.
14	I am aware of many of the jobs available for a civil engineer.
15	I am aware of many of the jobs available for a computer engineer.
16	I am aware of many of the jobs available for a chemical engineer.
17	I am aware of many of the jobs available for a mechanical engineer.

Because the camp was designed to improve accessibility, provide representation, and to increase participation in engineering for minority and underserved groups, it was essential to collect data specific to the camp so that goals can be assessed, and improvements and adjustments can be made. Using a 5-point Likert-scale of 'Strongly Agree' to 'Strongly Disagree' and 'Very High' to 'Very Low' in combination with free response questions, campers were encouraged to provide feedback for improvement. Table 4 offers a view of these questions.

Table 4. *Survey Questions – Program-Specific*

Question Number	Question
1	The application process was easy to complete
2	The process to submit camp forms and documents, including fees was easy to complete
3	The process of check-in / check-out process was efficient
4	The camp representatives were responsive to questions that students or families may have had
5	Provide opinion on Food (breakfast, lunch, and dinner).
6	Provide opinion on Dorms and bathroom facilities.
7	Provide opinion on Transportation.
8	The camp staff was available.
9	The camp staff was visible.
10	The camp staff was approachable.
11	There were multiple opportunities to experience/explore different engineering disciplines in academic settings.
12	There were multiple opportunities to experience/explore different engineering disciplines in industry settings.
13	Active participation and collaboration were used to perform different tasks.
14	New skills were developed and implemented throughout the camp.
15	Activities and lectures were challenging but in a good way.
16	A sense of belonging was felt throughout each activity during the camp.
	Free Response Questions
17	What was your favorite part of camp? Why?

18	What was your least favorite part of camp? Why?
19	How can this camp be improved?
20	What was your favorite Keynote talk? Why?
21	What was your least favorite Keynote talk? Why?
22	What was your favorite Hands-on project? Why?
23	What was your least favorite Hands-on project? Why?
24	What was your favorite Site visit/factory tour? Why?
25	What was your least favorite Site visit/factory tour? Why?
26	What was your favorite Entertainment activity? Why?
27	What was your least favorite Entertainment activity? Why?

Survey Results

At the start of the week, campers were asked to complete a pre-camp survey on their knowledge of items related to engineering and its career possibilities. The students were assessed again at the end of the week using post-camp surveys. This process allowed for the direct comparison of the knowledge participants gained throughout their stay. The percentages were calculated using the total positive responses from 5-point Likert scale. The standard deviation (SD) and Mean were calculated using the 5 to 1 coding in Likert scale. Assessments from summer 2022 showed pre/post camper increases in all items measured.

Table 5. *Survey Data*

Survey items	Percentage		Mean		SD	
	Pre	***Post***	***Pre***	***Post***	***Pre***	***Post***
Exposure to engineering design concepts	58.6	100.	3.41	4.28	0.867	0.497
Exposure to modern engineering design tools	62.1	92.6	3.59	4.14	0.945	0.634
Interest in studying engineering in college	65.5	92.6	3.76	4.15	1.32	1.18
Awareness of engineering as a career pathway	41.1	81.5	3.12	4.15	1.16	0.772

As shown in Table 5, the push towards STEM is evident with pre-camp results indicating half of campers had exposure to, interest in, and awareness of engineering before arriving at the camp. Moreover, post camp results affirm the success and achievement of the broader camp goals. As shown above, the campers acknowledged learning more about engineering design with an increase in knowledge of concepts of 41.4% and increase in knowledge of modern engineering tools by 30.5%. Results also show a 27.1% improvement in the interest to study engineering beyond high school and an increase in pursuing engineering as a career path by 40.4%. According to the mean scale score of all survey items shown in Table 5, the pre-camp results (Mean score of 3+ : Neither agree or disagree/ Neutral) show that although campers may have had some familiarity with engineering and its opportunities, they did not have a complete understanding of engineering concepts, tools, studies, or even potential career pathways. However, the post-camp Mean score results (4 + : Agree) show that through attending the camp, campers not only gained knowledge of and but also increased their interest in engineering and its possibilities. Additionally, as seen in Table 5, pre-camp survey results present higher SD values

compared with post-camp survey results for all survey items. This further supports camp participants had a scattered understanding of engineering and all it has to offer before camp, and upon the conclusion of the camp, the participants had a more focused understanding of engineering. This data indicates that through participating in the Innovation Through Engineering summer camp, the attending demographics experienced an increase in pre-college awareness and an increase in interest in engineering.

Camp counselors conducted one-on-one exit interviews where participants were asked questions about the program's goals. Participants were also invited to submit an anonymous evaluation form to express their opinion on all camp program items, including speaker topics, lectures, projects, tours, entertainment, dining, housing, and staffing. Overall, scores indicating strongly agree and somewhat agree were high regarding all topics including:

- application process
  - completion ease (100%)
  - submission ease (100%)
- organization/planning
  - check-in/check-out (96.3%)
  - answering questions (100%)
- camp faculty/staff
  - availability (96.3%)
  - visibility (96.3%)
  - approachability (100%)
- engineering content
  - academic experiences (88.9%)
  - industry experience (92.6%)
- camp environment
  - active participation (96.3%)
  - sense of belonging (81.5%)

Due to the method of recruitment and the distribution of application materials, results obtained regarding the application process indicate accessibility was not an issue for campers. Additionally, feedback gathered on camp faculty/staff and camp environment show that camp participants were comfortable with faculty/staff due to the representation and felt an overall sense of belonging. When interviewed about their opinions of camp faculty/staff, many camp participants expressed that their favorite item about the camp was the ability to meet new people, people who were kind and supportive, had similar interests and offered new perspectives. One camper expressed that their “favorite part was meeting new people because they were all different from the people I already knew.” Another camper said that they enjoyed meeting “new people who also enjoyed engineering and getting to ‘geek out’ with them.”

An email received from a camp participant who identified as a female Asian/Pacific Islander expressed her gratitude for the connection she was able to make with a camp director during her attendance of the camp. Stated directly from her email to a member of the camp staff, “As you may know, I was one of the campers who had attended the INnovation Through Engineering

summer camp. This camp was really helpful to me and has also provided a broader idea of how the field of engineering works. It has also helped me look deeper into my interest in biomedical engineering and how it works and what I would expect from it in the future. Thank you so much for this experience, looking forward to many more! I also wanted to add, Mrs. Tanja Green(e) was extremely helpful and was always interacting with us and sharing her experiences. As she has also pursued a degree in biomedical engineering, I would be extremely grateful if I could get in touch with her so I could receive some guidance on the kind of courses I have to take in college and in the future and what would be the best fit for me. This would really help me and give me a better clarity when I apply for colleges during fall. Thank you so much once again, hope you have a great summer!"

The industry partners who offered their time to provide lectures and keynote talks for academic programming were of diverse backgrounds providing inspirational and aspiration role models to our campers. During exit interviews, multiple campers noted their appreciation for the opportunity to see others who look like them in engineering. To quote a male Hispanic camper when asked who their favorite lecturer was, he responded with, "My favorite was the biomechanics lecture by (the Hispanic biomedical engineer) because she inspired me the most and spoke the most truth that could help someone in our perspective." Due to her race and her journey in a country where the first language is non-native to her, this lecturer easily connected with many of the campers, demonstrating again through representation that camp participants can achieve success and that they do belong. In addition to the above-mentioned lecturer, campers expressed the impact of witnessing a successful engineer who is a female Black/African American. During her talk, she spoke of how reframing one's thought process and broadening one's perspective through diversity will support a person along their path to greatness. A camper specifically stated the phrases shared. "'I can't do it, yet' and 'How will I do it' stuck with me." Another participant commented that "the talk by (the engineer who was a Black/African female). was captivating" further supporting the benefits of creating environments with proper representation due to intentional planning.

Industry visits allowed camp participants to visualize themselves as practicing engineers and to meet real-world engineers who may be of inspiration. A Black/African American male camper stated he was able to fulfil a dream because of this camp: "My favorite part about this camp was definitely meeting a structural engineer it's been a dream of mine for a while, and I actually got offered a job from the people whom we spoke to and that was the best feeling ever!" Additional campers also commented on being able to talk to real engineers and interns, and that the engineers on site were "very interesting and approachable." Campers made statements supporting the benefits of visiting industry sites due to being offered a different view of engineering. When asked what the camp participants enjoyed most about the industry visits, they mentioned the "new info" available for them to witness and appreciated "exploring different engineering departments." As another camper revealed, "Structural engineering, I didn't know that was an engineering discipline" thus further demonstrating the importance of broadening ones understanding of what engineering has to offer through industry site visits.

When interviewed post camp, camp participants articulated their enjoyment of many of the entertainment/cultural activities that were planned specifically to build community. Regarding the talent show held on the final night of the camp, one camper was quoted saying, "The talent

show was great because we made up our own fun and it will stick in my memories." Another participant echoed this sentiment and stated, "The talent show was fun to watch being all together." Multiple campers answered that they appreciated game time together whether it was through playing sports, attending a sporting event, or even playing board games. "Volleyball was fun because it was interactive and the people were fun to be around," one camper said. Others commented that the minor league baseball game as a favorite and of those, one revealed that this was "because of the atmosphere." Game night was also a success amongst campers as they enjoyed their time together. "It was fun to just play games" stated one camper. "Game night (was my favorite) some people brought their own games to play, and we were all just hangin(g) out" In addition to the items mentioned above, the Indiana State Museum resonated to many campers. Not only had many never visited the state museum, which was expressed directly by campers to the camp directors when on site, but many were delighted to learn new things. Below is a sample of quotes given by campers specifically about the state museum.

- "The state museum was really cool."
- "The museum was (a favorite) because of the history it had."
- "I liked the Indiana State Museum, I enjoyed all of the exhibits I saw."
- "I also liked the Indiana State Museum because we could just do something relaxed that taught us a lot."

As evidenced above, through careful planning and intentional choices, all aspects of a residential summer camp can be structured to be inclusive, improve accessibility, and to provide opportunities of representation to underrepresented camp attendees. As the camp is hosted in the years to come, greater efforts to improve the sense of belonging will be necessary as the results indicate there is room for improvement. Securing an even more diverse group of counselors and ensuring that all campers are included for each activity will be important moving forward. Data also suggests that camp participants were pleased with their engineering experience and agreed that multiple opportunities to participate in engineering-related activities existed.

Feedback from campers provided valuable input for future improvements to the summer camp including increased opportunities for socialization and recreation activities each day. Campers also requested more time during the week to work on design projects and provided important feedback on visits/events/activities. Obtaining the long-term goal of increasing participation in engineering, the dean's office has remained in contact with previous campers and will continue to follow their progress both pre-college and post-high school. In fact, through these efforts, the dean's office is proud to announce that after the first iteration of the INnovation Through Engineering summer camp, at least one camp participant has been accepted into engineering school starting fall of 2023.

Conclusions

Camp faculty worked with specific partners to ensure the necessary demographics were recruited, resulting in a diverse population of minority, underrepresented participants for the first iteration of INnovation Through Engineering summer camp hosted by the E.S. Witchger School of Engineering at Marian University. Others who have used intentional efforts in the recruitment of their summer engineering camps have also reported similar successes in securing a diverse

population [14, 15]. By way of scholarships, due to partnerships with industry, financial assistance was made available to those who deemed it necessary, and camp enrollment costs were all-inclusive as well as heavily discounted. These items allowed for greater accessibility, helping to ease the burden of costs and transportation deficits. Camp faculty/staff and industry speakers/lecturers were depicted by diverse populations to offer aspirational and inspirational role models. Further supporting the need for thoughtful planning when providing representation for those that are underrepresented, in a similar program which was designed to enhance STEM self-efficacy in underrepresented minority women, it was found that the female participants were "appreciative of … seeing other individuals who were interested in their majors and those who were already professionals in their fields" [16]. On-site visits provided access to practicing engineers as well a look into other aspects of engineering. Even the hands-on design activities, community building, and entertainment/cultural events, were strategically chosen for campers to increase participation and/or to offer a look into the greatness of others who may be similar to them while inspiring them to pursue engineering after high school. Just as we have shown in our camp, in studies of comparable STEM summer camps, it has been documented that carefully designed programs positively influence the interest of those in underrepresented students [17, 18]. Designing a camp with intent and utilizing valuable partnerships with industry, allows for increases in accessibility, provides opportunities of representation, and works to improve awareness and participation in engineering of those in minority, underserved, and other traditionally underrepresented high school students. Actively addressing these concerns will aid in reducing the hesitancy to pursue areas of STEM among these populations.

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