



## **A Summer Program Focused on Developing an Entrepreneurial Mindset in the Context of the NAE Grand Challenges for Engineering**

### **Dr. Jared Schoepf, Arizona State University**

Jared Schoepf is the Director of Operations for Engineering Projects in Community Service (EPICS) at Arizona State University. Jared received his PhD in Chemical Engineering at ASU, developing a tiered approach to rapidly detect nanomaterials in the environment and consumer products. Jared has been a lecturer of EPICS for 6 years, mentoring over 300 teams. Currently he teaches introduction to engineering, EPICS, and chemical engineering courses. He has founded 2 starts ups and has 3 patents for water purification, removal of trash from storm water, and antibacterial liquid hand soap formula. He has a passion for teaching and mentoring students, aiming to help each student achieve their goals

### **Dr. Stephanie M Gillespie, University of New Haven**

Stephanie Gillespie is a lecturer at the University of New Haven in the Engineering and Applied Science Education department. She previously specialized in service learning while teaching at the Arizona State University in the Engineering Projects in Community Service (EPICS) program. Her current teaching and research interests are in developing study skills and identity in first-year engineering students and improving retention rates. She acts as the faculty liaison for the University of New Haven Makerspace and facilitates student and faculty training. She received her Ph.D. in Electrical and Computer Engineering from the Georgia Institute of Technology, and her BSEE from the University of Miami.

### **Amy Trowbridge, Arizona State University**

Amy Trowbridge is a Senior Lecturer in the Ira A. Fulton Schools of Engineering at Arizona State University and is the Director of the National Academy of Engineering (NAE) Grand Challenge Scholars Program (GCSP) at ASU. Through the GCSP, Amy aims to prepare students to become globally and socially aware engineers who will lead future efforts to solve the world's biggest challenges. Amy also helps new schools to develop GCSPs as part of the NAE GCSP Proposal review committee. She is also actively involved in the Kern Entrepreneurial Engineering Network (KEEN), focused on students' development of entrepreneurial mindset through GCSP and curriculum. Amy recently received the 2019 KEEN Rising Star award for her efforts in encouraging students to develop an entrepreneurial mindset. Amy has contributed to the development of a new hands-on multidisciplinary introduction to engineering course and a unique introduction to engineering MOOC. She is interested in curricular and co-curricular experiences that broaden students' perspectives and enhance student learning, and values students' use of Digital Portfolios to reflect on and showcase their accomplishments. Amy earned her Master's degree in Biomedical Engineering from Arizona State University (ASU), and is currently pursuing her PhD in Engineering Education Systems and Design.

### **Dr. Alison Cook-Davis, Arizona State University**

Dr. Alison Cook-Davis is Assistant Director for Program Evaluation at the Arizona State University's Office of Evaluation and Educational Effectiveness (UOEEE). She has a BA in Psychology, MS in Social Psychology, MLS Legal Studies, and a Ph.D. in Experimental Social Psychology. Prior to joining UOEEE, she supported the research and program evaluation efforts of Maricopa County Adult Probation Department, coordinated and executed the research and program evaluation for a large Department of Justice Second Chance Act grant. These efforts included monitoring, assessing, and evaluating the impacts of program outcomes. Since joining the UOEEE in 2015, Dr. Cook-Davis has led research and evaluation activities for over 50 separate grant-funded programs or initiatives funded by the National Science Foundation, U.S. Department of Education, U.S. Department of State, U.S. Department of Agriculture, National Institutes of Health, and The Kern Family Foundation. These projects have focused on the evaluation of student success, outreach impacts, innovative learning techniques, and STEM-related interventions and curricula.



**Mrs. Kristen Peña M.A., Arizona State University**

Kristen Peña is the Senior Program Coordinator for the Arizona State University (ASU) Kern Grant. The project's goal is to instill an entrepreneurial mindset (EM) in engineering education. She works closely with the Ira A. Fulton Schools of Engineering and Undergraduate Student Engagement office. Kristen manages several entrepreneurial programs and events across the project's initiatives at ASU including: KEEN Entrepreneurial Catalysts, KEEN student grants, the Grand Challenges Scholars Program (GCSP) Entrepreneurial Experience, NAE Grand Challenges for Engineering Speaker Series, and the Robots That Matter series.

**Ms. Courtney Argenti, Arizona State University**  
**Dr. Daniel J Laxman, Arizona State University**

Building on existing research, I use advanced statistical analyses and research methods to answer questions regarding parenting, family relations, disabilities, and other topics. I also use these skills to evaluate the effectiveness of programs. I use R and other statistical software for my analyses and reports. I am continually expanding my skill set in statistics and data science to best answer research questions.

Leaders in science, policy, and business committed to evidenced-based decision-making embrace the refrain, "Data or it didn't happen." I have adopted this refrain as a guiding principle in my life and work. I use data to make sound decisions and draw conclusions that do not extrapolate beyond the data. When hard data are not available, I wait to make a decision, when possible, or critically evaluate what is known before making a decision.

My extensive training and experience have focused on obtaining and analyzing data. As a firm believer that days of statistical analyses cannot make-up for a missed hour of project design, I value the design process of generating good data. Indeed, some have suggested a revised refrain "Good data or it didn't happen." Good data are data that answer the right question. Part of the design process involves updating measures and methods to answer the question and, in many cases, revising the question to address what we really want to know.

I have invested and continue to invest significant time and effort into developing quantitative and qualitative analytic skills. I do this because it allows me to select the methods that best answer a research question. It also allows me to balance methodological rigor and practical constraints, but still obtain the most correct answer possible. My approach to data analysis is (paraphrasing Einstein) that data analysis should be as simple as possible, but not simpler.

# **A Summer Program Focused on Developing an Entrepreneurial Mindset in the Context of the NAE Grand Challenges for Engineering**

## **Abstract**

This paper describes the development and implementation of a three-week project-based entrepreneurial experience summer program focused on the National Academy of Engineering (NAE) Grand Challenges for Engineering through the theme of Sustainability. This program aimed to give students opportunities to (1) apply an entrepreneurial mindset, human centered design process and related tools to solve a problem for a client; (2) observe and/or experience Sustainability work in the private, public, and non-profit sectors; and (3) identify and explain the influence of societal, technological, economic, political, and environmental challenges and impacts related to Sustainability challenges and solutions. An additional aim of this program was to provide students in the NAE Grand Challenges Scholars Program (GCSP) at different institutions with an opportunity to meet and work with each other. Since this program was designed for GCSP students, it was intended to be an experience that students could utilize to fulfill requirements within the Viable Business/Entrepreneurship competency of the NAE GCSP.

This program, created as part of the authors' work with the Kern Entrepreneurial Engineering Network (KEEN) and hosted at Arizona State University (ASU), was designed to provide students with hands-on project-based experiences to learn and apply entrepreneurial tools without the pressures of starting their own business. The primary learning activity of the program was a three-week team project in which students worked to develop a solution to a real-world opportunity presented by a real client. Students applied the human centered design process to perform customer discovery, specifications development, brainstorming, and prototyping to develop effective solutions. Students also learned and applied business tools such as a business model canvas and elevator pitches to develop a business model and communicate the value of their solutions to the clients and other expert judges.

A pre-post program evaluation survey created to assess the program outcomes was administered to all participants. Follow-up interviews were also conducted with several student participants to evaluate the impact of this program on students' actions after the program. Twenty-five students from thirteen different institutions participated in the first implementation of this program. Results obtained from the pre-post program evaluation survey indicate that the program was successful and met its intended learning outcomes. Findings from the interviews complemented the survey results, providing some indication of longer-term impacts of the program on participants. Participants described the connections and network of peers they gained, increased entrepreneurship and business-related knowledge and skills, and increased confidence and/or self-efficacy as key takeaways from the program.

## **Introduction**

Engineering education aims to prepare students to meet the complex interdisciplinary challenges facing the world today. Undergraduate engineering curriculum has evolved to include more active, project-based learning to provide students the opportunity to address "real-world"

problems, such as the National Academy of Engineering (NAE) Grand Challenges for Engineering [1]. The skillset that engineering education teaches students has become broader, expanding beyond the technical to include skills such as communication, leadership, and project management. An emphasis on mindset, or how students approach the interdisciplinary problems they solve, has also become increasingly important. In particular, there have been many recent efforts focused on helping students to develop an entrepreneurial mindset. Institutions in the Kern Entrepreneurial Engineering Network (KEEN), for example, aim to develop students who approach the world with curiosity and develop connections between different types of people and information in order to identify and pursue opportunities to create real value for society [2]. The NAE Grand Challenges Scholars Program (GCSP), a co-curricular program inspired by the NAE Grand Challenges for Engineering, also recognizes the need to prepare engineering with a broader skillset and mindset to address the complex global Grand Challenges facing society in the 21<sup>st</sup> century. Specifically, the NAE GCSP identified five competencies future engineering leaders need: Talent, Multidisciplinary, Viable Business/Entrepreneurship, Multicultural, and Social Consciousness. The NAE GCSP network continues to grow nationally and internationally, with NAE GCSP currently implemented at more than 70 institutions [3].

A variety of curricular, co-curricular, and extracurricular activities have been developed to prepare engineering students with the skillset and mindset needed to address society's needs. As mentioned above, recently, there has been an increased focus on preparing engineers with an entrepreneurial mindset, helping them to develop viable ideas that will create real value for society. The NAE GCSP has also gained a lot of momentum in recent years, working to develop students with a global interdisciplinary perspective, entrepreneurial mindset, and social consciousness to complement their technical skills. This work aims to integrate these two movements together, creating a short-term project-based summer entrepreneurial experience focused on solving problems related to the NAE Grand Challenges. Specifically, a three-week project-based summer program was developed for students in the NAE GCSP, with the goal of helping students to develop an entrepreneurial mindset, gain business and technical skills, and recognize the various societal challenges and impacts related to engineering solutions. This program also aims to fill another gap identified by the program development team, to provide students in the NAE GCSP an opportunity they rarely have, to meet, collaborate, and develop connections with other students in the GCSP from across the nation. This paper will describe the program design, implementation, and results of the program obtained from a pre/post program evaluation survey and follow-up interviews with participants.

## **Literature Review**

In 2008, the National Academy of Engineering (NAE) announced 14 specific goals for engineering in the 21<sup>st</sup> century, representing a vision for “continuation of life on the planet, making our world more sustainable, secure, healthy, and joyful” [3]. The Grand Challenges Scholars Program (GCSP) was developed by the NAE in 2009 as a means to promote an engineering education that is supplemented with global education and an awareness of social skills relevant to solving the Grand Challenges. As a supplement to the engineering curriculum, college students must achieve five competencies through the approved pathways at their universities. These five competencies, defined by the NAE GCSP, are:

1. Talent Competency: mentored research/creative experience on a Grand Challenge-like topic
2. Multidisciplinary Competency: understanding multidisciplinary of engineering systems solutions developed through personal engagement
3. Viable Business/Entrepreneurship Competency: understanding, preferably developed through experience, of the necessity of a viable business model for solution implementation
4. Multicultural Competency: understanding different cultures, preferably through multicultural experiences, to ensure cultural acceptance of proposed engineering solutions
5. Social Consciousness Competency: understanding that the engineering solutions should primarily serve people and society reflecting social consciousness [3].

Each university in the NAE GCSP network creates their own GCSP requirements through which they utilize available university resources and opportunities to support their students in achieving all five competencies. These requirements may include coursework, extra-curricular opportunities, other organized programming, or approved individual experiences. Donaher et al.'s survey of 35 GCSP programs across the US highlighted various ways in which programs are structured to meet the competencies [4]. There is no stated level of minimum engagement defined by the NAE GCSP that must be met to have students complete work towards a competency; this is left to the discretion of the university. This creates variability in the time students at different institutions may devote to a single competency, ranging from participating in a school club or a 1-credit class, to completing up to 6 credits worth of classes or programs.

Large institutions may be able to offer multiple student opportunities to develop business and entrepreneurship skills. As an example, students at Arizona State University can participate in startup accelerators, startup workshops, entrepreneurship classes, or even earn an entrepreneurship minor [5]. In order to meet the Viable Business/Entrepreneurship competency of NAE GCSP, students at different universities may participate in a variety of opportunities including enrolling in entrepreneurship or business classes, competing in business competitions, or starting an entrepreneurial venture [3].

An analysis of e-portfolios from GCSP students at Worcester Polytechnic Institute (WPI) revealed that while many students reflected approximately evenly on curricular and extra-curricular experiences in their e-portfolios (55 and 45% respectively), they were most likely to reflect on coursework to meet the viable business and entrepreneurship competency. Of the 14 e-portfolios analyzed, 11 (78%) reflected on a specific course experience as a part of their viable business/entrepreneurship competency [6]. While many of the GCSP competencies can be met via coursework, Gerhart advocates for offering summer experiences for university students as an alternative to coursework [7]. Specifically, offering summer experiences alleviates the need for students to take additional coursework outside of degree requirements that may be challenging to fit into student schedules already filled with academic rigor. Many college students already participate in Research Experience for Undergraduates (REUs) or other undergraduate research opportunities, or obtain an internship with a company during their summer semesters. These summer opportunities develop not only valuable skill sets for academic and career development, but may also help students achieve the various GCSP competencies.

Examples of existing summer programming for university students not related to undergraduate research are limited. Many programs identify themselves as summer enrichment experiences or summer intensive experiences, shying away from the term “camp” which is traditionally used for K-12 student programs. Lawrence Technological University created a 1-week summer program for current undergraduate students from multiple institutions that emphasized creativity and innovation techniques [7]. While similar to a course offered by the university, assessment showed that both the course and the 1-week summer experience were successful in meeting learning objectives related to creativity and problem-solving [8]. The program was only held for three years and ended due to a lack of additional funding.

While multiple summer programs emphasizing the connection between engineering and entrepreneurship exist or existed at one time, the programs tend to be targeted toward middle or high school students. Recent offerings of these types of programs include the Invention Bootcamp at the University of Portland [9], the Summer STEM Makerspace course at the Cooper Union [10], and the LaunchX summer programs offered at multiple universities [11].

Examples of summer programs for university students focusing on entrepreneurship include a 2-week summer experience offered as a part of the Frank Fellows program at the University of Washington [12], a 6-week research experience which included entrepreneurship at North Carolina A&T State University [13], a 6-week Summer Innovation Internship hosted by UC Davis [14], and a 10-week REU experience hosted by the University of Connecticut [15]. Another innovative program was a program in China that included an internship focused on entrepreneurship within a summer study abroad experience [16]. Most of these summer programs assessed the impact of the program on developing entrepreneurship skills, mindset, or awareness with pre/post participant surveys. As an alternative to a summer program, Bucknell University ran the KEEN Winter Interdisciplinary Design Experience (K-WIDE) for ten days over winter break as an entrepreneurial experience [17]. While the program theme for 2012 was one of the NAE Grand Challenges, it does not appear that was a requirement for the K-WIDE program as a later theme was “human weight.” The program appears to have been last run in 2016 based on available web media [18].

With student schedules already filled with required course credits, we proposed the idea of an intensive summer experience, similar to an REU but in shorter duration, through which students across the United States, and possibly the globe, gain valuable skills and experience toward the Viable business/entrepreneurship competency of the GCSP program. As none of the various profiled summer programs incorporating entrepreneurship competencies with engineering directly related to the NAE Grand Challenges or the field of sustainability, there was an identified gap that the program could fill. This program aimed to provide NAE GCSP students the opportunity to collaborate with each other to gain and apply an entrepreneurial mindset and related skills to develop viable solutions to fulfill a client’s needs related to the Grand Challenges theme of Sustainability.

### **Program Design: GCSP Entrepreneurial Experience**

In June 2019, Arizona State University (ASU) hosted 25 students from 13 institutions across the United States and from Australia as part of a three-week summer immersive experience, the

“2019 GCSP Entrepreneurial Experience”. The program was targeted towards undergraduate engineering students entering their 2nd year in the Fall 2019 semester; the 2019 cohort included: 13 students entering their 2nd year, 10 entering their 3rd year, and 2 entering their 4th year or higher. These students explored the NAE Grand Challenges theme of sustainability throughout this program, with a key goal of making progress towards the Viable Business/Entrepreneurship competency of GCSP. Official progress toward the GCSP competency was given at the discretion of the GCSP directors at the students’ home institutions.

The GCSP Entrepreneurial Experience summer program had eight program objectives for participants:

1. Explain some of the many societal, technological, economic, political, and environmental challenges and impacts relating to the Grand Challenge theme of sustainability
2. Express curiosity around sustainability solutions
3. Utilize design thinking and data from multiple sources to develop solutions
4. Create and explain the value of ideas from a business perspective
5. Utilize the Summer Entrepreneurial Experience as a stepping-stone into other GCSP activities and programming
6. Meet and connect with GCSP students from other institutions who share similar interests
7. Observe and experience sustainability work being done in the private, public, and non-profit sectors
8. Develop transferable skills for academic and professional experiences

Throughout the three-week program, participants collaborated on a team project to research, design, and build a sustainable product or service prototype and business plan. The three weeks of curriculum followed a cyclical structure, which introduced each topic via a mini-lecture, followed by a theoretical or hands-on activity allowing the student teams to practice applying the content, and concluding with time for teams to apply the various topics to their specific project. The cyclical structure allowed students to apply the lecture to a simplified case to practice the application of the concept before applying it to the main complex challenge each team was working on in their project.

The first week of the program focused on project identification and human centered design practices including customer discovery. On the first day of the program, local professionals (serving as project clients) visited campus to “pitch” their problems to students. Students were then given the opportunity to choose their project and form teams of 3-5 members based on their interest areas. Selected projects included: recycling porcelain from toilets, creating value from excess organic citrus waste, creating viable recycled plastic products, sustainable parking lots, automated composting system, and reusing/recycling solar panels. For the remainder of the first week, students learned and applied several concepts including identifying pain points of customers, problem identification, social contexts, specification development and interviews, value proposition canvas, surveying, competitor analysis and business model canvas. Several teams conducted site visits to their clients during the program, along with virtual check-in calls. The clients were real industry contacts that presented problems their company was facing which student teams focused on creating solutions/processes for in their projects. To aid in the experience, each student team had two external mentors, an engineering and a business mentor, throughout the experience that provided additional in-depth guidance on their engineering design

and business practices. Student teams met in person with their mentors once per week and also met virtually as needed.

The second week emphasized minimum viable products, prototyping and testing environments, secondary stakeholders and experts, client feedback, budget creation, investor/business funding, and technical skill sessions. The third and final week's topics included communicating value/impact, marketing, presentation basics, and prototype building time for the student teams. Technical skills sessions were offered during the program to support students' development of their project prototypes. These sessions included: 3D printing, wood and metal work, Arduino, and cardboard prototyping.

The teams practiced their project/solution pitch during each phase of the experience leading up to a final pitch presentation to a panel of judges. At the conclusion of every week the student teams practiced their project pitch to their mentors and faculty for feedback. This allowed them to focus their pitch on the phase of their design/solution they were currently in during the experience, and helped them to further develop their communication skills. At the conclusion of the program all students presented their five-minute pitch for their final product and business design to a panel of judges. Several of the industry clients were in the audience for the final pitches as well.

Additional off-campus activities and experts were incorporated into the three-week program to complement the students' curricular and project-based learning experiences. Through site visits, guest speakers, and tours, participants learned about business practices across industry, non-profit, governmental, and start-up ventures to obtain a broad view of entrepreneurship and sustainability. Participants explored Arizona with trips, site visits, and lab tours in the local and regional area to give context to campus lecture and activities. A visit to the Grand Canyon National Park, coordinated in collaboration with the Grand Canyon National Park Conservancy Field Institute, introduced students to federal government business models, and allowed for conversations about factors unique to the public/government sector including the impacts of a government shutdown and federal conservation efforts.

A tour of Chase Field, the Arizona Diamondbacks baseball stadium and a member of the Green Sports Alliance, was also given to participants of the program. Chase Field implemented a wide array of sustainability features to accommodate the thousands of guests who visit the stadium. Students traveled to the stadium using the electric rail system to further understand the benefits of implementation of public transit. Students observed and utilized the sustainability measures of the venue including: recycling bins, internal recycling program for vendors, Vertical Urban Garden, staff uniforms composed of recycled materials, solar panel pavilion, heating and cooling system for the stadium, implementation of artificial grass on the field, grease from concessions recycling and biodegradable diesel program, left-over food donation program, and the stadium's compost program. Students also visited the Laboratory for Algae Research and Biotechnology at ASU where they learned about the lab's work in producing renewable energy, biofuel production, crop protection, wastewater and nutraceuticals.

Zero Mass Water, a local startup from ASU, provided a seminar on research and development of new products at the start-up level. Zero Mass Water has developed an off-grid water purification device using solar panels and a catalyst to convert water vapor into potable water. The seminar



explained research practices related to ideation, creation, and experimentation that the startup uses to invent and sell products around the world.

This summer program is part of a broader initiative at ASU supported by the Kern Family Foundation, to integrate Entrepreneurial Mindset (EM) into engineering education. Nineteen of the student participants' travel, lodging, meals, and program costs were funded through this initiative. Six additional student participants were sponsored through their home institutions.

Faculty and staff effort for development and implementation of the first iteration of this program included curricular and logistical planning throughout the spring semester as well as implementation of the program in June 2019. The faculty director for the Grand Challenges Scholars Program at ASU oversaw the planning and implementation of the experience. Two additional faculty members led the program itself and developed the materials and curriculum, and staff members provided logistical planning and support. The team also partnered with representatives from the University Office of Evaluation and Educational Effectiveness (UOE) for assessment creation, data analysis and reports. The program also employed 2 student workers to support the faculty leads during the program in June. While the first iteration of this program required a heavy lift for the members involved, the content and resources created allow this program to be an easier implementation for any institution in the future. As the curriculum, activities, and other materials have already been created, the workload for another host team to adapt and implement is vastly reduced.

## **Assessment Methods**

### *Pre-Post Program Survey*

Evaluators created a pre-post survey in collaboration with program leadership to measure the program's success based on the intended outcomes of the program. A hard-copy survey was administered to all 25 participants at the beginning and end of the three-week program. The pre- and post-survey questions regarding skills and attitudes were identical to allow for comparisons. Students were asked about their ideas of the Grand Challenge theme of sustainability; about their attitudes regarding their own skills related to sustainability, business, and entrepreneurship; and about their level of awareness of sustainability-related work and practices. Students also rated their confidence in specific entrepreneurial and business-related skills, such as designing stakeholder or customer surveys and defining a minimum viable product. Paired-samples *t-tests* were used to examine self-reported change over the course of the program.

### *Follow-up Interviews*

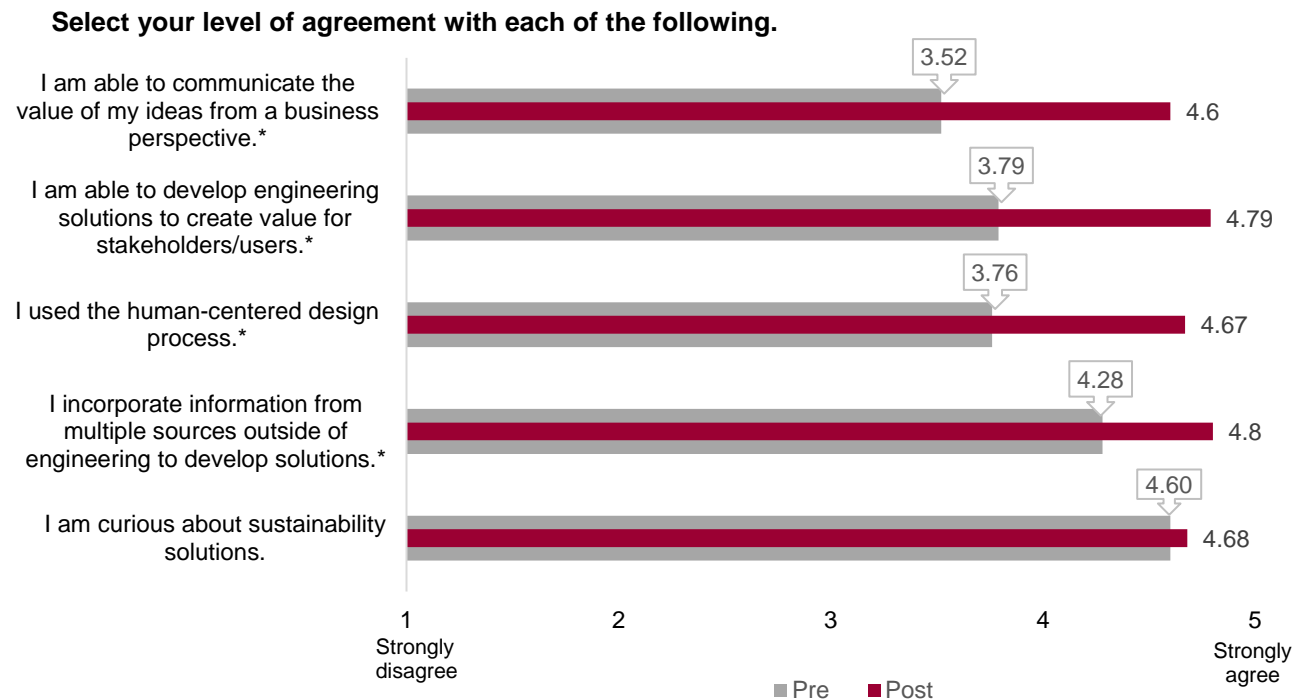
Six months after the summer program, evaluators were able to contact 24 of the 25 participants and invite them to participate in a brief 15-minute follow-up interview. Of the 24 individuals contacted, 13 participated in interviews for a response rate of 54%. The interviews were designed to gain a better understanding of participants' experiences within the program and its longer-term impacts on their knowledge, skills, and college or career goals. Questions focused on connections made with other GCSP participants during the program, the application of skills, current educational or career plans, subsequent involvement with the GCSP program or related

activities, and participant reflections about what they gained by participating in the summer program. The data from the interviews were recorded, transcribed, de-identified, and coded.

## Results: Pre-Post Program Survey

### *Change in Attitudes, Knowledge, and Skills*

Curiosity, Connections, and Creating Value make up the 3C's of Kern Family Foundation's (KFF) Entrepreneurial Mindset [1]. The first five Likert-scale questions on the pre- and post-surveys asked participants to rate their level of agreement with statements about items related to entrepreneurial mindset, including questions about participants' curiosity, knowledge of the human-centered design process, multidisciplinary competency, ability to create value, and capacity to communicate the value of ideas from a business perspective. This group of survey questions utilized a five-point Likert-scale with responses ranging from (1) *Strongly disagree* to (5) *Strongly agree*. Participants also had the option to choose, "I don't know what this means," which was not included in the comparison of scores.



\* Indicates change is significant at the 95% confidence interval

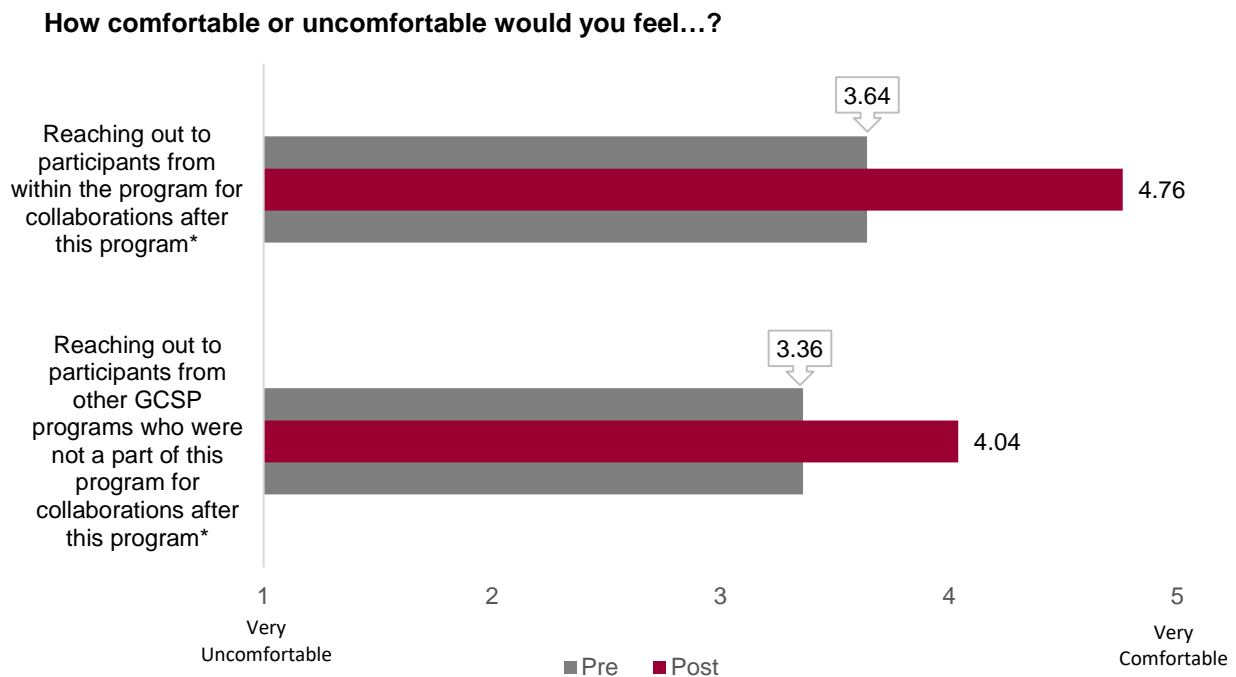
**Figure 1. Pre-Post Survey Mean Change: Entrepreneurial Mindset Skills**

As illustrated in Figure 1 above, participants showed significant increases on all key items related to entrepreneurial mindset,  $t(20-24) > 3.98$ ,  $p < .01$ . However, participants did not show significant change in curiosity about sustainable solutions. The students' high initial curiosity is likely a result of their self-selection into the GCSP Entrepreneurial Experience: Sustainability program.

The largest change was evident for participants' ratings of their abilities to "communicate the value of [their] ideas from a business perspective." Forty-four percent disagreed with or were neutral on the statement prior to completing the program. After the program, 100% of participants agreed or strongly agreed with the statement indicating a large shift in students' self-rated abilities. Additionally, there was a large change in participants' scores regarding their ability to use "the human-centered design process." Prior to completing the GCSP Entrepreneurial Experience, 16% of participants (4 individuals) did not know what that meant. By the end of the program, all participants agreed or strongly agreed with the statement.

*Meeting and Connecting with other GCSP Students*

Participants rated their comfort level with reaching out to other participants within the GCSP Entrepreneurial Experience and also to participants from other GCSP programs who are not part of the summer program (Figure 2). After completing the summer program, participants reported that they felt significantly more comfortable reaching out to other GCSP students who were a part of the GCSP Entrepreneurial Experience,  $t(24) = 6.35, p < .05$ , and also to those who were not  $t(24) = 2.65, p < .05$ .



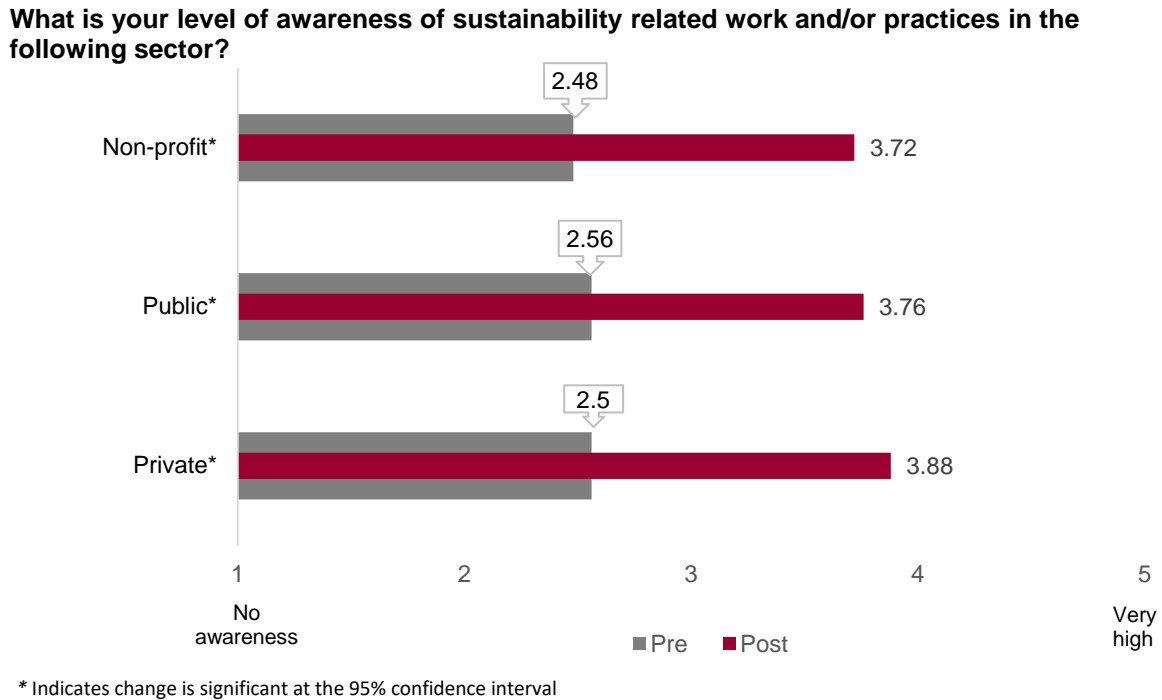
\* Indicates change is significant at the 95% confidence interval

**Figure 2. Pre-Post Survey Means: Meeting and Connecting with Other GCSP Students**

*Awareness of Sustainability Related Work and Practices*

The pre- and post-surveys included a group of questions to assess participants' level of awareness about sustainability-related work and practices in the private, public, and non-profit

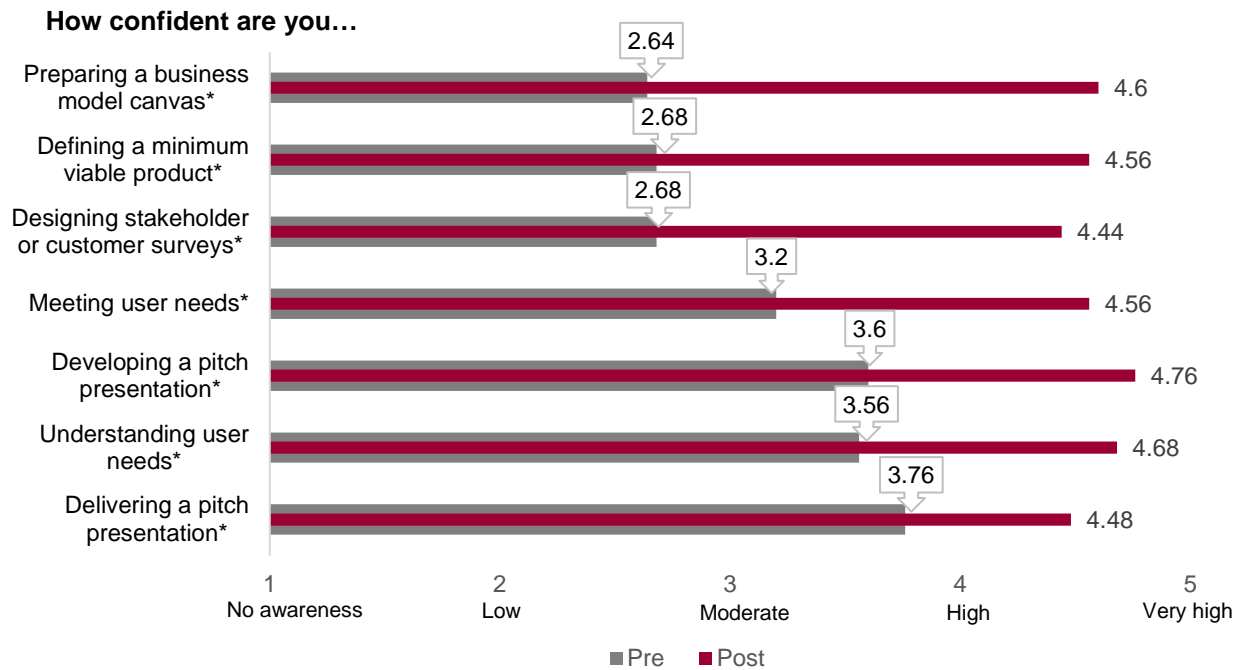
sectors, before and after participating in the GCSP Entrepreneurial Experience program. This was an important question as one of the main objectives of the program was to introduce and familiarize participants with applications of sustainability across the public, private, and non-profit sectors. Comparing the change from pre- to post-survey responses, participants indicated significant increases in awareness of sustainability work and practices for each sector (see Figure 3).



**Figure 3. Pre-Post Survey: Awareness of Sustainability Work and Practices**

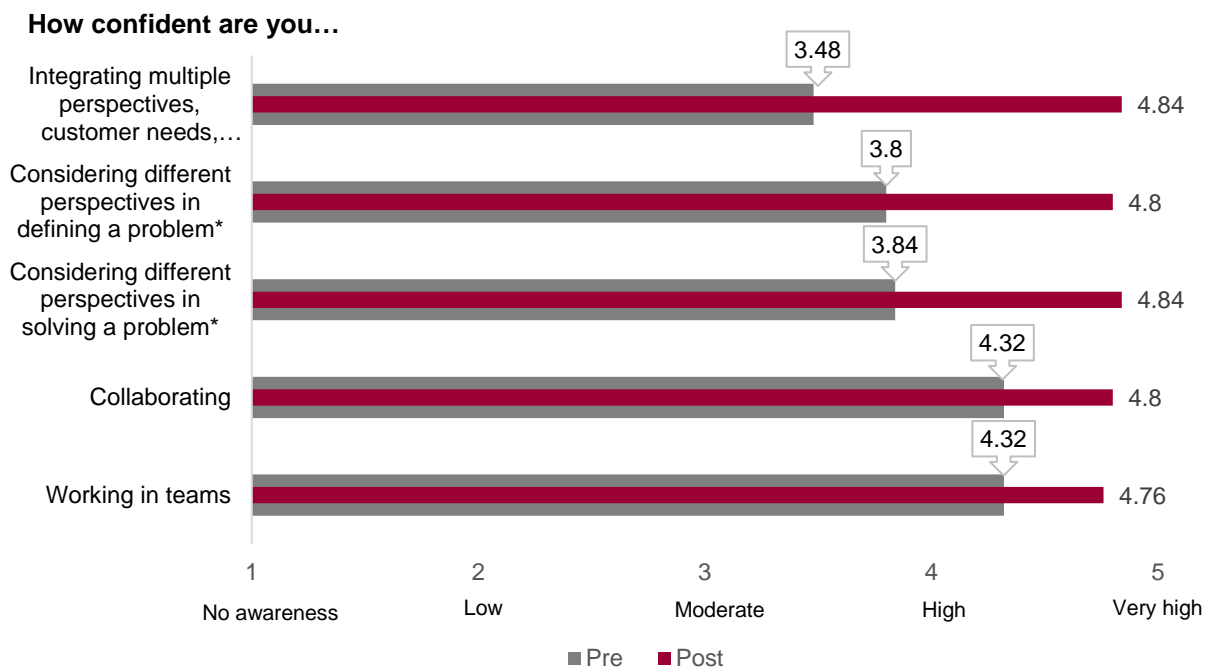
*Business and Entrepreneurial Skills*

GCSP Entrepreneurial Experience participants rated their confidence in business and entrepreneurial skills on both the pre- and post-surveys. These specific skillsets included designing stakeholder/customer surveys, preparing a business model canvas, defining a minimum viable product, developing and delivering a pitch presentation, understanding and meeting user needs, considering different perspectives in defining and solving a problem, and integrating multiple perspectives. Participants also rated their confidence in transferrable skills such as collaborating and working in teams. Overall, individuals’ skillsets in all areas increased after participating in the summer program. With the exception of transferrable skills, “collaborating” and “working in teams,” all increases were statistically significant at the 95% confidence interval ( $p < .05$ ). See Figure 4 and Figure 5 below for details. Students had high confidence in their collaboration and teaming skills at the beginning of the program, as their mean confidence ratings on the pre-survey were well over the scale midpoint ( $M_s = 4.32$ ), leaving little room for additional change in these skills.



\* Indicates change is significant at the 95% confidence interval

**Figure 4. Pre-Post Survey: Business & Entrepreneurial Skills**



\* Indicates change is significant at the 95% confidence interval

**Figure 5. Pre-Post Survey: Business, Entrepreneurial, and Transferrable Skills**

Overall, survey data indicated that the 2019 GCSP Entrepreneurial Experience program met its educational program objectives.

### **Results: Follow-up Interviews**

When follow-up interviews were conducted six months after the program, interviewers were able to extend the understanding of whether and/or how the program influenced participants post-program. Thirteen of the 24 (54%) former program participants contacted submitted to an interview to provide additional information and feedback regarding the program and its impacts.

#### ***Key Takeaways from Summer Program Identified by Participants***

Interviewees were asked to elaborate on the most important things they gained from the Summer Entrepreneurial Experience. The most common themes discussed were developing a professional and/or personal network, increasing knowledge and skills within business and entrepreneurship, and gaining hands-on experience with real clients. Other individuals talked about how participating in the GCSP Entrepreneurial Experience increased their interest in the GCSP or their inspiration and confidence to solve engineering problems.

#### ***Network and connections gained***

Nine of the thirteen interviewees explained that the network and connections made over the three weeks at ASU were some of the most important things gained from the GCSP Entrepreneurial Experience. The quotes highlighted below are a response to the question, “What are some of the most important things gained over the summer Entrepreneurial Experience?”

“Well, I think first and foremost would be friends, connections. So, I think I added 25 more people into my life who I can just say hey I'm running into this problem, do you know? Or I can say mind helping me? It's a big thing, because sometimes even though you can figure it out, you need help from other people. So, I think the first thing would be having those friends who come from different backgrounds, who come from different faculty, and being able to connect to them and say hey I'm running into that problem, can you help me out? Or to collaborate with them on this project and they would be a part of it. I think that is the biggest part for me.” – GCSP1923

“I think definitely the variety of students that participated was really beneficial. That was probably one of my favorite parts was just meeting everybody. I also liked going to different schools. I thought it was really fun to just kind of see all the ASU facilities and see what they work on.” – GCSP 1903

#### ***Knowledge and skills gained***

All participants said that one of the most important takeaways from the 2019 GCSP Entrepreneurial Experience was gaining knowledge and skills related to business, entrepreneurship, engineering, or sustainability (Table 1). Over half of the interviewees (seven people) specifically mentioned presentation skills, five talked about gaining business skills, and

two discussed increasing their knowledge about entrepreneurship. One person talked about how they became more conscious of the environment and being efficient with the resources they utilize, while another explained how the program increased their self-efficacy to pursue their goals.

**Table 1: Reported Gains from the 2019 GCSP Entrepreneurial Experience**

“What are the most important things that you gained from the Summer Entrepreneurial Experience?” (n=13)		
Theme	Count	Example
Presentation skills	7	"I definitely think it helped my presentation skills... I think kind of working and acting like we were pitching, it just seemed so professional. And, I don't know if I would have been ready to do something like that on my own or without the three weeks."
Business skills	5	"I would say an understanding of how to set up an effective business model would be...it's pretty important."
Entrepreneurial knowledge	2	"I kind of came into the entrepreneurship camp as well just to learn about what was entrepreneurship, and I was quite surprised that entrepreneurship is basically a key component of engineering."
Self-efficacy	1	"There's something about demystifying something that really makes it accessible and maybe inspires you to pursue it further, and that's definitely what happened. So in that way, it made this dream of, of paving my own way, moreover in the world, more of a reality...It just makes you realize how much you're capable of or how much...I think there's these unarticulated, but also sort of non-existent limitations that we place on ourselves. And then this program, in a lot of ways...demonstrated that there aren't as many barriers as you might think or that the barriers that do exist are not the ones that you imagined."
Sustainability perspective	1	"Other thing is I think I became more concerned about the environment. Right after I came back on the three-week experience I started thinking about, I think kind of personally, how I can be more efficient with the resources that I use."

*Other benefits: Hands-on experience, job opportunities, and getting to know [State]*

Aside from gaining a network, knowledge, and skills, participants discussed other benefits of the program. Some specifically talked about the hands-on experience they gained, and how it was different than any other experience they have had. A couple of people believed the experience led to more interviews or call-backs from work positions for which they applied. Finally, some individuals were appreciative of the activities that took place outside of the classroom and of ASU. See below for excerpts.

Two individuals said that the greatest takeaway from the 2019 GCSP Entrepreneurial Experience was the hands-on experience gained:

“...just also working with my group to create this product and finding out a way to sell it. I had just never done that before and I thought that was really cool and interesting.” – GCSP1904

“...I definitely learned a lot about the business aspect for sure. And it was really interesting getting to work with local companies.” – GCSP1920

Two participants explained that they believed their experience within the three-week summer program was beneficial in terms of obtaining job interviews or positions:

“When they heard about my summer experience, I got on-the-spot interviews, so I think that was one of the biggest takeaways for me.” – GCSP1921

“I mentioned [the summer experience] and the skills I used and the project just working on a team and presenting it as my application for that project, which was really helpful I think because it gave me definitely a step-up for working on an additional project more than I had done at school so far.” -- GCSP1903

Finally, two people mentioned that one of the most important things gained from the GCSP Entrepreneurial Experience was the experiences outside of the classroom:

“The other one I guess is just like the experiences outside of the classroom that we had being in Arizona. We had a lot of fun and got to take cool trips up to the Grand Canyon and go to the Arizona Diamondbacks baseball game and we did hiking on the weekends and during the weekdays and really got to see Arizona.” – GCSP1917

“I guess the last thing I would say is just getting to know Arizona, Phoenix, Tempe, as somebody who hasn't been there I think...[it] was a big plus to get to know that place.” – GCSP1905

### ***Longer-Term Impacts***

#### *Approach to engineering*

All interviewees said the program had an impact on their approach to engineering. Most commonly, individuals' perspectives changed to include entrepreneurship, business, or sustainability points of view. For example, almost half of all interviewees talked about their increased knowledge and/or interest in entrepreneurship within engineering or how they now view engineering and engineering solutions within a business context or perspective. Other individuals explained how their understanding of engineering improved and how their approach to problem-solving changed after completing the program. A common theme was considering human-centered design; many said they had not considered the perspective of the consumer or customer before this program. Others more generally said that their understanding of engineering improved or that they gained an appreciation for sustainability and using resources efficiently. Finally, one person said that the entrepreneurial experience helped them “collaborate with other disciplines.”



**Table 2 Interview Excerpts: Change in Approach to Engineering**

<p><b>“What effect, if any, did the Summer Entrepreneurial Experience have on the way you approach engineering, or in other words, how did it affect your mindset?” (n=13)</b></p>		
<b>Code</b>	<b>Count</b>	<b>Example</b>
Increased knowledge-entrepreneurship	6	<p>“The way that the camp really changed my mindset was that before I had taken Engineering 101. That's like the class everybody has to take for their major. I had taken FSE 150, the introduction class and I've done all these classes, and it kind of never clicked on how like the engineering method, these engineering methods kind of building machines and how they're built for the customer, it never really clicked for me...doing it through the camp finally made sense because they brought the entrepreneurial part into it, and why are you making a product if it's not for a customer and you're not fitting it to the customer's needs? I think the camp really helped me understand that part and everything kind of clicked into place, and I really did have the ability to practice it.”</p>
Business perspective	5	<p>“I think that before, I really did not think about engineering through like a business context at all. I just thought of it more as like something like you consult for, like a company. But it really helped me see that you can actually make your own business within engineering. So, you need to be cognizant of business aspects, which I wasn't planning on being.”</p>
Approach to problem-solving	4	<p>“Yeah, I guess that entrepreneurial mindset of really taking a look at the bigger picture and the problem at hand, really digging into why does the problem exist and where does it come from and who does it impact and all these types of questions that you look at when you're initially solving a problem and that helps you look at maybe what your business or what that's trying to solve. And that's what we learned over those three weeks. So, I guess I apply that pretty often now and just makes me think more in-depth about problems.”</p>
Understanding engineering	4	<p>“Yeah, so before I worked on this program, project, I never really had the experience of like building something tangible. So, I just thought that was really cool to kind of work hands-on because I'm only a sophomore so I haven't like been in any big projects at my school. But this program really like helped me to see what engineering was like on the big scale”</p>
Human-centered design	3	<p>“The other thing is I think I would have never thought about going to the public, or going to the consumer first and asking questions like hey what are you looking for? I think that's one of the biggest parts, understanding a consumer before making something.”</p>
Sustainability perspective	2	<p>“The other thing is I think I've become more environmentally concerned about what I make or what I do, not just as an engineer, but as a human being. Every time I think about things that I do, I think about is it going to affect the environment or not? And if there are other ways which reduces impact on the environment I try to do those things. So, I think, as an engineer, I think I became more like I started seeing things in a bigger-picture way. I started thinking how the consumer will react and what are their needs, and how I can build something that is more sustainable for the environment. And on a personal level, I started thinking about how can I reduce my own impact on the environment?”</p>

“What effect, if any, did the Summer Entrepreneurial Experience have on the way you approach engineering, or in other words, how did it affect your mindset?” (n=13)		
Code	Count	Example
Interdisciplinary collaboration	1	“It really helped me to collaborate with other disciplines because in our group there was civil, and biomedical, and electrical. And at school, all I really do anything with is mechanical, for working, because you haven't done any interdisciplinary projects yet. So, it really helped me see how other disciplines can help, so there are long projects.”

### *Application of knowledge and skills*

The evaluators asked participants if they have applied any of the skills learned in the 2019 GCSP Entrepreneurial Experience, and if so, how they applied them. All but three interviewees said that they have applied the knowledge and skills learned over the summer outside of the program (two of the three said they will apply what they learned next semester in related classes). The most common theme among responses was that participants utilized business and entrepreneurial knowledge and skills in related school projects (n=4). For example, the participant below discussed how they started taking an ethics class on chemical engineering this term, and they were familiar with the ethical standards because of the GCSP Entrepreneurial Experience:

“I’m taking an ethics class on chemical engineering this term. When they talk about, when there are guest lectures about patterns and they just talk about ethical standards or how it works in real industrial operations, it just gives a really good understanding, because I have the previous knowledge from the program, which enhances my understanding a lot.” – GCSP1902

Some individuals mentioned they applied specific skills, such as prototyping (n=2), presenting (n=2), or communicating in a professional setting with either clients or with colleagues who are “higher in seniority” (n=2):

“I think for me I’ve never been a part of a group where we actually built a device, so I think I’ve become more focused on building prototypes, which is really new for me. And right now, I’m working on a project for one of my classes. And I think that the exposure that I got in those three weeks about ordering different parts and putting them together, and seeing if that works or not, and building those prototypes, I think that became a big learning lesson for me. Other than that, I think the main three things that we learned was understanding the need of people, building a prototype, and then putting that out in a market.” – GCSP1923

“When we’re talking about giving a pitch, I guess the template they provided was really helpful. I know where to start and what are the important points I should hit throughout the way. I guess the skills they provided for pitching is really important, and it’s really applicable in my life.” – GCSP1902

“I think probably the most useful thing that I learned was communication. I've recently had the opportunity to explore more opportunities for this summer as far as jobs are concerned and being able to communicate on a professional level with probably people who were higher in seniority than me, which I had to do a lot during that program, helped me.” – GCSP1908

Finally, two participants explained that they advised other students on concepts learned over the summer:

“Well, I got a job as a peer coach over the summer as well. So, with the experience from the entrepreneurial camp, I think I've been able to understand a lot more about the projects that people do in, say [Introduction to Engineering]...I have a better understanding of the business side of things, the project that they're doing in terms of saying, finding a customer or working with a contact or having some sort of competitor analysis...So it's given me a better understanding of essentially being better able to relate with students and then from there, giving better advice on how to make their experiences even better or making them.” – GCSP1918

“I also work for the engineering school at my institution...I'm a PA advisor, so I advise students on their projects and stuff, so when they come to me for different sorts of advice, I'll refer to that booklet and to the different steps of how to develop your idea into an actual business plan slash product. But then in that aspect, it has really helped me.” – GCSP1901

### *Change in future plans*

In the interviews, individuals discussed whether their educational or career plans changed as a result of completing the 2019 GCSP Entrepreneurial Experience: Sustainability (Table 3). Commonly, individuals said the experience increased their interest in either business, engineering, entrepreneurship, or sustainability, or motivated them to continue on their decided path within those areas. Specifically, people talked about becoming more interested in business (n=3), in business and entrepreneurship (n=1), in sustainability (n=1), in engineering (n=1), one in “the energy sector” (n=1).

**Table 3 Interview Excerpts: Change in Career Plans**

“What effect, if any, did the Summer Entrepreneurial Experience have on the way you approach engineering, or in other words, how did it affect your mindset?” (n=13)		
Code	Count	Example
Confirmed plans	7	“So, it has kind of expanded my interests more so. It hasn't really changed my career path in general, but I think it's made me more interested or at least have a better understanding of processes that go into, or processes that contribute to the engineering projects that I might do.”

“What effect, if any, did the Summer Entrepreneurial Experience have on the way you approach engineering, or in other words, how did it affect your mindset?” (n=13)		
Increased awareness of opportunities	2	“They had a few people talk, I think one of them was Zero Mass Water. They came in and spoke to us and I was, “Wow, this is amazing.” And, just things like that I recognize that there's a lot of different opportunities for sustainability beyond what I think I had ever generally thought. And, it made me a little bit more passionate to go out and try and get that job like now rather than say, “Oh, that's something I'm going to work towards...” So, that was one thing that kind of made me recognize that those jobs are everywhere and it's not this farfetched dream.”
Increased interest-business	2	“I may look towards getting a job with the small business development center. I guess the program helped spark my interest in that.”
Change in industry	2	“Moving forward, my goals have definitely changed. I no longer want to go into industry. I have an internship with a startup right now at the university. So, let's see how that goes. I want to work for startups and small companies because I feel like that's where you learn the most.”

Some interviewees said that completing the 2019 GCSP Entrepreneurial Experience influenced them to change their educational plans by adding or switching a major or minor in their program. For others, participating in the program confirmed that they are on the correct path. Uniformly, the program impacted individuals by helping them become more aware of their own interests. For example, one person added a major in finance, because they realized they liked finance after taking on that role in their group over summer:

“Definitely. It actually had a big impact [on educational plans]. Before, I was just majoring in chemical engineering, but now I'm also majoring in finance as well as chemical engineering because I wanted to learn how financing for different projects works. So, when I got into that [role] I also started liking the field of finance a lot, so I'm also majoring in that now” – GCSP1901

Others talked about how the program influenced their academic paths by increasing or solidifying their interest in engineering, entrepreneurship, or sustainability:

“I really liked the sustainability aspect of it. And, I did mention that, and I've kind of changed course on what classes I've taken. I have a minor [in] sustainability but that's definitely become more passionate to me after I heard from all the different students, all the different things they work on at their schools and just different things like that.” – GCSP1903

“I'm already in entrepreneurship focus. So, I had an intent on possibly going down an entrepreneurship path already. But it definitely hardened those ideas in me.” – GCSP1908

A couple of individuals explained that the GCSP Entrepreneurial Experience influenced their decision to change their career plans. Specifically, two people talked about changing industries and two discussed an increased awareness regarding their opportunities. The majority of interviewees (n=7), however, said that the experience confirmed their plans or made them more enthusiastic about their career choices.

### *Continued Connections and Collaborations with Other GCSP Participants*

When discussing the connections made over summer, all thirteen interviewees said that they remained in contact with their teammates after the GCSP Entrepreneurial Experience finished. Most interviewees (10 of 13) said they became friends with their teammates and kept in touch for personal reasons, and some said that they kept in touch for professional reasons as well. For example, the participant below explained how they gained both friends and a professional reference over the summer:

“I've stayed in contact with them, but we haven't done any projects or anything together... We actually just became really good friends through the program so we just kind of like stay in contact mostly and I did ask one of them to be a reference for me for a job.” – GCSP1920

A handful of participants (n=5) explained that they attempted to continue collaborating on their summer projects (n=3) and on new projects (n=2) with their teammates after the summer experience. Two teams successfully submitted applications to a competition or a poster for a competition. Others noted that the distance and time constraints were limiting factors to continuing their collaboration after the program ended, as illustrated by the quotes below.

“My group was working on the PepsiCo project, actually there's a conference about PepsiCo after the program in California. So, we submitted our poster. That is the final collaboration we had, but we did not get selected. After that we just keep in touch but not really collaborating anymore.” – GCSP1903

“We had three meetings after the experience, but unfortunately, those meetings never really had anything follow through, and so we're not collaborating anymore. I think the main reason that it was very hard to me was that it was different time zones. Everybody was in a different place. Another reason was that we were super, super busy...It's my junior year. I have work, and I'm also part of a large student organization, so stuff caught up to me and unfortunately, I couldn't make the time.” – GCSP1921

### *Increased Participation in GCSP*

Eleven interviewees said they continued to participate or participated more frequently in GCSP after completing the Summer Entrepreneurial Experience. It was common (among 6 of 13 interviewees) for participants to serve as formal or informal ambassadors for the GCSP program, encouraging other students to apply for and complete the program. The quotes below highlight these themes:

“I've been telling a lot of my students that are in the GCSP program, they're sophomores and freshmen, ‘Stay in the program. It's an amazing experience. You think that entrepreneurship is important to engineering, but it's actually the most important component you'll ever need to learn.’ GCSP does really make a well-rounded engineer, and that's what, in the end, the industry wants. They want you to have all of these experiences, so ultimately give you a perspective about a holistic perspective.” – GCSP1917

"...I've put a lot more stock into that program as a whole and tried to recruit other people here at the university to join also because I think it's a very valuable program." – GCSP1908

Additionally, one participant explained they had been working with their professor to implement it in the school, and will likely continue efforts in the spring semester.

"Yeah, so my school actually doesn't have the Grand Challenge Scholars Program. We were kind of just intrigued in like finding out about it and trying to start it at our school. So, like last semester we had meetings about it and they chose to send me to this program to kind of like see actually what it's about because none of us had really heard about it except our instructors. So, this semester I emailed my instructor with my experience but we all haven't been able to meet, so next semester we're probably looking to meet and discuss like starting it at our school." – GCSP1904

Other ways participants stayed involved included attending GCSP events and completing GCSP learning components.

Overall, participants were pleased with their experiences within the 2019 GCSP Entrepreneurial Experience and felt that it was a beneficial experience. The interview data extended what previous pre-post surveys had shown in summer 2019. Specifically, participants increased their knowledge and interest in business, entrepreneurship, and sustainability, and they later applied the skills learned over the summer in school, work, or other GCSP projects. Interview participants expressed a change in attitudes and an improved understanding of engineering, with the majority saying they incorporated an entrepreneurial, business, and/or sustainability perspective into their approach to engineering. Participants' attitudes about their future educational and career plans were also impacted by the GCSP Entrepreneurial Experience: five participants changed their educational plans by adding or switching their major, for example, and seven participants said the experience further solidified their career plans. Finally, after completing the GCSP Entrepreneurial Experience, the majority reported they were inspired to become more involved within the GCSP. Many individuals became formal or informal ambassadors for the program, encouraging other undergraduates to participate.

## **Discussion and Conclusion**

This work aimed to assess the impact of a three-week immersive summer entrepreneurial experience on NAE GCSP student participants. The GCSP Entrepreneurial Experience was designed to be a project-based learning experience that helped students develop an entrepreneurial mindset, gain entrepreneurship and business-related skills, and gain experience applying a human centered design process to develop a viable engineering solution for a real client. The program also aimed to help students develop an awareness of sustainability related work in the public/government, private, and non-profit sectors. Finally, another important program goal was to provide NAE GCSP students with the rare opportunity to develop connections to other NAE GCSP students from institutions throughout the U.S. and world.

Results from the program evaluation survey indicate that all program learning outcomes were met. Specifically, the participants' perceived ability to apply skills related to the entrepreneurial mindset, such as using the human centered design process to develop solutions, and the ability to develop solutions to create value for stakeholders/customers, significantly increased during the

program. The largest change was observed for students' perceived ability to communicate the value of their ideas from a business perspective, indicating the program may have improved transferrable skills such as communication skills as well. Participants' confidence in their skills related to business and entrepreneurship also significantly increased, with the largest changes occurring in skills related to specific tools or techniques such as creating a business model canvas, developing a minimum viable product (MVP), and implementing stakeholder or customer surveys. According to survey results, students also experienced an increased awareness of sustainability work and/or practices in public, private, and non-profit sectors, meeting another goal of this program. Interestingly, as a result of this program, students also reported a significant increase in their comfort with connecting to other GCSP students, including both participants and non-participants of this summer program.

Findings from interviews with participants confirmed and extended the results obtained from the survey. When asked what they gained most from the experience, students often mentioned outcomes related to the program goals including developing a professional and/or personal network, and increasing knowledge and skills related to entrepreneurship and/or business. However, they also mentioned other important gains including experience in working with real clients, an increased interest and involvement in GCSP, and increased confidence and inspiration to solve engineering problems. Participants also indicated that this program helped them to confirm their interests in engineering and/or find new interests related to engineering and entrepreneurship/business, which is an unintended positive outcome. It is possible that providing students the opportunity to explore new topics (e.g. business and entrepreneurship) and to work on projects they chose based on their interests may have contributed to students finding and confirming their interests. Another finding that stood out from the interviews was students' discussion of how participating in the program impacted the way in which they approach engineering, with several students specifically stating how they now view engineering problems from a business or entrepreneurial perspective. This indicates that the program may have been successful at enhancing students' development of an entrepreneurial mindset, which was one of the key goals of the GCSP Entrepreneurial Experience.

The perceived gains in entrepreneurial skills combined with this evidence of a possible change in mindset indicate that this three-week summer experience achieved the desired outcomes related to entrepreneurship. This study result confirms Gerhart et al.'s findings concerning the value of short-term summer programs in developing skills related to creativity and innovation [7]. It is possible that the multidisciplinary multi-institutional nature of this program may have also influenced students' success in this program, particularly related to developing innovative ideas. Similar to findings by Gerhart et al., participants in the GCSP Entrepreneurial Experience also mentioned, in interviews, the value of working with students with different educational backgrounds and experiences [7].

Although this program was successful at meeting its objectives, there are some limitations and considerations to make for similar programs in the future. First, the applicability of the program results to other summer programs is limited, as the sample size was relatively small and focused on participants in a very specific program (the GCSP Entrepreneurial Experience). Also, although qualitative research provides a detailed understanding of how participants experienced the program, the findings from interviews may not be applicable to a larger population. A limitation to the program itself is the amount of resources required to develop and implement the program. Although the goal was to develop program resources that could be adapted and used at

ASU and other institutions in the future, in order to develop a truly sustainable program that would continue indefinitely in the future, sustainable funding and other resources are required. However, there are other less-resource intensive alternative formats that could be utilized to implement this program. For example, an institution could offer a shorter-term program, or a non-residential program that is located close to multiple institutions. Alternatively, some of the experiences included in this program, such as working with real clients on projects, and collaborating on multi-institutional teams, could be implemented virtually as part of an extracurricular/co-curricular program or course. Based on ASU's experience with this program in 2019, ASU is currently planning for the next offering of this program in Summer 2020 focused on a different Grand Challenges theme. The program will have the same outcomes and will be similar in structure, but will incorporate some improvements made based on feedback received from prior participants. Future plans also include packaging the materials from this summer program and working with other institutions to develop a sustainability plan for this program to ensure this experience can be offered annually to GCSP students, hosted by a different institution each year.

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