



An Evaluation of an Implementation of High School Girls Summer Outreach Camp Converted to an Online Format (Evaluation)

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1. INTRODUCTION

Broadening participation in engineering has long been of national importance. To fulfill this, organizations continue to implement efforts to increase the participation of groups that are historically or systematically marginalized [1]. There is evidence that participation in summer engineering camps impacts increasing interest in STEM fields [2]–[4]. It is shown in [5] that well-organized, experiential summer camps are a good recruitment tool for higher education institutions as well. An example of such a camp is C-Tech², an experiential two-week residential program offered by the diversity office at Virginia Tech. The camp was established in 1997 and is designed and intended for rising junior and senior high school females. The program is typically run as an in-person camp, but with COVID, it had to transition to an online format.

During the summer of 2020, the shift to an online camp environment was made quickly. Based on that first online experience, improvements were made to enhance the camp experience in the summer of 2021. Looking forward to 2022, some of the changes implemented in the online iterations of the program will remain in place due to positive feedback and outcomes we have seen across the past few years.

This summer camp has historically and continues to be driven by a desire to increase student engineering self-efficacy [6], broaden perceptions of engineering [7], and support students' identification of their interests [8] that might align with engineering. As the summer camp shifted from in-person in 2019 to virtual in both 2020 and 2021, these frameworks continued to inspire our decisions.

The purpose of this paper is to describe the transition of the camp to an online modality and additional changes made in the second year of the implementation of the camp in an online modality. In writing this paper, the overarching question we have is: **How did a summer camp experience change in the midst of COVID, and what was the impact of these changes on student experiences?** In addressing this question, the following paper first discusses the process in which the camp shifted to the online format, followed by a description of the summer camp and its key components in 2019 - 2021 with specific attention to the shifts from in person (2019), to online (2020), to the second summer online (2021). The paper concludes by describing changes that the team is keeping moving forward into in-person camp (2022) and beyond, as well as an evaluation of the online camp across the three years.

A. COVID Pandemic in 2020

In response to the COVID pandemic, the full-time staff coordinator and the graduate coordinator met and decided on alternatives to stay aligned with the safety restrictions accompanying the pandemic. Once the in-person component was confirmed by Virginia Tech to be unable to happen, a consensus was reached to shift the camp to a purely online format. The full-time staff coordinator decided this in early April. From April to early May, the full-time staff coordinator conducted a significant amount of research to determine the best structure for this setting,

including webinars with other K-12 camp coordinators, meeting with experts in technology education, on-campus resources, and online resources. Later in the planning process, six weeks before the camp, bi-weekly meetings were scheduled with the undergraduate student staff to offer their input as students navigated the online space. Many of them were former C-Tech² participants familiar with the in-person version of the camp. The overarching goal of the camp was to maintain the hands-on nature of activities and to develop a sense of community that is central to the program's success. Ultimately, it was decided that the main mode of meeting would be via Zoom synchronously.

B. Program Changes

The shift to the online modality resulted in several reductions in the volume of daily activities required for the camp. These decisions were made to help manage zoom fatigue and ensure that the campers are not overly tired as the camp wore on. Full details about the daily schedule are in Table 2. Because the online program did not require room and board, which makes up most of the costs, participants were charged 10% of the usual tuition (\$200 vs. \$2,000). Additionally, the staff coordinators were able to increase the number of participants in the program from 60 participants in 2019 to 64 participants in 2020.

2. C-TECH² OVERVIEW AND CONTEXT

C-Tech², short for “Computers and Technology at Virginia Tech,” is a two-week residential engineering camp for high school women at a large research university. This camp uses a rigorous application process to choose rising female high school juniors and seniors participants who wish to learn more about engineering. The camp aims to expose participants to the various disciplines of engineering, science, and technology commonly offered at undergraduate institutions through many different activities that they engage in. These activities include a team-based engineering design project hosted by a corporate partner and based on a current concern/issue/trend in the engineering field that concludes with participants sharing their prototypes and solutions during a design project showcase in which company affiliates, faculty, family, and others are invited to attend. Other activities include a few daily engineering activities hosted by faculty in various engineering departments at the university and other academic support events, such as presentations with the admissions office. In the following sections, we will discuss each of the major components of in-person C-Tech² and how they shifted to the online environment from 2019 to 2020, and further shifts that were made in 2021 for each of the elements.

A. Staff

The high school student participants are supported throughout the camp by a combination of undergraduate student staff, graduate student coordinators, engineering faculty, and a faculty who is responsible for overseeing all summer camps at the respective university. Undergraduate staff includes residential assistants and student support staff. Table 1 shows the number of involved staff members across the three years. In 2020 the residential assistant position shifted to additional program assistants so that there would be two program assistants for each group of C-Tech² participants.

Table 1 - *Representation of the staff and volunteers over the three years*

Staff	Role	2019	2020	2021
Undergraduate Students	Residential Assistants	4	0	0
	Program Assistants	4	8	8
Graduate Students	Coordinators	1	1	1
	Co-Coordinator	1	0	0
Engineering Faculty	Staff Coordinator	1	1	1
	Activity Leaders	21	19	12
Other Partners		6	7	4

B. Camp activities

Throughout the two-week in-person camp, students had a very packed schedule which included engineering activities, social activities, and other relevant university sessions. Students started the camp with an opening ceremony for all the high school participants and their families offered by the Dean's office. Throughout the two weeks, high school students were divided into four groups and engaged in many different activities led by their undergraduate leaders.

a. Schedules

When the camp transitioned to a virtual environment in 2020 and 2021, the opening and closing sessions, engineering sessions, and social activities remained, but were less time-intensive. In order to avoid Zoom fatigue, the schedule was significantly reduced. In 2021 the biggest schedule change was a shift from two technical sessions per day to only one. The reduction of activities and time required across the three years is shown in Table 2.

Table 2 - Daily schedule across the years

	2019	2020	2021
7:00	Breakfast		
8:00			
9:00	Technical Session 1		
10:00			
11:00	Technical Session 2	Technical Session 1	Technical Session
12:00	Lunch	Lunch & Learn (only 3 required)	Lunch and Learn (only 3 required)
1:00	Technical Session 3	Technical Session 2	Break
2:00			
3:00	Team time		
4:00	Technical Session 4		

5:00	Dinner		
6:00			
7:00	RA Activities	Social Activities (optional)	Social Activities (optional)
8:00			
9:00			
10:00	Curfew		

b. Technical sessions

Engineering activities spanned across the disciplines of engineering majors offered at the university and often offered by an engineering faculty, staff, or graduate student from the university. Some examples of sessions included Avoiding Failures through Engineering Design, Lotus Leaf Effect, Intelligent Systems and Smart Materials, and Sea Urchin Structures.

In 2020 the staff coordinator surveyed the engineering faculty and staff to see who was available and to shift their activity to an online modality. These activities were done in various modalities, most of them were done synchronously via zoom. These activities are similar to those offered for in-person camp and were much the same in 2021.

c. Lunch and learn

In addition to the technical engineering sessions where participants were able to see the engineering lab spaces on campus and engage in hands-on learning of technical content, they also engaged with engineering faculty during lunches where faculty made themselves available for informal discussions and mentoring.

With the online format in 2020, we were able to expand our faculty lunch offerings. Lunch & Learn sessions were offered for all engineering majors, other colleges (science, business, CNRE, CAUS), and certain businesses/organizations. These sessions were also held synchronously via zoom. Faculty, advisors, and undergraduate students participated in the lunches. Participants were required to attend three lunch sessions but were encouraged to attend additional sessions. The number of participants was capped at 12 for most sessions to encourage direct interaction. The participants were asked to do a small amount of preparation for the departmental sessions including coming prepared with two questions.

Faculty lunch offerings remained part of the 2021 program, but were restricted to faculty in engineering departments, with only two exceptions. Lunches were held Monday - Friday of week 1 and Monday - Wednesday of week 2. Faculty, advisors, and undergraduate students participated in the lunches. Students were only required to attend three faculty lunch sessions. On days when they were not participating in lunch sessions, they were encouraged to work on their design projects or connect with other camp participants during the lunch hour. By taking this approach, we also inherently limited the number of participants in any given lunch, thereby providing opportunities for more meaningful engagement and conversation.

d. Social activities

While days were often filled with engineering sessions and lots of learning, evenings and weekends were spent on social activities for community building and exploring the local area surrounding the university. Evening social activities were often facilitated by the RAs and included things like Minute to Win It, Lawn Games, movie nights, tie-dye t-shirts, ice cream sundaes, talent show, s'mores, or otherwise. On the weekend, the girls were taken on a sightseeing adventure including time at a local small town, a visit to an old mill, and a local hike. The field trips and weekend social experiences were not offered in 2020 and 2021.

Alternatively, in 2020 the online modality social activities were siloed to optional evening activities were led by the counselors and included watch parties, group games, painting, trivia contests, and baking. The graduate program co-coordinator also led pre- and post-focus group sessions during this time. In 2021 the same approach was taken with the slight modification where participants were highly encouraged to attend several of them.

Evening social opportunities will remain optional going forward. We found that by allowing participants the choice of whether or not to engage in evening activities, those who did participate did so because they wanted to and were more likely to have a positive experience. Similarly to faculty lunches, we required participation in three evening activities throughout the two weeks, which in many instances made participants want to come back for more fun on other days outside of their three required evenings.

e. Engineering design project

Participants engaged in a design project that spanned the length of the camp. A large national engineering company sponsored the engineering design project, including introducing the project to students, providing some resources to students, and enacting engineers from the company to engage in a judging process to both provide feedback to students and choose a 1st, 2nd, and 3rd place team. The 2019 design challenge was to “create a product that helps individuals living in a food desert acquire healthful “whole foods” without needing extensive plots of land for gardening.” Participants worked through the engineering design process in teams of three to produce a method or product best suited to address the prompt. They had a \$20 budget, access to an engineering workspace with some engineering machinery, such as a laser cutter, and received feedback from industry engineers throughout the process. Each group presented their final prototype in a design showcase where industry engineers attended and listened to the pitches of all groups, and others from around the university and participant families were also invited. Groups were judged on teamwork, customer engagement, adherence to the challenge, the likelihood of implementation, novelty, and delivery (technical and non-technical).

When the camp switched to virtual in 2020 and 2021, the design project remained as part of the camp but was shifted to a fully virtual environment. In 2020, On the first morning of the camp, a representative from the sponsoring company introduced the engineering design project VIA Zoom. Teams engaged with the team-based design process on the first day by brainstorming current products on the market that could be improved and ended with presenting their virtual prototypes and ideas for final feedback. Each team worked together to think through possible products that need to be improved. Throughout the camp, teams worked together in breakout

sessions via zoom, google slides, and other virtual mediums throughout the two weeks. During the end of the first week (halfway through the project), each team was scheduled to receive feedback from multiple sponsored company representatives and engineering graduate students in the Design Project Mid-Point review VIA Zoom.

The sponsoring company provided a number of employees from their company to support the Engineering Design Project. Given the different modalities, the final design project showcase was held VIA zoom which consisted of holding three different zoom rooms simultaneously and cycling the teams through each room to ensure each team saw three different sets of judges. Because of the modality of online, the design project presentations were recorded and posted onto the shared google drive that the campers all had access to so that all of the projects were readily available for viewing by parents, professors, and whomever else participants of the camp deemed worthy of inviting to see. The same design project process was followed for the 2021 iteration of the camp in addition to feedback from other camp participants.

The design project portion of camp was altered by the online environment, and one positive outcome was the ease of receiving ongoing feedback on the design projects. This component of the design project experience was new to the 2021 iteration of the camp. Each team within the larger groups had opportunities to review and provide feedback on other teams' design projects throughout the camp; something that had not previously been done. This ended up being very helpful as teams worked toward completing their projects and we will continue to include this element in the future.

C. In-person components of the 2019 camp

Throughout the camp, participants are exposed to life as undergraduate students through the residential aspect of the program where they remain in a freshman dormitory with a roommate and residential assistant (R.A.), just as all undergraduate freshmen who live on campus. Additionally, participants have the opportunity to learn about life as an undergraduate – anything from living with a roommate for the first time to how to successfully navigate the dining hall – and begin to develop peer and professional networks.

D. New components of 2020 camp

a. Material kits

Material and supply kits were provided and shipped included in the camp fee. These kits included t-shirts, fidget spinner supplies, other swag, and small items for design challenges and were sent via mail prior to the start of the camp. All supplies that were required for activities throughout the duration of the camp were provided, and participants kept all materials and supplies at the end of the program.

b. Team time

Team time was an idea proposed by the undergraduate program assistants in the planning meetings. The main goal was to make sure that participants developed a sense of community and created connections with peers and program assistants. Team building exercises, design project

feedback, and either a mini-design challenge or watch party were held each day. PAs planned the mini-design projects in advance and simple materials for these (pipe cleaners, popsicle sticks, rubber bands, etc.) these materials were included in the materials kits sent out to the campers. Team time is meant to be a flexible time where the program assistants would assess the participant's energy levels and adjust accordingly. During this time the program assistants also had options to end the time early or have the girls do different activities depending on the participant's energy levels.

c. Daily check-ins between staff

What turned out to be important conversations were daily check-ins held between the graduate program coordinators and the undergraduate program assistants in a synchronous zoom meeting scheduled before the camper's team time. During these check-ins, the program assistants touched base with the graduate program co-coordinator for announcements and getting a general idea of how the campers were doing on a given day in the camp. As a result of these check-ins, it was clear that by the end of the first week of camp the participants were experiencing significant amounts of zoom fatigue. In response, the program assistants would end team time early or have a low-energy activity for the day. Overall, these gave insight into how the participants were experiencing the online modality day-to-day.

d. Camper engagement in the virtual environment

Because the camp was online many different approaches to camper engagement were employed. This included an Instagram account that had photos and updates throughout the duration of the camp, the Facebook group where the camp staff coordinator interacted with the campers and shared opportunities within Virginia Tech. Each of the four groups had group chats and with their respective program assistants as well.

E. New components of the 2021 camp

a. Mini design challenge olympics

An addition that added to the 2021 program that will continue into the future is the mini design challenge olympics. This activity coalesced out of the desire to promote more social interactions between the participants and program assistants in the online space. Previously, student leaders were responsible for developing and facilitating engineering challenges for their respective groups. In 2021 we streamlined the process by having a bank of activities created and specified which days each activity would take place. A Virginia Tech graduate student created instructions for each activity, along with facilitation guides and rubrics for assessing the design challenge outcomes. Within each group smaller teams were formed and competed against each other on each activity. All projects were engineering- or design-related. Examples included a LEGO challenge, construction paper tower, and a coding challenge. To help with consistency and understanding, a training on the design challenges was held for student leaders before camp started. During the 2021 summer, these challenges were an especially important component of team-building.

F. Summer camp 2022

As we look forward to the summer 2022 program, several of the changes we've implemented during the last two years will remain in place regardless of modality. The two major elements include the mini design challenge olympics and online faculty lunches. Evening social opportunities will remain optional going forward. We found that by allowing participants the choice of whether or not to engage in evening activities, those who did participate did so because they wanted to and were more likely to have a positive experience. Similarly to faculty lunches, we required participation in three evening activities throughout the two weeks, which in many instances made participants want to come back for more fun on other days outside of their three required evenings.

Even if we return to in-person programming, online faculty meetings will remain by having more flexible lunch hours. By giving them from 12 pm-1:45 pm time as a choice between lunch/design project/faculty meet-up and giving the campers more freedom with how exactly they may wish to use their time as an outcome of the flexibility of team time during the online format. The online format of these lunches provided better opportunities for intentional engagement between faculty and students than the in-person setting in a busy dining hall. Previously, the logistics of making faculty lunches happen proved challenging. Student leaders and staff had to manage meal swipe cards, long lunch lines, and scouting out open tables. The dining hall is loud, which also inhibits conversation. Additionally, Zoom lunches are far more accessible for faculty members since travel across campus in the middle of the day is no longer necessary.

Scaling back the requirement of daily faculty lunches also helped. We will continue to assign campers to their top three faculty lunch choices, but they will not be required to attend every five faculty lunches as has been the protocol in the past. Students will be able to select their top three choices of engineering majors and will be assigned to faculty lunch slots accordingly. By taking this approach, we also inherently limit the number of participants in any given lunch, thereby providing opportunities for more meaningful engagement and conversation. On days when students are not participating in lunch sessions, they can use that extra time to work on their design projects.

G. Challenges of online modality and evaluation

The biggest challenge to implementing this camp virtually was managing the energy levels of the participants because of zoom fatigue. As the first week of camp came to a close all of the program assistants observed tiredness from the campers and campers' ability to focus as the camp went on. To manage this, program assistants shortened and modified team time as needed day-to-day. Some days watching youtube videos as a group and others canceling team time altogether. The second salient challenge was the occasional miscommunications between the full-time staff coordinator and the graduate co-coordinator or between the graduate co-coordinator and program assistants. This manifested itself mainly through the formal evaluation of the camp, and the distribution of the post-camp survey to the participants. While all camps were motivated by the same frameworks, only the in-person camp resulted in a complete (pre and post) set of survey results. Surveys were a compilation of the Engineering Personal Interests Survey adapted from O*NET Mini Interests Profiler [8] to measure engineering interest, the Perceptions of Engineering Survey [7], and the Engineering Self-Efficacy Survey [6]. Online camps proved more difficult to get complete data sets with limited response rates and more difficult communication hurdles. Due to this, the surveys weren't included in this paper.

Additionally, previously for the in-person version of the camp focus groups were required for all camp participants and were done pre- and post-camp by each of the four groups. For the online modality, in order to reduce screen time for campers, the camp coordinators elected to make the focus groups optional for the campers. For both the pre- and post- camp the optional focus groups led to a small number of participants and in the focus groups and not super robust data from it. Because of this, there was incomplete data that led to the inability to fully assess the effectiveness of the online virtual conversion. This was a similar problem that crossed over to the 2021 online iteration of C-Tech² as well.

3. EVALUATION

A. Limitations

Some limitations to this evaluation are that the data that is used is emails from students that decided to send a follow-up email so we have a skewed sample. It is possible that all student experiences are not reflected in our subset of students represented with our data. Only qualitative data is analyzed to provide some context into the differences between the student experiences (this is more of a reflective, lessons learned, sharing camp design paper). Looking forward, the collection of quantitative data to compare specific changes that happen year to year is a potential future study.

B. Participants

All participants were female students and were selected for participation in this camp. Participants are selected based on a model that Virginia Tech admissions uses for acceptance which is based largely on their previous academic performance and their extracurricular activities, especially those related to STEM. Previous academic performance is based on the number of advanced courses they have taken and their GPA, but consideration is given to the number of courses that are even offered to these students by the high school that they attend. Their statistics and information is shown in Tables 3,4, and 5

Table 3 - *Participants upcoming grade year*

Grade	2019	2020	2021
11 th	19	24	19
12 th	39	40	46
No response	2	0	0
Total	61	64	65

Table 4 - *Percentage of participants in-state/out of state*

	2019	2020	2021
Rising Seniors	70%	62.5%	71%
Rising Juniors	30%	37.5%	29%
Out-of-State	34%	34%	28%
In State	66%	66%	72%

Table 5 - *Participants Race/Ethnicity*

Race / Ethnicity	2019	2020	2021
African American / Black	5	6	5
Asian	10	21	34
Latino / Latina / Hispanic American	1	5	3
White (non-Hispanic)	37	27	18
Two or more races	3	5	6
No response	4	0	0

C. Data collection

Because of the difficulty with assessment/evaluation in the two years of virtual implementation of the camp, the only data that is consistent across the three years of the camp's iterations from 2019-2021 is qualitative and open-ended feedback from the participants after the camp had concluded. In 2019 and 2020, these were in the form of emails to the staff coordinator and in 2021, these were in the form of optional surveys sent to all participants post 2021 program. These comments and feedback were qualitatively open-coded by the authors and salient themes that came out of the different modalities were recorded.

In 2019, when the camp was an in-person experience for the participants, camp leaders received 11 formal follow-up emails, 10 from participants and one from a parent of a participant. In 2020, camp leaders received 10 formal follow-up emails, 7 from participants and three from parents of a participant. In 2021, camp leaders received open-ended survey feedback from 20 program participants and no parent feedback. The open coding of this data led to 10 different codes which were applied to all of the participant feedback from 2019 - 2021. Table 6 shows the respective codes, their definitions and the number of times which they appeared in the data across the three years.

D. Data Analysis

The developed codebook that shows the salient themes that emerged from our collected data is shown in Table 6, which includes the applied codes, definitions of these codes, and code counts for each of the respective years.

Table 6 - *Codebook and frequency of relevant codes*

Code	Definition	Example Quote	2019	2020	2021
Major Exploration	Participants shared that they had time to explore the different majors offered by the university College of Engineering during the camp.	“It helped me develop a better understanding of what I want to pursue as a major and a career. I now have a better understanding of which types of engineering appeal to me and which don't.” -2021	3	2	3
Supporting Career Choice	Participants explained that they have a greater commitment to engineering as a career choice as a result of the camp.	“I have never been more excited to pursue a career in Computer Science” - 2020	5	5	4
Presence of other females	Participants identify the importance of having other females interested in engineering at the camp.	“ C-Tech ² made me realize how many other women there are with similar passions to me” -2021	3	1	4
Increased Confidence	Participants identify that they have more confidence as a result of the camp.	“Thank you so much for the confidence and inspiration that I have found during camp.” -2020	4	1	3
Appreciation for the campus	Participants specifically identify elements of the university campus that they are thankful for (i.e. culture, presence of specific organizations, good food, etc.)	“This was my third time on the Virginia Tech campus and I know that this is the place for me because I can be an engineer while following my other passions such as dance, helping others, movie critics, and all the other things that make me who I am.” - 2019	5	1	7
Connections with other people	Participants note that they have developed connections with other members of the camp, including other participants, staff, faculty, etc.	“I had so much fun building connections with some amazing students at Virginia Tech who will definitely help me as mentors.” - 2019	11	2	2
Increased engineering knowledge	Participants note that they have more engineering knowledge after completing the camp.	“I learned so much about myself and engineering that will help me through these last two years of high school.” -	6	1	7

Code	Definition	Example Quote	2019	2020	2021
		2021			
Commitment to university	Participants explain that the camp increased their commitment to attend the university once they graduate from high school.	“The program helped to reaffirm that engineering is for me and that I definitely want to be a part of Virginia Tech engineering program in the future.” - 2019	9	5	8
Good camp structure	Participants identify the camp structure and their daily schedule as benefiting them.	“Even though the program was online due to COVID-19, I couldn’t have asked for a better experience.” -2020	2	1	0
Had fun at the camp	Participants had fun during the camp.	“I had so much fun building connections with some amazing students at Virginia Tech who will definitely help me as mentors.” - 2019	3	2	2

E. Results

a. Summer Camp 2019

For 2019, the most salient codes were connections with other people and commitment to the university. In their emails, participants noted that their positive experiences were often strongly linked to the connections that they made throughout the two-week camp, including RAs, Virginia Tech students, faculty, company leaders, or most commonly other female participants of the camp. All eleven emails specifically noted the connections made and the bonds formed during the C-Tech² camp. For example, one participant mentioned that “I had so much fun building connections with some amazing students at Virginia Tech who will definitely help me as mentors.” Additionally, many of the emails shared that the participant was now further committed to attending the university at which the camp took place. Some participants noted that they appreciated the culture of the university, that they found hobby-based activities on campus that they appreciated (such as dance organizations, swim clubs, or faith-based societies), or that they just enjoyed the general area. These experiences allowed them to confirm their desires to attend the university, and they explicitly state their commitment to attending the university when they start college. For example, one participant shared that: “The program helped to reaffirm that engineering is for me and that I definitely want to be a part of Virginia Tech’s engineering program in the future.” It is important to note that these most salient components of the email are directly linked to in-person experiences. While it is possible to build connections virtually and to better understand the experiences available on a university campus, it is more challenging than when things are in person.

b. Summer Camp 2020

For the 2020 iteration of the camp, the most discernible codes were related to supporting career choice and university commitment. Within these emails from 2020 participants highlighted the camp helped them confirm their choice in pursuing engineering as a career. An example of this is from a participant who reported “ I feel like engineering/STEM is definitely the path for me- this is coming from someone who wasn't sure about her future at all 2 weeks ago.” What was perhaps unsurprising was many of the participants setting their commitment to studying at the university which the camp was offered. Additionally, there was evidence of continued commitment to an interested other volunteer outside of camp as a result.

A significant relationship and outcome from the 2020 iteration of C-Tech² is an ongoing partnership between one of the design project groups and a faculty at Virginia Tech. The faculty member offered an internship to this group and allowed for continued relationship and “he said that if we wanted to, he would help us write a research paper on our design this year. We will all now be meeting with him over zoom during our senior year of high school, and I am so thankful for the opportunity.” The opportunity in which resulted in the publishing of a journal article and became a story of note for media outlets, story linked in parentheses (<https://www.yahoo.com/entertainment/high-school-students-invented-revolutionary-161300456.html>) Thanks to the online modality of the camp there is an opportunity for continued access to people online because they did not have to shift modality.

c. Summer Camp 2021

In 2021, the most salient codes were related to engineering knowledge, university commitment, and instilled confidence in participants’ abilities to engage in engineering. In emails from 2021, participants consistently noted that camp helped shape their perceptions of what engineering entails. This happened in three notable ways. First, the camp taught participants about the breadth of the engineering field. One participant commented “I used to think that the fields in engineering were pretty limited. But with this program, I've learned of how engineering takes place in an immeasurable amount of careers.” Second, the camp helped some participants narrow down which specific engineering discipline they hoped to pursue. Someone said “It helped me develop a better understanding of what I want to pursue as a major and a career. I now have a better understanding of which types of engineering appeal to me and which don't.” Another participant expressed both of these themes in a single comment, saying “[camp] opened my eyes to all the possibilities available in engineering. It reaffirmed my interest in STEM topics and helped to narrow my focus.” The third-way camp helped instill deeper engineering knowledge was by conveying different applications of engineering knowledge. An example quote that showcases this theme comes from a student who said camp activities “allowed me to gain actual insight into real-world applications of engineering in terms of research projects and potential careers.”

Another salient code from 2021 was confidence. Several participants said that they gained confidence in their engineering ability throughout camp, and others gained confidence in their understanding and navigation of the college admissions process. In sum, camp gave students the information and experiences they needed to feel like they are better prepared to navigate next steps in their academic and career journeys.

Finally, many participants expressed that they learned enough about Virginia Tech, despite the online modality of camp, to know they want to apply or enroll at the institution. While they were not physically on campus, participants were able to connect with faculty, learn about opportunities on campus, and interact with current students to learn about the environment and culture of the campus. Comments that align with this theme include “ C-Tech² made me realize that I would love to attend Virginia Tech because of its diversity, several opportunities, and amazing courses/professors!” and “I was able to meet some of the amazing professors which made me more excited to apply and hopefully be a future hokie!!”

4. CONCLUSION

Overall, it is evidenced that the shift to the online environment impacted the experiences of the participants of C-Tech² across the three years. The clearest and perhaps most notable shift is the lack of connections with other people made in the online environment which may be attributed to the limiting nature of zoom and the reduced schedule that the campers were given. Therefore limiting the participant's ability to develop a similar level of community and connection to faculty members and camp staff at Virginia Tech. What was clear is that the camp was still successful in its goals of introducing students to the various fields of STEM and how they can be involved in the collegiate environment as undergraduates in college. Regardless, some of the advantages of the flexibility of the online modality will be kept for future in-person iterations of camp.

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